National Competitive Advantage of China in Electric Mobility: The Case of BYD

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Abstract

Whereas in Europe, national activities to drive e-mobility forward still have to be coordinated at EU level, Chinese leaders have adopted a plan aimed at turning the country into one of the leading producers of hybrid and all-electric vehicles within three years, and making it the world leader in electric cars and busses. This paper presents the case of the Chinese company BYD („Build Your Dreams“), that began selling a plug-in electric car in China, at least a year ahead of similar efforts in the U.S. and Japan. In a Case Study setting, it addresses BYD's strategic approach of consequently exploiting locational advantages, the importance of a favorable national home base, and the strategic implications for both western and Chinese companies aiming at positioning themselves in the market for e-mobility.

Keywords: Porter's diamond; BYD; e-mobility; National competitive advantage; China; Automobile industry

1. Introduction

China is now the biggest automotive market in the world. Within only 10 years, all relevant car producers have established joint venture companies with mostly state-owned Chinese companies. In 2009, 8.3 million passenger vehicles were manufactured in China, surpassing the U.S. as the second largest automotive producing country. The growth process – driven by domestic and foreign firms as well – has been strongly supported by a focussed government strategy. With only 48 cars per 1,000 inhabitants, the remaining growth potential is considerable. As local competition is increasing, Chinese automobile producers start to exploit foreign growth options and to position themselves increasingly as global companies. The barriers for positioning in classical markets for gasoline-engine cars are high, and realizable competitive advantages in the global competition still have to be identified. However – Chinese companies clearly see their chance for an early positioning in the electric vehicle market, where all global players now start from the same technology level. Automakers even break a long-embraced rule of secrecy, spotlighting models 18 to 24 months ahead of production to be in the forefront of what they expect to be a large-scale shift to electric power vehicles in the next few years. Government policy is strongly supporting this development. The main arguments for Chinese carmakers and China becoming a major player in e cars is not based on technological advance but on favourable national framework conditions combined with a strategy exploiting national advantages – building together a strong diamond.

2. The Competitive Development of China

The competitive development of national economies proceeds, according to Porter (Porter, 1990), in four consecutive steps.

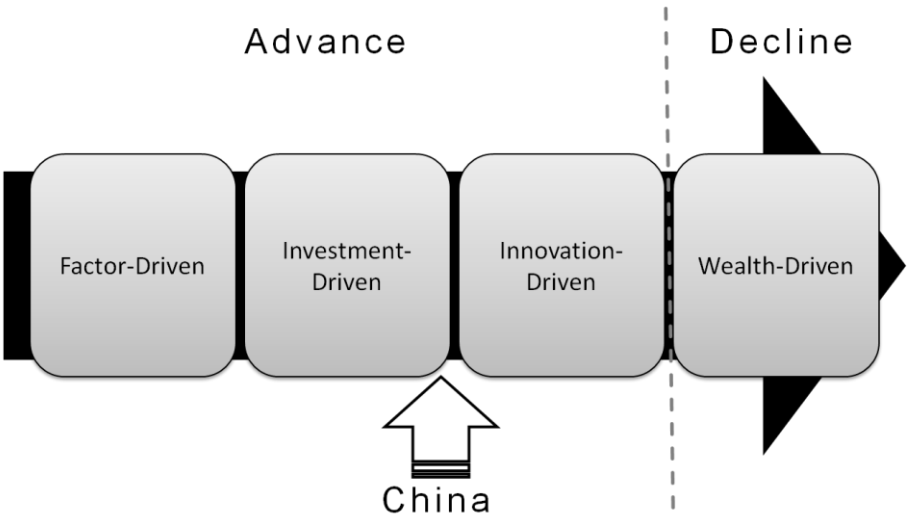

figure 1*: stages of country development and the positioning of china (porter,* **1990)**

According to the Global Competitiveness Report, China is currently ranked as a country in the investment-driven stage, which is also named “efficiency-driven stage” (World Economic Forum, 2009). For countries in this second stage of competitive development, the willingness to invest heavily is the main driver for development. Government plays a substantial role, as it takes the lead in channelling money to key industries, supports the acquisition of foreign technologies and encourages exports. The political focus is to be laid on long-term economic growth, while the distribution of income and current consumption are no primary objectives. This theoretical statement is closely mirrored in China’s current political agenda. (Porter, 1990) A stable and strong government is crucial in this phase, as it ensures continuity of decision making. The World Economic Forum ranks China 8th worldwide in macroeconomic stability (World Economic Forum, 2009). Unlike many western societies, whose frequent elections and wide range of varying values within the political system imply the risk of policy changes, China has but one all-embracing party, the CPC, guaranteeing a high level of stability.

