

Manufacturing of Electric Vehicles

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Abstract: As time goes by with the development of society, the climate has been through irreversible damage that could push the environment to the tipping point. Therefore, the new energy vehicles came out which would directly reduce the exhaust emission, at the meanwhile the use of renewable energy can best achieve the goal of environmental protection. The new energy vehicle, especially the electric vehicle, is a brand-new market in the world. Tesla shows how beneficial the market is. More enterprises notice the new market and develop their electric vehicle.

1. Introduction

In the year 2020, there are more than 10 million electric cars on the world's road. The "International Energy Agency" organization provides a graph showing the global electric passenger car stock between 2010-2020 [1]. In the graph, IEA found out that electric cars developed rapidly from 2016-2020. China is the biggest electric vehicle in the world. Governments across the world spent USD 14 billion on direct purchase incentives and tax deductions for electric cars in 2020, a 25% rise year-on-year. In addition, automakers entice the customer with a wide menu, giving the customer more car models. Currently, about 370 electric car models were available in 2020, which has increased 40% from 2019.

Over 10 years of development, the technology of new energy vehicles is becoming more and more mature. Tesla is the first batch of enterprises to develop new energy vehicles. They have unveiled their battery technology and electric power train in the year 2008. In June 2012, Tesla released the first premium all-electric sedan [2]. BMW is an old automobile enterprise. In 2017, BMW's CEO announced that the company is making a wholesale shift to the electric car. He also told a journalist, "By 2025, we will offer 25 electrified vehicles. Twelve will be fully electric." [3] The BMW shift the company to electric car shows the future mainstream is not gasoline vehicle. Mercedes-Benz also released a new electric car called "EQS". It is a redesigned high-end S-class, a luxurious ride. The CEO, Ola Kallenius, told reporters that EQS is part of the brand's plant to convert more than half of its sales to electric drive systems [4]. From the above information, we can find that more and more automobile enterprises are transforming into electric vehicles. The electric car market is the mainstream of the future.

In this paper, we are going to research Tesla, Mercedes-Benz, and BMW. Their developed electric vehicles have now entered the market. First, we are going to compare their sales amount, production, and user coverage. Then, analyze the data, find the management problem, optimize it, and develop strategies that help them get more benefit from the market.

2. Method

2.1A subsection

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2.1.1 General method.

We used the literature research method, case analysis method, quantitative analysis method, and contrastive analysis method to do the scientific research. The literature research method is a scientific research method based on the project and the need for the research, which needs to look up the documents and information. The case analysis method is a method that uses the documents to analyse cases and leads to the regular pattern or laws of a case. Quantitative analysis is a method that analyses the characteristic of quantity, the relationship between quantities, and the quantity variation. Finally, the contrastive analysis method is a method that compares the cardinal number and the practical number to know the problem of the economy.

2.1.2 Concrete method

The data of new cars purchased by the customers are shown in the data introduction to present the annual increase in the numbers of civilian cars. In addition, we list the data of the car company's annual sale number in China from 2015 to 2019. The data shows the popularity and the annual increase of their sale, and they are likely to figure out the flaws in their products and whether the customers welcome their new products. Together with the annual increase of the general vehicles in China, the annual market share of each company can be calculated.

2.2 Data introduction

We searched several social media and catechetical websites. The data from the website, which were formed by car fans, showed that the BMW car needs 5 days to build up from accessories to a car and the whole process that from getting the order to building a car cost 15 days. The data might vary from brand to brand. Tesla's car's manufacturing process can be shortened to 10 hours theoretically. According to the data from the National Bureau of Statistics of China, the number of new cars which were produced in 2015 was 23317507. The number of new cars which were produced in 2016 was 27244374. The number of new cars which were produced in 2017 was 28003955. The number of new cars which were produced in 2018 was 26521129. The number of new cars which were produced in 2019 was 25445941.

Table 1. The Number of New Produced

	BMW	BENZ	Tesla
2015	464000	373500	5042
2016	516355	472844	3330
2017	594000	587900	20000
2018	639953	653000	156000
2019	723680	702088	367000

By analysing the data above, we can discover the variation in their sales each year. All three companies grew fast and Tesla, as a new-energy car firm, grew tremendously. The BMW and Benz grew at a constant speed, and their sale overwhelmed Tesla. Additionally, we need to distinguish between the traditional car firm and the electric car firm. The traditional companies were built in the last century, and they were well developed. As for the electric car firms, they are new to customers and the market. So their market shares are less than the traditional ones.

The tremendous increase in Tesla's sales in China is not so unreasonable due to the promotion of electric cars in the government policy.

