Volume 1 Issue 1, February 2024 ISSN: pending

QUANTITATIVE INSIGHTS: A DEEP DIVE INTO TESLA'S OPERATIONAL TRIUMPHS VIA DATA ANALYSIS

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Abstract: Tesla Inc., a pioneering force in the realm of electric vehicles and clean energy, stands at the forefront of innovation, with a commitment to designing and manufacturing electric cars, battery energy storage, and an array of related products and services. Headquartered in Palo Alto, California, United States, the company's journey began with its incorporation as Tesla Motors, Inc. on July 1, 2003, by visionaries Martin Eberhard and Marc Tarpenning. This abstract offers a glimpse into the genesis and evolution of Tesla Inc., tracing its trajectory from a nascent venture to a global leader in the electric vehicle and clean energy sector. The narrative unfolds against the backdrop of a shifting automotive landscape, as Tesla emerges as a transformative force challenging traditional paradigms. The company's foundational commitment to electric vehicles and clean energy solutions underscores its visionary approach to addressing environmental concerns and redefining the future of transportation. This abstract delves into the early days of Tesla Motors, highlighting the pivotal role played by founders Martin Eberhard and Marc Tarpenning in shaping the company's identity and mission. Tesla's impact extends beyond its innovative products; it has become synonymous with pushing the boundaries of technology and sustainability. The incorporation of Tesla Motors marked the inception of a journey that transcended the conventional automotive industry, leading to the establishment of Tesla Inc. as a symbol of cutting-edge engineering and environmental consciousness. This abstract encapsulates the essence of Tesla's transformative vision and its enduring legacy in reshaping the automotive and clean energy landscape. In conclusion, Tesla Inc.'s evolution from its roots as Tesla Motors to its current standing as a global leader epitomizes the convergence of technological innovation and environmental responsibility. The abstract provides a snapshot of Tesla's journey, highlighting its commitment to revolutionizing transportation and clean energy.

Keywords: Tesla Inc., Electric Vehicles, Clean Energy, Innovation, Environmental Responsibility

INTRODUCTION

Tesla Inc. is an electric vehicle and clean energy company, designing and manufacturing electric cars, battery energy storage and related products and services. Based in Palo Alto, California, United States, the company was incorporated as Tesla Motors, Inc. on July 1, 2003, by Martin Eberhard and Marc Tarpenning. Tesla's business and its market share have grown exponentially in recent years. In 2020, it had the most sales of battery electric vehicles and plug-in electric vehicles, contributing to 16% of the plug-in vehicle market and 23% of the electric vehicle market worldwide. Tesla released Q2 earnings and revenues in the last week of July 2021, reporting a record of \$1.1 billion in net income on \$12 billion revenues, which were well above the Wall Street analysts' expectations. Along with its success in the vehicle market, the company's subsidiary, Tesla Energy, is also a

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significant installer of photovoltaic systems in the US, one of the largest global suppliers of battery energy storage systems. This paper studies the operation of the company to provide reference for the company and stakeholders.

Business Model

Tesla's business model has the following unique traits. First, unlike other vehicle companies that distribute their products through various worldwide dealers, Tesla focuses solely on direct sales. Second, Tesla has service centers in all its natural sale stores with personalized services. Third, Tesla's business model has an exclusive emphasis on rolling out charging stations, which act as the most significant hindrance in electric vehicle popularity

Key Problems Facing the Company

While Tesla appears to have good sales and stock gains, it also has some problems, which will be discussed in this report. Overvalued Stocks. From the perspective of this thesis, Tesla's stock is overvalued because both it's unique positioning in its industry and its ahead-of-the-curve technology have caused its stock to rise more than it should have. Understanding how much a stock is overvalued and the reasons for being overvalued is one of the problem. Existing or upcoming competitors. Tesla has been a leader in the electric vehicle industry for many years, long enough to know if it is profitable or still an excellent time to join. As of the completion of the paper, news can be found that many well-known fuel car companies such as GM, Toyota have started to enter the EV initiative. So, adapting to the new competitive environment and fighting against other competitors is also one of the problems. Lower net profit compared to revenue. Looking at Tesla's revenue and net profit separately, both are excellent values. However, because the company's total expenses are too high, Tesla's net profit looks low once the two are compared. Analyzing the income statement and finding solutions is what this part of the discussion is concerned with. Need for accurate positioning. Tesla is undoubtedly a company with a wide range of industries, but this also makes it difficult to abandon a new field after it has entered and developed it, because the industry in the new field may involve the internal chain of the company after it has taken shape. All of the above causes Tesla can't put all its money and energy into one field to develop it to the best.