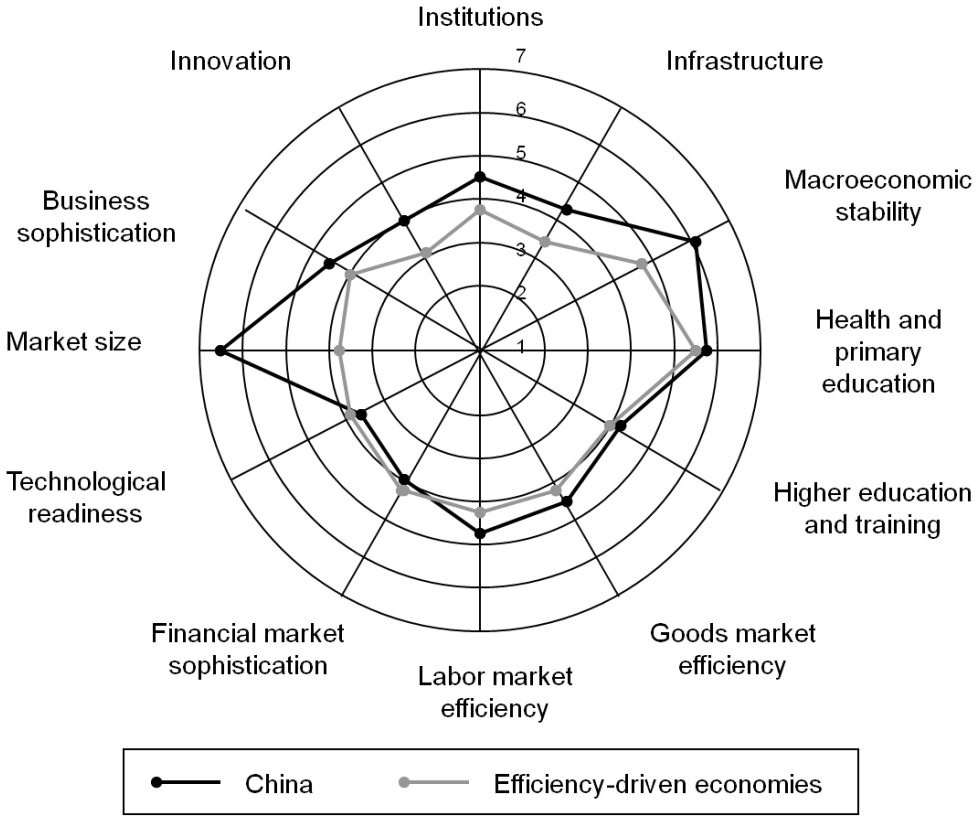

figure 2*: comparison china / efficiency-driven economies (world economic forum, 2009)*

In comparison with other efficiency-driven economies, China is outperforming the average in all aspects but technological readiness and financial market sophistication.

According to Porter, investment-driven economies may gain a competitive edge in industries with economies of scale, high capital costs and high labour intensity. They ought to

specialize in standardized products with relatively low service requirements. The technologies used should at best be easily transferable, a wide availability of core technologies via multiple international sources being preferable.

The electric mobility sector meets all of these prerequisites, so China is ready to pursue the challenge of gaining excellence in this particular industry. The following section provides an overview of selected favourable aspects of the diamond dimensions with regard to the electric mobility industry, focussing on the strategy of the Chinese company BYD ("Build Your Dreams"). The assignment of certain facts to a particular corner of the diamond is, due to the interdependencies between the various dimensions and the sheer complexity of the subject, not always redundancy-free. Ambiguous aspects are therefore treated in the section with the best fit.

3. Competitive Advantage of Nations: Porter's Diamond

The concept of *Competitive Advantage of Nations*, often referred to as *Porter's Diamond*, was initially introduced by Michael E. Porter (Porter, 1990) and eventually became one of the most prominently used theories for displaying competitiveness of nations. Porter posits that the international competitiveness of a given industry is heavily influenced by the configuration of four national key attributes that constitute a nation's home base.

The four corners of the diamond are each subdivided into a variety of indicators. Government and Chance are introduced as additional factors that pose influence on the four corners of the diamond. Only a perfect combination of key and additional factors leads to a sustainable basis for the growth of globally competitive firms. Porter posits that the corners of the diamond are not only shaped by positive forces, but also the lack of certain resources or constraints is apt to create a competitive edge. In the following, only the positive influence of factors will be outlined in order to decrease complexity and to decrease the ambiguity of the diamond.

3.1. Government and Factor Conditions

Within the last ten years, the Chinese government has demonstrated consistency in the formulation and implementation of economic strategies. The 11th economic development plan outlines a strong will to put the automotive industry, which is one of the key Chinese industries, on independent feet. As the Chinese government is aware of the technological gap between their companies and the world leaders in the field of combustion engines, the focus is clearly on the emerging field of electric mobility. The government plans to have 10,000 hybrid, electric and fuel-cell vehicles on the road by the end of 2010. The annual production capacity will be extended to 500,000 hybrid or all-electric cars and buses by the

end of 2011, from 2,100 in the year 2008. This would support the internal growth process, which would cause severe environmental problems in the case of gasoline cars on the one hand, and would be the basis for gaining global competitiveness on the other hand.

