The Economic Analysis of Clean Energy Powered Vehicle Manufacturers: A Tesla Case Study

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Abstract: With regard to historical trends of global energy security issues, climatic changes, air pollutions, and renewable energy technological progression, the general public has been leading to reconsidering the conventional individual mobility service based on fossil fuel combustion engines (Kley, Lerch and Dallinger, 2011). Compared with conventional internal combustion engine vehicles, electric vehicles (EV) represent an alternative solution to reduce individual fossil fuel consumption substantially. The technological achievement in battery storage and fast charging techniques are now driving individual consumers to become more willing to seek electric-powered engines instead of the fossil-fuelled vehicle. Therefore, the raised social demand and associated spending have lead electric car manufacturers including Tesla, to experience a dramatic market development and achieved an incredible performance in sales revenues over last ten years. According to the report published by the International Energy Agency (IEA) in 2016, the global registration number of the electric car has reached a record with over 750 thousand sales number worldwide. Meanwhile, China remained the largest market with more than 40 percent of the electric car sold across the global market (IEA,2016).

1. Introduction

China's vast urbanisation process and technological development have collective drove consumers to become more willing to purchase personal vehicles to deal with issues associated with mobility. Zheng (2017) discloses that there are over 300 million registered vehicles in China in 2017, which is the population size in the United States. Nevertheless, Ebnesajjad (2017) reported that there are around 1.6 million people in China die every year due to health issues induced by the country's polluted air, where motorised car emission mainly attributes the urban air pollution.

Therefore, the raised public concerns in air pollution issues couple with increased social demand in electric vehicles have inevitably lead the market size of electric vehicles in China to remain enormously huge in the coming future. In this paper, it aims to provide an academic investigation of a chosen electric vehicle manufactures "Tesla" in context of both economic analysis and managerial evaluation.

2. Description of the Tesla's organisational characteristics

Tesla is an American multinational corporation that specialises in electric vehicles, energy storage, and renewable development. The company operates in a functional organisational structure with estimating 37,543 employees across different offices. The structure mainly consists of seven departments including Chairman and Chief Executive officer, Finance, Technology, Global sales service, Engineering, Legal department and manufacturing factory. Tesla is also being observed to comply with traditional centralisation structure, as its headquarter is responsible for making the most of operational decision for its entire global teams and associated offices.

In the context of microeconomic analysis, the Cobb-Douglas production function is widely applied to represent the relationship of production source input and output (See Equation1). The production output is defined as a function of labour employed (L) and the capital (K) investment,

while the coefficient b represents the total factor productivity and α and β represent the output elasticity of labour and capital investment respectively.

$$P(L, K) = bL^{\alpha}K^{\beta}$$
 (1)

Regarding Tesla's EV manufacturing, having well established production process can positively impact on Tesla's managerial decision in determine the least cost combination. With respecting the reality of imperfect substitution between the labour and capital input in Tesla's Electric Manufacturing process, Figure 1 indicates Tesla's would reach its optimal combination of cost inputs at level of Lp and KP, to complete the predetermined target of quantity output.





In 2013, Tesla's CEO Elon Musk emphasised, Tesla's corporate vision aims to accelerate the advent of sustainable transport by bringing electric cars to market as soon as possible. The vision of deliverying mass volume of an electric vehicle with a lower price makes the factor of technology to play a critical role in Tesla's production process.

Having advanced, reliable technology allows Tesla to achieve the economies of scale in which leads its production process to become more efficient by hiring less number of employment. As a result of less human capital input in Tesla's production process, the reduced production cost would make Tesla's vehicle models turn out to be more affordable for mainstream consumers. The future development of technologies in production lines would eventually lead feasibility of making no cost difference in producing electric vehicle or fossil-fuelled cars.

However, there is still a large scope of future development for Tesla to seek to achieve economies of scale. Stock (2018) reported, Tesla was hiring an average number of 35 employees for every Model 3s coming off the production line, which is far more human workers per vehicle than most of its major competitors, such as Nissan, Ford. Hence, the technology would be a significant role for Tesla's production process, as the developed technology would allow Tesla to either produce the same quantity of vehicles with less labour employment or to excess current production volume with a same number of employees.

Besides from production function, firms often apply the economic concept of the cost function to determine the optimal production output level in according to their business objectives.