Management

When Tesla was first founded by Martin Eberhard and Marc Tarpenning in 2003, its objective was to produce premium electric sports cars before changing to more affordable and standard vehicles. In 2008, Elon Musk became the CEO of Tesla and raised nearly \$190 million within one year. Later on, in 2009, Eberhard filed a lawsuit against Musk for breaching a contract and forcing him out of the company, but the case was dropped after two month. In the years that followed, Musk faced multiple criticism and lawsuits due to his highly controversial statements to the public. Some examples were when he was sued for defamation of a caver during the Tham Luang cave rescue and when he tweeted false information about secured funding for the private takeover of Tesla ("Elon Musk", 2021). He was forced to resign as a chairman for several years but could remain as a CEO in the latter situation. As a person of his status, there are many other questionable statements from Musk such as the recent tweets that said "Tesla stock was too high", "I am selling almost all physical possessions", "my gf is mad at me"^[1] or the spread of COVID-19 misinformation. Musk even consumed whiskey and smoked pot during one of his public appearances while being watched by millions of people. [2] More than once Tesla stock has been affected by Musk's impulsiveness, but overall its price has been rocking since the beginning of 2020. Despite that, many people admired Elon Musk for his characteristics and accomplishments. Not only Musk himself, but he also asked his senior executives to motivate the employees. He also believed managers should put more effort into their work than their subordinates and act as role models for them. Elon Musk's objective is for everyone to

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enjoy their work by making them feel like a part of a large community that shares the same goal – "to make the company successful".^[3] For this, the CEO was praised by many of his employees for being creative and inspiring, but some oppose his management

Style and costly business decisions.^[4]

Marketing Analysis

Tesla's marketing model has proved successful so far. It became the world's fastest growing brand in 2021, and Tesla's market value is on an increasing trend and has surpassed many well-known car manufacturers such as Audi and Toyota. As sales rise and new products are introduced, Tesla's biggest problem is production. Growth in car production is largely tied to battery supply. The ideal solution would be self-sufficiency. Tesla would build its own battery factory.

The product life cycle of TSLA

The product life cycle is associated with marketing and management decisions within businesses. It describes the journey all products take from their introduction to eventual decline. The life cycle is usually broken down into four stages; introduction, growth, maturity, and decline. The length of the product life cycle is influenced by industry, product, and market factors. Since its founding in 2003, Tesla has gone through the introduction stage and is now growing. In this phase, their target customer is Early Adopters to Early Mortality. In other words, customers are willing to take more risks and pay more to get Tesla's latest and greatest. They are eager to learn about Tesla, see its potential, and buy it. Tesla's audience tends to be young, energetic, high-income people. These consumers tend to focus on shaping the concept of environmental protection, are easy to accept new ideas, and like to try new things.

The main business of Tesla

Tesla's business areas are modern products, including electric vehicles, green energy production and storage. Electric vehicles are now Tesla's main marketing product. The company's automotive business includes the design, development, manufacture, sale and leasing of vehicles and the sale and service of vehicle regulatory credit. The Energy production and storage segment includes the design, manufacture, installation, sale and leasing of solar systems and energy storage products and services related to their products. "Its current vehicle offerings include Model 3, Model Y, Model S and Model X. The company's energy storage products include Powerwall, Powerpack and Megapack". [5] The first electric vehicle they developed and produced was the 2008 Tesla Roadster.

Four P's: Product, Price, Place, Promotion

Product. As electric vehicles become a norm, Tesla can further promote their products to a more extensive customer base. Tesla could expand production and increase distribution to meet growing demand in Europe and Asia and capture potential markets. Tesla can stop selling unprofitable or insufficiently differentiated products to add features and value to existing brands and help them consolidate and improve their market position. Now the company is most likely to face the problems: how will the launch of Tesla's new product brand affect the overall brand equity of existing brands and products? Can it meet the needs of potential customers and create profits for the company? For the above problems, we can introduce the new brand into the existing product line or establish a new product line.