The Chinese government has just demonstrated its strong direct and indirect support for the automotive industry. While in 2008 and 2009, nearly all automotive markets in the world were affected by a slow down following the world financial crisis, the Chinese passenger vehicle market grew by more than 40% in 2009, after a “moderate” growth rate of only 8% in the year before. Part of this growth was triggered by a consequent government incentive and subsidy policy. In January 2009, sales tax was reduced from 10% to 5% for small displacement engines, being extended to a reduction to 7.5% in the year 2010. In addition, replacement of 3-wheelers and light trucks with combustion engines under 1.3 litres in rural areas was subsidized by approx. CNY 5 Billion; for special vehicle types, an incentive payment of CNY 6,000 was paid for scrapping.

As the reduction of CO_2 emission is a declared political goal, strong incentives or even direct prohibitions are expected to support the substitution of gasoline-driven vehicles in Chinese megacities and – later on – in the countryside. This development would also support China´s wish to reduce the import of crude oil, which is linked to aggressive investment in nuclear power and new power systems.

Currently, a private car can be used on four working days in the city centres, this limitation will soon be extended. Beside the tax reduction to 7.5 % for cars under 1.6 litres, direct subsidies on low emission vehicles are available (Global Insight, 2009). At the moment, the government offers about CNY 50,000 (5,000 €) for consumers buying an electric automobile. Subsidies of the same size are being offered to taxi fleets and local government agencies in 13 Chinese cities for each hybrid of electric vehicle they purchase. The Chinese government is also aggressively investing in infrastructures necessary for the dissemination of e-vehicles. At the moment, the state electricity grid has been ordered to set up electric car charging stations at Beijing, Shanghai, Tianjin, with other economic development zones to follow. Some details of the new e-vehicle strategy were published in June 2010: five cities – Shanghai, Changchun, Shenzhen, Hangzhou, Hafei – are obliged to establish charging stations for car batteries. In these model regions, e-cars are subsidized with 7,500 € each, which levels prices for e-cars with other models for taxi fleets as well as private customers.

Having in mind the international competitive arena, the government recently announced that norms for e-mobility will be defined soon with the clear aim to be faster than European committees and institutions for standardization. China and the US have signed a joint agreement on initiatives promoting e-mobility, including aspects of standardization.

As resources are getting scarcer, automotive companies respond with greater vertical integration along the entire value chain. The Chinese government strategically tries to establish a working diamond for the e-vehicle by industry by securing access to lithium, which is one of the key *physical resources* for electric mobility. It is the most important component used in batteries, making it indispensible for this particular industry. The technically recoverable global reserves of lithium are approximately 15 million tons with China holding about 17% (Roland Berger, 2009). Following an aggressive e-leadership strategy, the Chinese government seeks to conclude contracts with the other major suppliers of lithium, Chile and Bolivia. At the moment, lithium, precisely LiFePO4, accounts for 20 % of the raw material costs in battery production. Considering the steep climb of lithium-carbonate prices that quadrupled from 2002 to 2008, in times of mass-produced batteries used for vehicles being a vision, this share will considerably rise in the future. China may, out of their resource advantage, gain a price advantage over their main competitors at the most expensive part of an electric vehicle: the battery.

As indicated in picture three, the financial market sophistication in China still has to be improved. But clearly focusing on their key strategic industries, the government is strongly supporting companies in the automotive industry financially. As most of the big automotive companies are partly state-owned, direct support can be given. For BYD, the electric vehicle producer no.1, estimates of financial government support reach one billion €.

Beside these direct interventions, different ministries are competing for developing and implementing support for the domestic innovation landscape. The leading universities of the country have established automotive competence centres to educate engineers and conduct research: on the campus of the Tongji University in Shanghai for example, ROEWE cars with e-traction, hybrid or fuel cell base, drive around. Although these initiatives have developed quickly and Chinese universities produce close to 40,000 engineers a year, the endowment with *human resources*, especially high-level professionals with expertise in the automotive industry is still not sufficient in China. (Mao et al., 2009) Mao et al point out that the income level is the primary lever to attract automobile industry talents (Mao et al., 2009). Considering a well-trained diaspora of more than 50 million Chinese that live abroad but still consider themselves Chinese at heart (Tung, 2008), another source for human resources is to persuade suitable professionals to re-immigrate to China. Not only would that greatly increase the pool of skilled labour, there would also be a significant transfer of tacit knowledge to China. Today, the easiest access to technology still is to learn from foreign partner firms. China has already accumulated relevant knowledge within their joint venture relationships within the last 20 years.

3.2. Demand Conditions

In the next 10 to 15 years, population growth will mainly concentrate on developing countries, where those people that can afford an automobile live in megacities. In 2025, 80% of all people in developed countries will live in cities, which will in general lead to a shift of vehicle segment shares toward smaller city cars using new technologies (Roland Berger, 2009).