3. Results and Discussions

Tesla is CHOSEN. Back in February 2008, whenever Tesla did not yet have their own factory, a red sports car rolled down the production line stopped next to Elon Musk, who would build an empire with the Tesla. But nowadays, "The second quarter of 2021 was Tesla's best quarter ever. For the first time, the company produced and sold (globally) more than 200,000 electric cars and achieved a record high profitability. The final sales numbers are slightly higher than in the preliminary report (the production numbers have not changed)" [5]. Tesla took 13 years to get this incredible accomplishment. This requires several critical success factors, which includes engineering management.

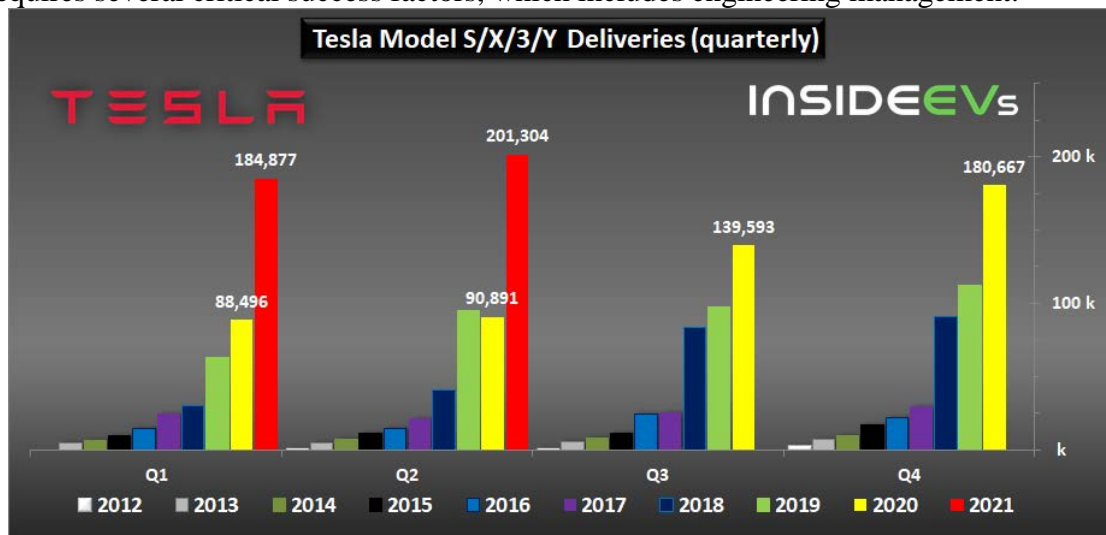


Figure 1. Two or more references

3.1 About Tesla

Tesla's mission is to accelerate the world's transition to sustainable energy [2]. Since the environment got irreversible impacted and facing the "breaking point" due to the exhaust gas emission mostly from the traditional way of transportation, Tesla was aimed to create an infinitely renewable clean energy to achieve sustainability without emission. "Tesla was founded in 2003 by a group of engineers who wanted to prove that people didn't need to compromise to drive electric – that electric vehicle can be better, quicker and more fun to drive than gasoline cars. Today, Tesla builds not only all-electric vehicles but also infinitely scalable clean energy generation and storage products. Tesla believes the faster the world stops relying on fossil fuels and moves towards a zero-emission future, the better." [2]. This specific idea perfectly met the aspect of the situations we are facing now, so the electric vehicle gained much support from many governments among their way of development.

3.2 Tesla in Marketing

People have a variety of choices in Tesla. At first, Tesla's product was the target of the high-end market, eventually with an affordable price to gain market share as much as possible. Therefore, Roadster, a fancy sports car, which will be their top performance, also the Model S and the Model X as being their grand luxurious level, at the meanwhile the Model 3 and the Model Y are also a good choice with a fair price. According to governor Newsom's announcements, he will aggressively move the state further away from its reliance on climate change-causing fossil fuels while retaining and creating jobs and spurring economic growth – he issued an executive order requiring sales of all new passenger vehicles to be zero-emission by 2035 and additional measures to eliminate harmful emissions from the transportation sector." [6]. With the support from the state, in the next future, Tesla has nothing to worry about but to develop and provide more and more new products to lead its own trend.

Compared to Mercedes-Benz, it is not as many models as Tesla. They published their new car, Mercedes-EQS, which is their first fully electric luxury vehicle. It will be released in late 2021. Unlike

Tesla, Benz doesn't have many models. Since the company has been involved in the electric vehicle for only a few years, according to the description, "With easy charging opportunities in the densest network of charge points, the EQS can get a quick boost in just 15 minutes. And unlike traditional gas-powered engines, the EQS electric engine has its own soundscape, designed to uniquely carve out space for tranquility within the cabin." [7]. The EQS has the quick charge ability, saving your time while waiting for charging. Mercedes Benz is an old automobile enterprise. They have enough funds and resources to develop more models. Time is the only thing that needs to consider.

