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Electric vehicles in China: BYD strategies and government subsidies

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Abstract

Central and local governments in China are investing heavily in the development of Electric Vehicles. Businesses and governments all over the world are searching for technological innovations that reduce costs and increase usage of "environmentally friendly" vehicles. China became the largest car producer in 2009 and it is strongly investing in the manufacturing of electric vehicles. This paper examines the incentives provided by Chinese governments (national and local) and the strategies pursued by BYD, the largest Chinese EVs manufacturer. Specifically, our paper helps to show how government support in the form of subsidies combined with effective strategies implemented by BYD helps to explain why this emerging industry has expanded successfully in China. Our study is based on primary data, including interviews with company headquarters and Brazilian subsidiary managers, and secondary data.

Keywords: China; BYD; Electric vehicles; Strategies; Subsidies

Introduction

Electric vehicles (EVs) are already a reality in the international market. Cars driven purely by battery now account for significant portions of the vehicle fleets of developed and some of the developing countries. The proliferation of these vehicles that are replacing engine combustion alternatives, with either purely electric car or some hybrid form of propulsion, has attracted the attention of researchers seeking to understand the factors that have been most instrumental to the development of this industry, which until only recently developed at a very slow rate without much progress. In a review of the evolution of the industry in the last four decades, Chan (2011) states that the successful production and marketing of EVs depends on overcoming many challenges, including:

- Availability of products with displacement of autonomy at an affordable cost.
- Availability of efficient and easy to use infrastructure.
- Availability of business model to leverage the cost of batteries.

In recent years, there has been a proliferation of scientific papers discussing the progress made by the development of this industry, considering these factors for developed and developing economies. Karlsson and Jonson (2010), for example, investigated a vehicle design plug-in hybrid (PHEV) in a medium-sized city in Sweden. Xonghu (2010) analyzed the shortcomings in the energy sector from the introduction of EVs in China. Du, Ouyang, and Wang (2010) studied business solutions for the mass penetration of first-generation battery electric vehicles in China. Wong, Lu, and Wang (2010) studied the adoption of different technologies for EVs in Singapore. Kudoh and

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Motose (2010) studied the preferences of Japanese consumers for EVs.

Searching to overcome its strong dependence on oil, the Chinese government is supporting the development of alternatives forms of clean energy. Chinese governments and businesses in tandem have sought different forms of partnerships to meet the challenge of increasing technological advancements to reduce costs and increase usage of "environmentally friendly" vehicles. This paper examines the strategies pursued by BYD, the largest Chinese EVs manufacturer, tracking its evolution and the factors that contributed to the rise of this company on the world stage. Specifically, our paper helps to show how effective strategies implemented by BYD combined with government support in the form of subsidies help to explain why this company has expanded in exponential terms in China in recent years. Our objective is to use the case of BYD to identify the factors that contribute to the effective adoption and development of this industry in the context of a developing country. Our study is based on in-person interviews undertaken by the authors with the management of both, the Chinese Headquarters and the Brazilian Subsidiary.

The rest of this article is structured in six sections. First, we provide an overview of EV development in China. Next, we briefly review some of the key findings from the literature on EVs in China. In Section 'The case of BYD and its expansion strategy', we provide an overview of BYD from a startup in 1995 to its main characteristics and main strategies in 2015. We show how BYD has benefitted from government subsidies in Section 'Chinese government subsidies for the EV industry'. The final section makes some concluding remarks on future directions for research on the development of the EV industry.

An overview of EV development in China

According to IEA (2015), Japan and the US are the biggest consumers of EVs. Although consolidated rankings on the production of these vehicles are not yet available, industry experts agree that Japan, South Korea, Germany and China have shown the most significant technological advances. This is because the top 10 leaders in the development of battery production are from these countries. Five are Japanese companies: AESC, Mitsubishi/GS Yuasa, Hitachi, Panasonic and Toshiba. Two are South Korean: LG Chem and Samsung SDI. There is also one joint venture company between Germany and South Korea: SK Continental E-Motion. BYD is the only Chinese firm among the top 10.

In studies developed by Fournier, Hinderer, Schmid, Seign, and Baumann (2012) and Castro, Barros, and Veiga (2013), batteries and their electronic components have been identified as the key technological challenge to be overcome in the successful development of the EV industry considering the entire production chain. This is even more difficult because batteries are the least durable component of EV cars. There are four types of batteries vying to be the standard for the EVs industry: LAB (lead acid); Li-Ion; NiMH (nickel metal hydride) and sodium, also known as ZEBRA, Zero-Emission Battery Research Activity, which is fully recyclable and which tends to be cheaper than lithium-based batteries (Castro & Ferreira, 2010).

Batteries have different degrees of durability. That is, the life of a battery varies depending on the technology used, the type of use and storage conditions. The factors that affect the durability of batteries are extreme temperatures, the excessive time to recharge and complete discharge of the batteries. Currently, manufacturers estimate the lifetime of a battery at 150,000 km and a durability of 5 years.

Recent initiatives of governments and major car companies have prioritized the search for alternatives to oil as a means of vehicle propulsion. A typical example of such an initiative was the development of the Toyota Prius hybrid vehicle, until recently, a world leader in sales in the category (Carrillo-Hermosilla, Del Río, & Könnölä, 2010; Sexton & Sexton, 2014). In addition to hybrid cars, there are other less known initiatives in the development of Battery Electric Vehicles (BEVs). The strategies being pursued and the challenges facing companies to explore this new emerging industry are only now beginning to be studied.

Japanese carmakers Mitsubishi and Nissan launched the pure electric compacts "i.MiEV" and "Leaf" in recent years (Gass, Schimidt, & Schmid, 2014). In 2008, Chinese BYD (Build Your Dreams) launched the e6 sedan crossover. Considering that these and similar initiatives represent an effective solution for oil shortage problems. According to Gao, Wang, and Wu (2008), the potential for development of the electric car industry in China is due to its own national characteristics and global stance regarding energy demands. However, according to Shen, Han, and Wallington (2014), it will be very unlikely for EVs to significantly reduce greenhouse gas emissions because electric power generation is still heavily dependent on thermal power plants that employ fossil fuels.

The need to reduce greenhouse gas emissions and achieve energy efficiency improvements is constant targets of studies and researches in the automotive sector, especially in China. In recent years, studies from the perspective of life-cycle energy consumption of electric vehicles in China and greenhouse gas emission have been a significant concern drawing the attention of scholars including Shen, Han, Chock, Chai, and Zhang (2012); Zhang, Wang, Hao, Fan, and Wei (2013); and Lin et al. (2013). Despite the studies and the progress made, a major obstacle facing the global EV industry is the high production cost of the batteries that drive electric cars – a factor accounting for approximately 50% of the total cost per unit produced (Kimble & Wang, 2012).

With China's economic success and the resulting increase in its population's purchasing power, the country has become one of the world's largest consumer markets (Starrs, 2013). The expansion of the Chinese economy in recent decades, however, has also caused a negative environmental impact that is currently raising concerns from both the Chinese government authorities and the international community (Vennemo, Aunan, Lindhjem, & Seip, 2009). From this perspective, Chinese leaders set out to foster the development of New Energy Vehicles (NEV) (Liu & Kokko, 2013). These vehicles, powered by renewable energy, can counter the ills caused by the rise in consumption and