A recent study conducted by Roland Berger indicates a sale volume exceeding 15% of all sales for domestically produced electrical vehicles by 2020. Depending on the scenario used, the global market for electric mobility will be between 21.1 billion and 53 billion € by 2020 (Roland Berger, 2009). Whereas in European countries about 50% of potential buyers would consider buying an e-vehicle, in China the awareness for the emerging technology of electric mobility is, according to a recent report by Nielsen, considerably high at 68%. Three quarters of the 1,487 respondents stated a purchase intention under the limitation that the price was not taken into consideration. While environmental and cost-saving issues are the main reasons to buy an electric vehicle, at least half the participants with purchase intention (1,104) state governmental subsidies as a possible reason for buying. Reasons for non-buying are to be seen in the lack of infrastructure and the inconvenience of charging as well as technological issues. The number of potential buyers is therefore extraordinarily high in China. In 2009 more than 1.34 billion people were living in the People's Republic of China, whereof more than 70 % were between 15 and 64 years of age (CIA, 2009). Market growth is substantial: for 2010, a growth rate of about 7% for all vehicles is to be expected (Global Insight, 2009).

Chinese consumers are familiar with e-bicycles and do not have to be convinced of the advantages of e-mobility. When the infection SARS froze the Chinese economy for several months in the year 2003 and people tried to avoid public transport facilities, the production of e-bicycles grew from 2 to 4 million. This was the starting point for the e-bicycle becoming an affordable and acceptable vehicle for the Chinese consumer. Although e-bicycles were initially forbidden in Beijing due to their speed and low noise, consumers just ran over this legal prohibition, pushing the supply to over 25 million e-bicycles and scooters today. Prices for e-scooters range between 150 and 500 €. Today the e-mobility consumer is aware that every year a new battery has to be bought for about 50 €, which has to be recharged after 30 – 70 km. The Chinese consumer has in general developed a mentality of fast adaptability to changes and the mentality to make use of all possible advantages: iron cages for batteries have been installed against theft, and e-bicycles are secured inside apartments, because power theft is a common phenomenon. The secondary sector soon followed the initiative of the private sector and substituted transport tricycles with auxiliary gas engines by those with electrical engines and starter batteries to reduce operating costs. The mobility profile of

people in China matches very well with e-traction. Not only in the megacities, but also in countryside people live extremely crowded together and daily life economic activities are normally restricted to geographical areas very limited in scope.

Especially owners of e-bicycles or e-scooters could afford to substitute these by small e-cars. Different from the U.S. and Europe, status is the main reason for the Chinese customer to buy a car. Solely owning a car – independently from technical details or drivability and operating range – is a goal that whole families are ready to invest their savings in. Again, the tremendous count of expatriate Chinese living all over the world implies a possible national advantage. They represent a bridgehead for the internationalization of the Chinese electric mobility industry. BYD and other car manufacturers are challenged to come forth with a product that is able to convert foreign customers used to European or American fuel-driven cars to driving cutting edge electric vehicles “Made in China”.

3.3. Related and Supporting Industries

The Chinese automotive supplier market is still very fragmented with more then 7,500 companies (CAAM, 2007), most of them being small or medium sized. Still, the booming automotive market in China has allowed its automotive supplier industry to realize an average return on sales rate of 7% in the last ten years, with some suppliers reaching up to 50%. About 70% of the world´s top 100 automotive suppliers have subsidiaries in China, with dispersed activities in this huge country, as most of the OEMs have developed their own supplier networks around them. These foreign companies still dominate the Chinese market. As market entrance was initially only possible in joint venture agreements with Chinese partners, they could improve the quality of their products considerably. Some of them have reached a quality standard similar to German suppliers in product segments with low and medium technological sophistication, where major investment flows are allocated to. However, the majority of Chinese automotive suppliers still suffer from low R&D activities and low production volume due to small scale production. Only very few are able to offer complete modules or systems, most of them offer simple spare parts like tyres, fuel tanks and bearings. In sophisticated product segments, Chinese automotive suppliers represent a market share of less than 10%.

Government policy is therefore driving a concentration process forward and aiming at enabling suppliers to develop to complete module producers or system providers instead of simply delivering simple spare parts. Increasingly, Chinese suppliers cooperate with universities and increase their spending in R&D. Although the gap between Chinese and global suppliers with respect to technology and quality standards is significant, Chinese suppliers are catching up sooner than predicted a couple of years ago.

3.4 Competitors in the Chinese Market for E-Vehicles

Most of the important players in the Chinese automotive market have already placed their prototype e-car and are hurrying to position this on the market.