Average & Marginal Cost



Figure 2 The Short Run Average cost and Marginal Cost

Figure 2 contains four cost elements of firms' short-run production cost including Marginal cost (MC), Average cost (AC), while Average cost consists of Average fixed cost (AFC) and Average variable cost (AVC). The economic term of fixed cost refers a business expenditure that is independent on the quantity of production output, such as the factory rental cost, while the variable cost represents that cost that associates with production quantity output. Regarding Tesla's production process, the average fixed cost refers to firm's annual expenditures on factor rental, capital investment in its vehicle production line, and variable cost represents the cost that is associated with production quantity output such as labour, electricity, and so on.

Adopting cost control technologies may effectively help Tesla to reduce both of operating average variable cost and fixed cost. Meanwhile, having accessed its production cost curve can effectively help Tesla to determine its optimal level of production output by where the marginal production cost (MC) equals to average cost(AC).

3. Market and economic environment in Chinese electric vehicle industry

Raising public demand in electric car has led Tesla to achieve a grate market development in both market share and income revenues. Figure 1 discloses that, Tesla has experienced revenue growth rate by average rate of 57% per year during 2013 to the end of the 2017. Tesla reached vehicle revenue of 11.68 Billion US dollar by the end of 2017, which is a 73.01% increase compared with previous year. In the first quarter of 2018, Tesla has delivered total number of 30,000 electric vehicle units, while 8,180 of Tesla's Model 3, 11,730 of Model S and over 10,000 of Model X (Statista, 2018).



Figure 3 Tesla's Electric Vehicle Sales Revenue and revenue growth rate: historical data from 2013-2017



Figure 4 Tesla's Stock Index Historical Movement, compared with S&P 500 Index. From 2013-2018. Sourced: Yahoo Finance¹

Tesla's excellent performance in electric vehicle section has lead a positive impact on market confidence in Tesla's future development, and financial investors are becoming more willing to arrange financial investment in Tesla's stock. Figure 2 displays that, between 2013 and 2018, Tesla's stock has continuously outperformed the S&P 500 index regardless of the general market environment. Specifically, the average daily return rate of investing in Tesla's stock is three times more than the return rate of investing in S&P 500 index. As the most recent figure published by Yahoo Finance on 10th of May 2018, the Tesla's market capitalisation is estimated to reach 52.8 Billion US Dollar.

In terms of corporate growth strategy, Rowland (2018) highlighted that Tesla applies the generic corporate growth strategy to gain competitive advantages over its competitors in the electric vehicle market. The generic growth strategy refers that Teals applies its high technologies in electric vehicle and associated accessories, to compete against with main automakers in the market.

Moreover, having vertical integration process, Tesla may able to receive benefits of having less transactional cost. Morris (2017) reported that over 5000 components, around 80% of a Tesla vehicle are self-produced. Furthermore, in May 2018, Tesla has established its wholly owned subsidiary in Shanghai with registered capital RMB 100 million to provide R&D on its electric vehicle, accessories, and battery storage.

Hence, a comprehensive business environment analysis regarding Chinese electric vehicle market may become primary important for Tesla to understand the Chinese market. The rest of this paper will mainly apply two analytical frameworks: PEST analysis and Porter's five forces analysis to identify the potential business opportunity and riskiness of electric vehicle market in China.

3.1 PEST analysis

The PEST analysis refers an analytical framework that is implied in corporate strategic management to provide general business macroeconomic analysis. The analysis consists of four elements including Political, Economic, Sociological culture and Technology. Due to the research focus in this paper, it will only investigate the economic environment of Chinese market.

In terms of Economic aspect, China has experienced an incredible economic growth over past three decades and overtook Japan became the world's second-largest economy in 2010 (World Bank, 2014). Due to the large sized population and a variety of other macro factors, China has remained one of the most attractive places for the foreign direct investment of international car manufactures (Abt and Erath, 2014). According to Santander (2017), China was ranked the world's third largest FDI recipient country with the inward flow at the level of 133,700 million US dollar.

With an average level of GDP growth at 7% per year, China's speedy economic growth has and will continuously generate positive impacts on the market development of electric vehicle industry in a

¹ For purpose of comparison each index series is set to equal to 100 on 31st of December 2013.

number of aspects. First, because of the boosted Economy, the disposal income of Chinese people has improved dramatically compared to 30 years ago, in which indicates that there is more people are becoming capable of purchasing personal vehicles (See Figure 5).