Price. Pricing needs to be based on the cost of the product and markup based on the profit you want to make. We can also earn a slight premium based on overall brand awareness and the performance of Tesla's current innovative

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products. Offering the right mix of product features, quality, and service combinations at a fair price. The key point about the pricing strategy is that we need to match our competitors' prices and focus on reducing operating costs to increase profitability. Fortunately, Tesla is currently a giant in the electric vehicle (EV) market and has a high level of name recognition, which stabilizes pricing.

Place. In terms of direct distribution, Tesla can increase the publicity of directly operated store locations to ensure that individual customers are provided with opportunities to purchase products. Through partners, stores are set up in major economic prosperity zones. The distribution mix of Tesla's vehicles can take on a new dimension with the emergence of online retailing and the domination of players such as Amazon. The main problem with marketing channels is that we need to ensure that we have more distribution channels than our competitors and that our products are available to the masses before they are.

Promotion. We need to understand what our customer base is and understand the gap between our competitors and us. Attract more customers by ensuring product quality and after-sales service. The emergence of social media and online advertising has boosted Tesla's communications mix. The most critical problem facing sales promotion is publicity. We have to make sure that our advertisements are more creative and eye-catching than our competitors.

Total Sales of EV and Market share

The following chart represents Tesla's total annual revenue over the past ten years and quarterly revenue from FY 2018 to FY 2021. As can be seen from the Table 1, the sales of Tesla's electric vehicles showed an apparent upward trend. The most important markets of Tesla include the United States and China. Tesla generated \$31.5 billion in sales in 2020, up 28% from the previous year. It is further confirmation that Tesla's sales are doing well. The company produced its one-millionth electric vehicles in March 2020, becoming the first automaker to achieve that goal. Tesla's cumulative vehicle deliveries in 2020 are approaching half a million. Between July and September 2021, Tesla deliveries crossed the 240,000 unit threshold. [6]

Table 1: Tesla's sales revenue 2009-2021 (Millions of US \$). [7]

Tesla Annual Revenue (Millions of US		Tesla Quarterly Revenue (Millions of	
\$)		US \$)	
2020	\$31,536	2021-09-30	\$13,757
2019	\$24,578	2021-06-30	\$11,958
2018	\$21,461	2021-03-31	\$10,389
2017	\$11,759	2020-12-31	\$10,744
2016	\$7,000	2020-09-30	\$8,771
2015	\$4,046	2020-06-30	\$6,036
2014	\$3,198	2020-03-31	\$5,985
2013	\$2,013	2019-12-31	\$7,384
2012	\$413	2019-09-30	\$6,303
2011	\$204	2019-06-30	\$6,350
2010	\$117	2019-03-31	\$4,541
2009	\$112	2018-12-31	\$7,226
2008	\$15	2018-09-30	\$6,824

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Table 2: The Top 20 best-selling electric vehicle brands in the world for the first eight months of 2021.^[8]

Ranking	Brand	202101-08 (unit)	Market Share (%)
1	Tesla	473,136	13.3
2	Wuling	267,206	7.5
3	BYD	259,108	7.3
4	Volkswagen	214,127	6.0
5	BMW	172,336	4.8
6	Mercedes	138,601	3.9
7	SAIC	132,712	3.7
8	Volvo	115,598	3.3
9	Audi	107,195	3.0
10	Kia	87,208	2.5
11	Hyundai	84,901	2.4
12	Renault S.A.	81,002	2.3
13	Toyota	80,321	2.3
14	Peugeot	76,688	2.2
15	GWM	72,563	2.0
16	Ford	70,808	2.0
17	GAC	67,188	1.9
18	NIO	56,765	1.6
19	CCAG	56,114	1.6
20	Skoda	49,171	1.4
	Other	891,268	25.1
	Total	3,554,016	100.0

In the first eight months of 2021, more than 3.55 million electric vehicles were sold globally, accounting for 6.6% of the global auto market. In accordance with Table 2, Tesla held a global electric vehicle (EV) market share of 13.3% during the initial two quarters of the year 2021. However, Tesla's market share reached 17.7% in 2020.^[9] That's a decline in market share of 25%. Even so, it won't have any material impact on Tesla's stock valuation.

Competitors

While Tesla is the market leader in electric vehicles, it grows more slowly than the overall market as other automakers roll out electric cars. Ford and General Motors (GM) could become their main competitors.