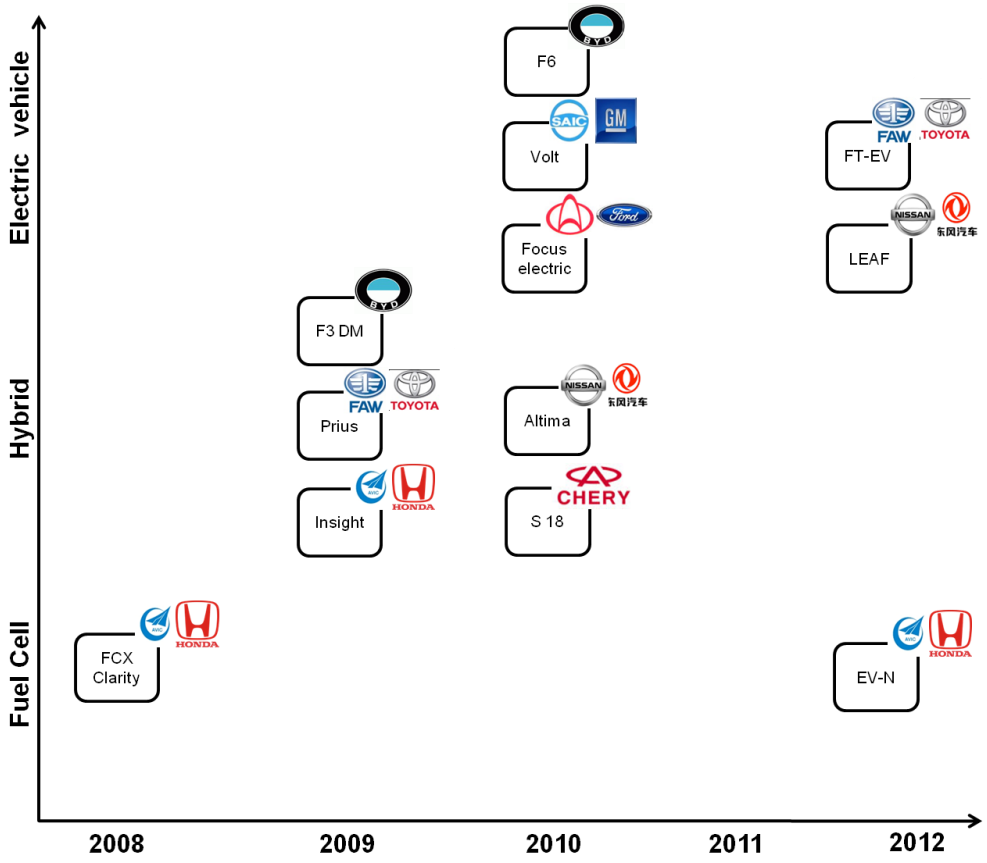

figure 3: selected competitors in the e-mobility market of china

Whereas the big companies follow different future scenarios, the smaller companies have to be focussed due to budget limitations and thus cannot develop several technical scenarios at the same time. Although facing tough competition in their home market, Chinese automotive companies cooperate to gain competitive strength for international activities.

The strongest competitor in the Chinese market is VW, which is still the largest passenger car company in China and will enter the e-market soon. Having in focus various e-platforms under development, VW China will convert the Lavida (a model only sold in China) simultaneously with the European Golf into an EV. The new small family car (Up!) will come in an EV version, the hybrids are sold already as Touareg Hybrid. Battery technology seems to allow now between 100 and 160 km operating radius, enough in China for commuting and the major use of a car during the working week. Most German and French car companies will present their commercial EV or hybrid versions between the end of 2010 and 2013: models

have been presented during the Beijing Motor Show 2010. Nissan/Renault will be the pioneer among the Europeans actually selling an affordable EV in China, the Nissan “LEAF”.

4. Methodology

This paper was based on the case study of the most successful Chinese automotive company “Build Your Dreams” (BYD), which underwent a fast development from the world’s 2nd battery producer to one of the first producers of e-cars. Due to its various linkages to the national homebase (e.g. infrastructure and raw material needs), the national framework conditions were analyzed along the elements of Porter´s diamond model. Two methods of data collection were used: in depth interviews with BYD managers, government officials as well as various managers from Chinese and Chinese-western automotive companies in China. The authors had access to strategic documents both from the company as well as governmental institutions. Case Study research methods were used to assess the competitive advantage of Chinese companies in the electric mobility industry for two main reasons (Yin, 1994)

- BYD has been the most successful automotive producer following a strategy contrary to most others: internalizing most of the value chain activities without cooperating with other global automotive brands and focussing on locational advantages instead of using sophisticated western technologies. Therefore, it can be seen as an extreme case that is worth closer analysis.
- The Chinese government has been demonstrating its consistency in implementing economic goals for many years now. The electric mobility industry is a case at hand to underline the unique power that results from matching company strategy with a developing national homebase and jointly developing it forward. The core competence of BYD, constant process design optimization, has resulted in a fast development from a battery producer to an automotive producer, perfectly combining the core ingredients of being a forerunner in e-car production.

5. The Case of BYD - “Build Your Dream”

5.1. Positioning in the Battery Industry by Developing Process Engineering and Innovation Competence (1995 – 2002)

BYD Limited, located in Xian, Shanghai and Shenzhen was founded in 1995 for the production of rechargeable nickel-based (nickel-cadmium, NiCd) batteries. Within only seven years, BYD has become the world largest manufacturer, producing 65% of the nickel-cadmium batteries used in wireless phones, toys and mobile phones. In addition, BYD has

also become number two for nickel metal hydride batteries and number three for lithium ion batteries.