Figure 5 China's Individual Disposable Income level from 2008-2018. Sourced: China's National Bureau of Statistics

Second, the incredible economic performance of the Chinese economy coupled with increasing social concerns of the national air pollution issue has inevitably stimulated the social demand of electric vehicles.

3.2 Porter's Five Forces Analysis

Michael E. Porter (1979) published Porter's Five Forces Analysis which offers an analytic framework for a business enterprise to identify its business and weakness in partuclary market. Figure 6 shows a brief summary of Porter's five forces analysis regarding Tesla's business operation in the Chinese market.



Fig.6 Poter's five forces analysis framework

4. Competitive Rivalry

In light of China's "One Belt One Road" diplomatic strategy and the raised market demand of electric vehicles, China has attracted many international vehicles to enter the electric vehicle market in China.

Ranking	Brand/Series	Sales (units)
1	BAIC EC-Series	7,870
2	Chery EQ	4,543
3	JAC IEV7 S/E	3,356
4	BYD Qin PHEV	3,339
5	BYD Song PHEV	2,681

Table 1 provides a ranking of China electric vehicle sales in January 2018.

BAIC was ranked as top seller for electric vehicle in the China's market, in which has successfully delivered 7870 electric vehicles in January 2018. Besides, the domestic electric vehicle manufacturers seem have dominated the Chinese market as there is no international brand was ranked into the top 5 sellers.

4.1 Threat of New Entry

Porter (1979) summarized major sources of a barrier to entry including the economics of scale, product differentiation. In perspective of existing electric vehicle manufacturers, it indicates that the cost of entering the market is relatively low as any qualified car manufacturers may able to engage electric vehicle productions. Firms include BYD, Chery and Roewe have only started to produce electric vehicle in recent five years. Comparing with existing firms in the China's market, Tesla contains key competitive advantages as it equips the best technology while other competitors could not achieve yet. Technologies including fast charging, battery endurance power, autopilot process enables Tesla's Model to remain the market leader in the global market.

Due to the stable financial background, Tesla may able to operate in large scale with a considerable level of capital investment in China to overcome the issue of production inefficiency and therefore to secure its output target will be constantly meet with a reasonably low level of cost.

4.2 Threat of Substitution

Porter's threat of substitute refers the availability of product or service that consumers can purchase instead of seeking electric vehicle for personal mobility devices. In the China's first tier cities such as Shanghai, consumers are very unlikely to choose the convention fossil fuelled cars are the cost of getting vehicle registration number plate is really high. Instead of it, as one of government incentive policies, consumers would be able to receive free vehicle registration service. However, such government incentive policies are not applicable to the China's second tier cities. In China's second tier cities, fossil fuelled vehicles are still the first options for consumers to choose.

4.3 Bargaining power of Buyers

The bargaining power of buyers depends on the level of market competition, consumer quantity demand, product uniqueness, and the characteristics of targeting consumer segmentation. In terms of electric vehicle market, the limited competitors in China restrict the consumer's choices. Hence, consumers are more likely to behave as price taker in the market. Besides, it is highly possible for domestic manufactures to gain consumers by offering low prices, Tesla's would therefore need to seek a different marketing strategy to promote its electric vehicles.

4.4 Bargaining power of suppliers

Porter (1979) highlights that suppliers may use its bargaining power by increasing prices and reducing the quality of raw materials or semi-finished products. Thus, dominant suppliers can squeeze firm's profitability in which firms are not able to recovery such cost disadvantages by raising its selling prices. Tesla's vertical integration growth strategy can assist Tesla to secure the reliability of its supply chain process, as over 80% elements of Tesla's Model are self-provided by itself.

5. Conclusion

In the presence of growing public concerns of climatic changes and air pollutions, the market future development of electric vehicle in China remains optimistically with tremendous investment potential and would also be best interest for Tesla to operate its business in China. This paper has applied three analytical methods to identify business opportunities and riskiness of Tesla's business in China. Typically, the economic analysis suggests that Tesla need to give a further focus on technological development in its production process in order to improve its production efficiency with hiring less human capital. The Porter's five forces analysis indicates that there are many domestic electric vehicles manufactures exists in the China's market, and would be highly possible for those firms to gain consumers by offering low prices. Therefore, it would be necessary for Tesla to seek a suitable marketing strategy to promote its product by offering consumer unique experience which is different from its competitors.

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