4. Pioneer of the Market

Increasing the productivity to face the demand for the next stage. Tesla is a company with ambition. They are developing the best product and their sustainable energy system, which includes Powerwall, Powerpack, and Solar Roof, etc., supported directly from the Gigafactory. But with the increasing demand, the Gigafactory 3, which the Tesla Giga Shanghai, activated in January 2020. This decision could save the cost of manufacturing to the maximum. Also, it is easier to export. One of the most important reasons is that the Chinese market of electric vehicles and renewable energy is still waiting to be explored with huge potential to be discovered. "Tesla's wholesale sales volume in China in June 2021 was 33,155 units, including 11,623 Model Y and 21,532 Model 3, including 5,017 exported. For comparison, Tesla's wholesale sales in China in May 2021 were 33,463, including 12,728 Model Y and 21,936 Model 3, including 11,527 exported." [8].

The battery is also a significant part of an electric vehicle. As he said, Prototype is easy. Production is hard. Tesla is unique in battery design and cost. It is better and cheaper than other car companies. Tesla pays an average of \$142 per kWh (kilowatt hour) for batteries, while the generals pay \$169 per kWh, the industry pays an average of \$186 per kWh [9]. It is much cheap than the general. Tesla's battery leads the way. Looking at the battery cost, Tesla reduced battery costs by 56% in three years [10].

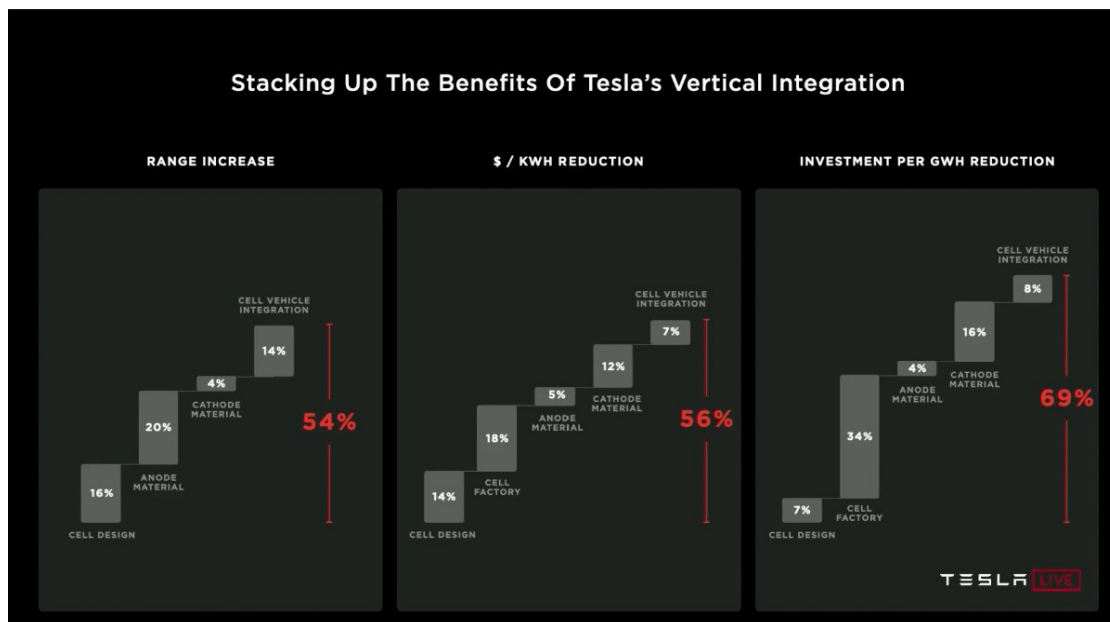


Figure 2. Tesla Live 1 Stacking Up The Benefits Of Tesla's Vertical Integration

5. Conclusions

In conclusion, new electric vehicles still got a long way to go. From the research above, we can see how fast does the battery improve in recent years. More car companies are transferring from traditional to the new electric vehicles. The company gets better batteries and faster produce process gets the lead of the market. Tesla is showing its leading technology in batteries and also has a higher dominance in the market. BMW and Mercedes-Benz have recently changed their corporate direction. Because of

their previous unassailable position in the automotive industry. They have sufficient funds to develop batteries, and many large production plants provide them with rapid production. Given enough time, they can also perform well in the new electric vehicle market.

Overall, the electric vehicle will be sustainable development as long as it is reliable and tested by the market since its adjusting ability between surplus and supply.

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