As Ford and General Motors start to move into electric pickups, Tesla will face tougher competition. Both companies announced in 2021 that they would offer iconic trucks in the form of all-electric vehicles. General Motors plans to produce the Chevrolet Silverado electric vehicle with a 400-mile range but did not give a release date. Ford said it would introduce an electric truck in 2022 called the Ford F-150 Lightning, with a range of up to 300 miles. But even so, Tesla still has an edge in the electric vehicle (EV) market for now. Tesla accounts for more than half of electric vehicle (EV) sales in the U.S. simply because its cars go further. Tesla's Model S has a range of 380 miles, and that is a number that none of its current competitors can cross. Another reason is that

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Tesla has been around the electric vehicle (EV) industry a lot longer than its competitors. Thanks to its time in the market, it enjoys brand recognition, word-of-mouth advertising, and a much more expansive charging network.

Finance

As depicted in the income statement, from 2017 to 2020 total revenue went up 40% to 50%, reaching almost 31.54 billion at the end of the period. Through quarterly income statements, the revenue and profit margin are volatile, but revenue increased to a high level in June 2021. Usually, the rapid increase in sales and net income is lined up with the release of a new product. Although net income was negative from 2017 to 2019, it improved over time and increased to 721 million in 2020. However, the net profit of only 721 million was still too low compared to its revenue of 31.54 billion.



Figure 1: Tesla's revenue, net income, profit margin % from 2017-2020. [10]

Through the profit margin trend and the earnings data in Figure 1, Tesla has been losing money for many years. It shows Tesla experienced depression from 2017 to 2019, and it just turned regular and started recovery in 2020. Even though net income increased during this period, it was a slow process due to the high total expenses. The income statement shows that they have operating expenses on selling general and administrative, research and development. Although Tesla often needs to produce new cars with the Times, they can cut costs with intelligent machines and intelligent warehouses to minimize labour costs. Perhaps Tesla should find an accurate positioning that would be easier for themselves. If Tesla focuses on producing one type of car, the operating expenses will be much less. For example, Tesla only produces new energy vehicles and stops producing non-new energy vehicles to reduce costs. Tesla also has more accurate positioning. Tesla's total assets are increasing from the balance sheet, but debt ratios were high in previous years. Until 2020, the total debts had a clear downward trend, with the debt ratio staying healthy around 50 percent. On June 29th 2021, the total debt decreased to 11,133 million, total assets increased to 55,146 million, and total current assets were 24,693 million. At the same time, total equity also increased to 24,804 million. Thereby, we can calculate a debt/equity ratio of 0.45, which is a healthy number. However, the total liabilities rose to 28,896 million, and total current liabilities increased to 16,371 million in 2021 Quarter 2. Thus, the current ratio is 1.5, less than 2, which indicates that Tesla is struggling to pay its bills, and short-term assets are challenging to undertake short-term obligations to creditors. From the cash flow statement, operating cash flow increased to 9,931 million on TTM. The change in working capital is positive, which means the company might have taken on new debt or sold a fixed asset to generate more money. The money they spend on their current inventory decreases year over year. But Tesla spends more and more money

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on investing and investing cash flow increased to 3132 million dollars. According to the quarterly table, supporting cash flow reached 2,582 million dollars on March 30, 2021. Cash flow from financing activities represents the company's strategy for raising money. Before 2021, financing cash flow was positive numbers, which means Tesla received more money than they spent, increasing its assets. In 2021, cash flow from continuing financing activities increased to 1.381 billion on September 29th. Moreover, common stock issuance is when Tesla went public, common investors can buy Tesla stock. Tesla generated 12.269 billion from issuing shares to the public in 2020. However, from the quarterly table, common stock issuance shows 0 dollars in 2021. From the data of net issuance payments, Tesla always received money through debt-related activities before 2020. But in 2020, Tesla spent 2.488 billion on debt issuance. On September 29th, 2021, the data became better. Tesla spent 1.526 billion on debt activities. In addition, free cash flow increases yearly because the company is continually generating more and freer cash to invest back into the business. Gross margin is about 20 percent for profitability ratio, and profit margin below 3, which is at a low level in 2020. It shows Tesla's strategy for 2020 is to expand its revenue, and the earnings growth is slow. They pay attention to gaining more market shares and developing their scale. However, there are many competitors in the car industry, so cars cannot sell at higher prices due to the price war. But profit margins have risen substantially in 2021 Q2. Tesla's ROE in previous years was negative, but it improved year by year. It rose to 3.24% in 2020. The financial statement still has enormous problems. Their ability of management cannot maintain or increase profitability in relation to equity provided. So, it is not a very good standard for investment. In summary, Tesla is a company with great potential for growth and many emerging growth points. However, it is difficult to gain profit through financial statements, so they do not have high risk on finance, and almost all financial indicators have improved features. If Tesla wants to expand production capacity further, they need to build more super factories and more capital spending. The huge amount of capital spending may cause financial statements to deteriorate again. In the future, it is challenging to grow the revenue at almost zero marginal cost when the demand of the market increases significantly, so investors should invest in Tesla carefully.