This outstanding success resulted from a strategy with a strong focus on internally developed strengths exploiting local labour cost advantages. Opposed to Chinese companies implementing high-tech equipment from their foreign partners, the founder of BYD, Mr. Wang Chuanfu, reinvented the manufacturing process by replacing machinery with manpower wherever feasible to obtain lower costs. Quality maintenance has been managed by firstly decomposing the production process into numerous simple-skill labour operations, which then have been constantly reallocated by R&D staff. Initially depending on external suppliers, the acquisitions of nearly 200 companies and their integration into BYD allowed to focus on internal strengths. Today, the complete value chain, including an R&D centre, has been internalized. As two-thirds of the engineers working in the field of battery technology are dedicated to process design, the assembly lines are also developed internally. As a consequence, from delivering initially batteries for mobile cell phones, BYD soon diversified to being a producer of all parts, which are sold under different brands (Nokia, Motorola...). Overall, in these initial seven years, BYD developed strong innovation as well as process engineering capabilities as core competences.

The process orientation is also reflected by the management of human resources. The 5,000 – 8,000 graduates recruited yearly by BYD in the last few years, have been systematically trained and gone through a job rotation programme. The BYD formulated their human resources approach as “BYD not only builds products, but it is also good at building people, converting university graduates into engineering teams. BYD recruits several thousands of graduates, because we know the manufacturing of cars starts with manufacturing of talent, then equipment, then cars. We need not only ten talents, but ten thousand, so we must have the capacity to convert graduates into talent”.

5.2. Transferring Core Competences to the Automobile Industry (2002 until today)

In 2003, BYD acquired the state owned auto company Shaanxi Qinchuan Auto Company Limited, following the company’s initial public offering on the Hong Kong Stock Exchange in July 2002, to get a license for car production. The outspoken vision of Mr. Wang is to become the biggest automotive company of China by 2015 as well as the world biggest car producer by the year 2025. In 2008, already 25% of revenues resulted from automotive sales, another 30% IT, 23% batteries.

Only two years after automobile market entrance, a new model (F3) was presented, with mass production beginning in 2005 and reaching 100,000 units in 2007. Several other

models followed, all being the result of an imitation strategy. Initially, the benchmarked cars (mainly Toyota) are decomposed, scanned and digitized and copied, or – if they are patented – modified (reverse engineering). Whereas basic models are delivered by Toyota, several Mitsubishi engines equip the F3, which results in a modular design strategy, where main components of two different carmakers are combined. Similar to the battery production, BYD relies on its own production network, except some parts like tyres and glass. Production lines are developed internally, whereas a clear focus is on exploiting labour cost advantages in China wherever possible. About 50% of all automotive-related production is handmade and the management is constantly aiming at increasing this portion. The reliance on internal knowledge development has created a comprehensive expertise base for the production of cars and all components, and has led to cost and quality efficiency. Here, BYD follows an entirely different strategy compared to Toyota. Similar to Volkswagen with an over proportional large self owned component division, BYD even boasts deeper upstream production integration than its German rival. Learning processes are organized in internal business units and interdisciplinary project teams. BYD itself develops its competitive advantage on a low-cost R&D strategy. Ten percent of the 130,000 employees are engineers who graduated from the top Chinese universities. Based on this imitation strategy combined with a low R&D cost strategy, the innovation cycle in the car business for BYD is three years. Mainly architectural adaptations to consumer needs, labour-oriented production processes and organizational advantages allow BYD to increase customer satisfaction and offer lower priced products. (Low price and fair quality as clear customer value proposition!)

Mr. Xia Zhibin stressed the future competitiveness of BYD as follows, “under the context of homogenization of key modules like engine and transmission, the competition of new cars will probably only be on appearance and design. The highest stage of BYD’s car production is to make the car body as easily changed as that for cell phones.”

5.3. Entering the New Energy Car Market in 2008

Today, all R&D activities are focussed on the electric vehicle and diversification in the battery business, making BYD the first mover in this market. BYD started selling a plug-in hybrid electric vehicle with a small gasoline engine (F3DM) in December 2008, at least a year ahead of General Motors and Toyota. The F3DM can go 100 kilometres on its battery and an additional 300 kilometers with BYD´s 1.0 litre gasoline engine, maximum speed 160 km/h. The newly developed ferrous-based battery has cost, capacity and safety advantages compared to the lithium-ion battery. Although the price more than doubles the basic gasoline model (60,000 Yuan or 8,800 US$ compared to 149,800 Yuan or 21,700 US$), it is still half the price of the Toyota Prius (280,000 Yuan or 40,600 US$). In 2010 it launched the E6, a

five-seat electric-powered passenger car (7 – 9 hours to fully charge when plugged into a regular home outlet).

Since 2010, marketing of the updated F3DM with a solar panel charging system on the roof was started for private customers at the price of CNY 169,800 (US$ 24,800). The solar panel can transform the solar power into electric power, which can be stored into the Fe battery. Although the amount of additional electric energy is low, BYD demonstrates an ongoing development of new energy options for automobiles.

A pure electric vehicle (e6), which has been presented to the public at the North American International Auto Show in Detroit 2010 - has been announced for December 2010. The minivan will be driven by four electric motors on the wheels, which charge their energy from a 100% recycle battery in the underbody, the capacity of the battery will allow 400 km without recharge.

5.4. Cooperative Branding and Inter-Company Cooperation since 2008

At the end of 2008, the MidAmerican Energy Holding Company, the unit of Mr. Buffett´s Berkshire Hathaway Inc., brought in $ 230 million. for 9.9 % of BYD shares. The Warren Buffet-owned parent company considered Portland to be a test market for its electric automobile and close ties will now ease market entry into the U.S market. Beside the financial investment, Buffett´s interest in BYD signalled to the rest of the world that a new potential giant in the e-vehicle industry had appeared.

In March 2010, a memorandum between BYD Company Limited and Daimler AG was signed to develop a new electric vehicle specific to the requirements of the Chinese market, which will be marketed under a new brand jointly created and owned by both companies. The technology partnership aims at combining Daimler's electric vehicle architecture know-how and BYD's excellence in battery technology systems. This decision is a new step for BYD's integrated approach, adding external competence in those areas that still show internal weaknesses.

5.5. BYD and the Diamond of the Electric Mobility Industry

As part of the Chinese automotive industry, BYD of course faces the above described advantages and shortcomings of their home base. Adverse *factor conditions* such as the shortage of skilled labour are circumvented through a strategy that is contrary to the conventional way in the automotive industry. Instead of relying on technology, BYD emphasizes the use of labour, managing to exploit the low factor costs. Consequently, they

turn a disadvantage into an advantage, having favorable circumstances in other dimensions of the diamond up their sleeves.

As presented earlier, the awareness for electric mobility in China is considerably higher, so the demand conditions are exquisite. BYD uses this awareness and the growing demand for environmentally friendly products to gain governmental support and market share respectively. Chinese megacities with all their environmental and traffic related problems are an ideal market for electric vehicles. Therefore, needs that are urgent there are to be expected in other emerging nations as well.

Problems with *supplier* quality are being eliminated through backward integration into BYD. More than 70% of the value creation is conducted inside the company (Wang, 2009) which is very uncommon in an industry with more than 2/3 of external value creation through supplier networks (Wallentowitz, Freialdenhoven & Olschewski, 2009).

The individual motivation of BYD's employees is considerably high, as China is both dependent on the automotive industry and the reputation is very high (Porter, 1990). Intense *domestic rivalry*, even though not directly under the control of the company, exerts a steady pressure on BYD to remain innovative. The commitment to the electric mobility industry is, due to concentration on core competences, to be seen as sustainable.

Finally, *chance* plays a prominent role. BYD is facing an ever increasing demand for a product that they are able to manufacture considerably better or at lower costs than most of their competitors. Moreover, the Chinese *government* has seen the signs of the time and heavily promotes low emission vehicles.

Taken together, the diamond favors the transition of BYD from a battery producer to one of China's most important car producers and one potential global player in electric mobility.

6. Conclusion and Discussion

The Chinese automotive company BYD has demonstrated its ability to use existing core competencies and develop its strategic capabilities with high speed in order to reach the self defined goal of becoming the world biggest car producer by 2015. The clear focus on internal strengths – process design and adaptive innovations for the Chinese customer – combined with the consequent exploitation of locational advantages – low labour and R&D costs – has enabled the company to realize high growth rates even in hard times following the world financial crises. In combination with its expertise in battery production, BYD could position as one of the first e-car providers.

Implications for Chinese as well as European automobile producers can be drawn from the case study as follows:

- Unlike Chinese-Western automotive joint ventures, BYD is consequently exploiting the given locational advantages of low labour and R&D costs; processes are constantly redesigned to increase the percentage of labour (and not technology) in the production process.
- To circumvent the weak elements of the diamond, mainly the comparably low qualification level of labour and low standards of Chinese suppliers, BYD internalized these shortcomings into the internal value chain. By acquiring about 200 suppliers in a short time frame and developing a sophisticated human resources process at the same time, BYD managed to integrate these companies successfully into the quality improvement and control process. This is contradicting to the trend in the European automobile industry, where the OEM's contribution is about to drop from 35.3 % in 2002 to 22.5 % by the year 2015. (Wallentowitz et al., 2009)
- European and American automobile companies are well-advised to timely establish strategic partnerships with the rising stars from China, as Daimler AG did with BYD. A key challenge for the Chinese companies is the reputation that is connected to the existing automobile brands such as Porsche, Mercedes and BWM. Building up such a brand image is very costly and time intensive. The case of Toyota shows that it is possible to get a high quality image, and how fragile this image is. Taken together, a mutual exchange of technology access and brand image is possible.
- Implementing the job rotation idea for employees – which is uncommon for Chinese firms – was one of the cornerstones to develop the core competence of the firm: process knowledge and process design capabilities.
- The clear focus on this core competence allows BYD to realize the strategy of innovative imitation and ongoing cost function optimization by using creative design capabilities.
- To compensate internal weaknesses, like original design, BYD took its time to develop a strong position in the Chinese automotive market first in order to develop into an equal partner for western brands, like Mercedes. This might be the first case of a Chinese-German joint venture where both partners contribute core knowledge for the end product: an e-car for the Chinese market.
- European and American companies can no longer rest on their dwindling competitive edge based on experience and size advantages. The rise of this new technology is most likely to shake the very foundations of the automotive industry. While competition is sure to intensify, strategic alliances and mutual development will play an even greater role in order to compete in an ever more complex and turbulent

environment. Not only will the demand for electric mobility rise steadly, there will also be a need for customized products to meet different market needs worldwide. Local responsiveness and global efficiency are important issues that challenge the automobile industry, implying very complex and sophisticate value chains and production networks.