Stock valuation

Valuation ratios

This section will analyze the price-to-earnings ratio, price-to-sales ratio, price-to-book ratio, and dividend yield ratio to discuss whether Tesla's stock price is overvalued or undervalued. However, since Tesla currently lacks strong competitors in the international market, this section does not extensively analyze competing companies' stock prices.

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PE Ratio (Q2 TTM)	439.08	93.43
PE Ratio Expected EPS		100
Price to Sales (oz TTM)	22.63	5.48
Price to Sales Ratio Expected Sales		D
Price to Cash Flow (Q2 TTM)	122.21	
Price to Free Cash Flow (02 TTM)	102.72	22 12
Price to Book (Q2 MRQ)	38.03	18.06
Price to Tangible Book (QZ MRQ)	38.79	20.4
PEG (QZ TTM)	1.13	

Figure 2: Tesla Inc (TSLA) Valuation Ratios Comparisons to Industry Sector and S&P, 2021^[11]

The price-to-earnings ratio is a ubiquitous tool for both investors and analysts to value stocks. As illustrated in Figure 2, Tesla's price-to-earnings ratio stands at 439.08, notably contrasting with the industry average of 93.43. The price-to-earnings ratio is much higher than the industry figure, indicating that Tesla's stock generates much revenue. Since Tesla is a technology company, this also indicates that its growth speed and extent of Tesla's growth far exceed that of other companies in the industry, and a large number of investors have confidence in its future growth. The price-to-sales ratio is also a critical stock valuation tool representing how much investors are willing to pay for each dollar of a company's stock. Tesla's price-to-sales ratio is much higher than the industry, with Tesla at 22.53 and the average of other industries at 5.48. Therefore, Tesla's stock is wholly overvalued if the analysis is based on this figure alone. This overvalued stock price is abnormal. More on this will also be discussed in the last part of this section. In the price to book ratio, the market value of a company is compared to its book value, which is an excellent way to identify potential assets. As the chart shows, Tesla also has a high price to book ratio of 38.03, compared to an average of 18.06 for the rest of the industry. In some cases, a high price to book ratio across the industry can drive up the price to book ratios of some leading companies, but even so, a price to book ratio of 38.03 is still too high. From this perspective, Tesla's stock is definitely overvalued. The dividend yield is not very comparable for Tesla because its dividend yield is 0%, as most of the auto industry. However, while this is part of the return on investment, one should not judge whether one should buy the stock

based solely on the size of the dividend yield, as it is attractive but by no means the most reliable way to judge whether a stock is good or not.

Margin of safety for valuation

As of October 17, 2021 Tesla's stock is 843.03 USD [12], Tesla's intrinsic value is 189.82 USD[13]. Substituting these two values into the formula: Margin of Safety = Intrinsic Value per share - Stock Price (-653.21 = 189.82 - 843.03) this means that Tesla's stock is overvalued by almost 77.48%, a severe overvaluation. Tesla's discount rate is challenging to analyze. It is like going to a bank and taking out a deposit early and having interest deducted, but the investor does not know how the interest will change in the future. For now, Tesla's discount rate is meagre because its stock price has been consistently high and earnings growth rates are very high [14], so low and high should be the positioning of both the discount rate and earnings growth rates. However, this seems to be the exact opposite of the data shown in the formula, which will be explained in the last part.