As well, more generalized inferences can be derived on country level:

- Two elements of the Chinese diamond in the automotive industry will be challenging for the European companies to compete with: the “educated” Chinese e-mobilist and the Chinese government. Compared to various national scattered activities related to e-mobility in Europe, the strategic long-term oriented will of a communist system to establish a favorable national framework for a globally competitive e-vehicle industry seems to be an enormous advantage. Strong incentives for the demand side, access to capital for e-innovative companies in times of financial crises and strategic attempts to secure access to raw materials needed for the production of e-cars are key for a successful diamond.
- Chinese companies can reevaluate their strategy of implementing over-sophisticated technologies instead of exploiting locational advantages. The innovative approach of BYD is a redefinition of the rules of an industry and a proactive configuration of a new industry.
- The use of state-of-the art green technologies such as batteries and solar panels combined with the vast market size is, though learning effects, apt to make China one of the world leaders in renewable energy. Spillovers to other domains are most likely, so the initial strength of the e-mobility-related automotive industry can be source of further competitive advantages.
- Planning and manufacturing a highly sophisticated product such as an electric vehicle almost single-handed is a strong indicator for a growing confidence in the own strength of Chinese companies. The times when the people’s republic of China was a prolonged workbench are history. The country is now fully aware of its advantages and able to exploit them.
- European governments are, not least against the background of the described developments in China, forced to react as soon as possible. Fraught with problems is the fragmented and often inconsistent policy decision making process of the European Union. In contrast to China, where a strong government is able to push the development of a favorable diamond, European countries have heterogeneous objectives that can hinder a joint solution. Hence, standardized and affirmative action

has to be taken on a transnational level in order not to lose too much ground in the future.

- European policy makers can learn from this explanatory example that a consequent will to jointly develop a vision for an industry which might compete globally later on is key to success: Proactively improving all elements of the diamond from the governmental side, whereas grounding the company strategic approach on those locational advantages that can be turned into sustainably competitive advantages.
- In this industry, the perfect match between political support and company strategy is the core for a splendid diamond.

References

CIA World Factbook (2009) <https://www.cia.gov/library/publications/the-world-factbook/geos/ch.html> (accessed 17.06.2010)

China Association of Automobile Manufacturers (CAAM) (2007) Automotive Industry of China, Beijing.

China Association of Automobile Manufacturers (CAAM) (2008) Automotive Industry of China, Beijing.

Global Insight (2009) IHS Global Insight Asian Automotive Industry Forecast Report, December 2009. Chapter 1, 84p.

Kang, R. and Ke, Y. (2008) BYD´s path of success and future potential risks, in: Huchet, J.-F., Wei, W.: Chinese Firms in the Era of Globalization. China Development Press House, Beijng.

Kasperk, G., Woywode, M. and Kalmbach, R. (2006) Erfolgreich in China. Springer Verlag, Berlin.

Luo, Jinaxi (2005) The Growth of Independent Chinese Automotive Companies, unpublished Paper, International Motor Vehicle Program, MIT.

Mao, G., Hu, B. and Song, H. (2009) Exploring talent flow in Wuhan automotive industry cluster at China. *International Journal of Production Economics*, *122*, 395-402.

Porter, M.E. (1990) The competitive Advantage of Nations, 10th. edition. Palgrave, New York.

Roland Berger (2009) Powertrain 2020 – China's Ambition to become Market Leader in E-Vehicles. unpublished Paper. Munich/Shanghai April, 2009.

The Wall Street Journal (2010) Technology Levels Playing Field in Race to Market Electric Car <http://online.wsj.com/article/SB123172034731572313.html> (accessed 07.04.2010).

Tung, R. L. (2008) Brain circulation, diaspora, and international competitiveness. *European Management Journal*, *26*, 298-304.

Wallentowitz, H., Freialdenhoven and A., Olschewski, I. (2009) Strategien in der Automobilindustrie. 1st edition. GWV Fachverlage GmbH, Wiesbaden.

Wang, H.: Betting on Chinese Electronic Cars? – Analysing BYD´s Innovation Capability (2009): 17th Gerpisa International Colloqium Sustainable development in the automobile industry: changing landscapes and actors, Paris 17-19 June.

World Economic Forum (2009) The Global Competitiveness Report 2009-2010, World Economic Forum. SRO-Kundig, Geneva, Switzerland.

Yin, R.K. (1994) Case Study Research: Design and Methods. 2nd edition. Sage Publication, Beverly Hills, CA.

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