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Qualitative factors for valuation

Looking at the chart of Tesla's stock price alone, it seems that buying Tesla's stock is like buying gold futures, a haven for stockholders and a sure-fire deal. In the price-to-sales ratio section, Tesla's stock is overvalued. As mentioned at the beginning of this section, Tesla currently lacks a strong competitor in the global market. This prevailing situation is the culprit for the overvaluation of the stock. As the global industry becomes more environmentally conscious, many automakers are beginning to research and develop teams and even hydrogen vehicles.^[15] Even large car companies like General Motors are joining the ranks of electric vehicle development.^[16] When these companies flood the EV market in the next few years, Tesla's advantage will be gone. Once this happens, the price-to-earnings ratio will fall because Tesla will no longer be the leading company. The price-to-earnings ratio of the industry as a whole will rise. When the price-to-earnings ratio difference between the company and its industry is not significant, the favorable choice to buy the stock will be lost. The price-to-sales ratio will also fall for the same reason because shareholders can buy shares of companies with similar or higher returns in the same industry. Then the price of buying a dollar's worth of stock at 22.53 may not be so acceptable anymore. In the above case, Tesla's discount rate and earnings growth rates will also change once the future and Tesla similar companies have risen, resulting in a decline in Tesla's share price. The discount rate will change to high, and then after the major companies have divided the electric market, Tesla's earnings growth rates may become medium. In summary, buying Tesla stock is not a very good choice. Tesla's stock price will probably level off in the next ten or twenty years and then fall to a stock environment where many companies are competing in the industry. Although the price to book ratio will normalize in the future, even if it falls, the priceto-earnings ratio and price-to-sales ratio will not be as high as they are now. The industry average, so it is not cost-effective to buy Tesla's stock now.

Recommendations & Solutions for Key Problems

Overall, the detailed analysis above clarifies the strengths, prospects, and weaknesses of Tesla Inc. Among them, over-valuation of the stock, low net profit compared to its revenue, potential strong competitors in the future, and vague corporate positioning are the main problems Tesla is currently facing. Under careful consideration, we have some recommendations based on those issues. Tesla is now in the growth stage, and it is normal for its stock to be overvalued in this period. However, Tesla needs to be prepared to face the future shrinkage of its stock price as the corporation enters the maturity stage. Besides, Mr. Elon Musk, as Tesla's CEO, needs to be careful about his controversial public statements to maintain Tesla's corporate image as much as possible to ensure the stability of the stock price. According to our analysis, Tesla has a meager net profit compared to its revenue. This condition was recovered from 2020, but it will be a slow process due to its high expense. The best way to expedite this process is to reduce total costs as much as possible. Tesla can cut costs with intelligent machines and intelligent warehouses to minimize labour costs. In addition, Tesla's product positioning is not precise enough. The product categories are too scattered, which has also led to the rise of various costs. Establishing the dominant product position and reducing investment in edge products can also help Tesla minimize consumption. Although Tesla is currently the leading brand in the electric vehicle industry, as other automakers launch electric vehicles, its growth rate has begun to be lower than the overall market. Ford and General Motors are both potential strong opponents. Therefore, establishing an excellent corporate image in the minds of consumers, increasing consumers' repurchase rate of products, and improving the after-sales service is what Tesla needs to do now. Once a good brand image is established, it will play a massive role in future market competition. Simultaneously, it is necessary to

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strengthen the publicity and promotion of Tesla products. Combined with the current network media to form an information matrix to make Tesla's brand image deeply rooted in the people's hearts and preconceived to occupy the consumer preferences. Finally, Tesla currently does not have a precise corporate positioning. Tesla is the largest electric vehicle manufacturing company and a leader in the development of new energy. For the prospect of the corporation, Tesla needs to maintain its leading position in the field of new energy to do an excellent job in the electric vehicle industry and develop and utilize other new energy sources. Otherwise, relying solely on the current electric vehicle industry can easily be divided by other competitors in its primary market. Therefore, after Tesla enters a stable period, it needs to shift its corporate positioning to develop and apply different new energy sources and reduce its dependence on electric vehicles to promote its long-term growth. In summary, Tesla needs to make corresponding adjustments to the above four main issues to promote the operation and the development of the entire enterprise in the future.

Acknowledgements

This article was discussed with my classmates in University of Manitoba, JoonHyup Lee, Longhao Li, Le Tran, Shuqing Liu & Yutian Yi, thanks again for their wisdom.

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