

# ***Development History and Enlightenment of Electric Vehicles Based on Tesla's Financial Perspective***

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**Abstract:** Facing the continually intensifying global energy crisis and environmental pollution challenges, electric vehicles, as an important representative of green transportation, are gradually becoming an important direction for the transformation and upgrading of the automotive industry. As a pioneering figure within the electric vehicle industry, Tesla's development history and financial performance are of great significance for understanding the current situation and future of the entire industry. This article first outlines the history of the development of electric vehicles and Tesla. Then, based on the current development status of Tesla at that time, Tesla's financial indicators were analyzed. Finally, four suggestions are proposed: firstly, electric vehicle companies should continue to increase investment in technology research and development, improve product performance and market competitiveness; Secondly, focus on cost control and operational efficiency improvement to achieve economies of scale; Thirdly, actively explore domestic and international markets, expand sales channels and market share; Fourth, pay attention to the development trends in cutting-edge fields such as energy storage and autonomous driving, and seize the market opportunities in the future; Finally, strengthen brand building and marketing to enhance brand influence and consumer recognition.

**Keywords:** Electric vehicle, Tesla, Financial Ratios.

## **1. Introduction**

With the global emphasis on environmental protection and sustainable development, electric cars, as a transportation mode that is both clean and efficient, have progressively emerged as a vital element in urban transportation systems. The development of electric vehicles is not only related to the transformation of energy structure but also directly related to the response to global climate change. Ren et al. conducted a comparative analysis of Tesla's operating performance and multiple financial statement indicators with other new energy vehicle manufacturers, pointing out that Tesla has a higher premium and better development prospects in the electric vehicle market [1]. As a representative enterprise in the electric vehicle industry, Tesla's financial performance is of great significance for understanding the current situation and future trends of the electric vehicle industry. Tesla has transformed from losses to profits through continuous technological innovation and large-scale production, setting a benchmark for the global electric vehicle industry. Tesla's financial statements not only reflect its operating results and financial condition, but also reveal the

challenges and opportunities in the electric vehicle industry in terms of technological innovation, cost control, and market expansion. Therefore, studying the development process of electric vehicles from Tesla's financial perspective helps to gain a deeper understanding of the internal logic and development laws of the electric automobile sector.

The technology of electric cars has been advancing since its inception. Since the first appearance of electric vehicles, batteries are disposable batteries that are used and discarded, and there is no such thing as charging. The charging method is to remove the battery from the vehicle and replace it with a new one in order to continue driving. But now electric vehicle batteries can be reused and there are more charging methods available. Zentani, A. et al. have provided a comprehensive overview of the diverse fast charging technologies currently available, encompassing fast charging methodologies, inductive charging systems, ultra-fast charging (UFC) capabilities, DC fast charging (DCFC) stations, Tesla's Supercharger network, the integration of bidirectional charging, as well as the practice of battery swapping [2]. Corrigan, D.A. described that the earliest electric vehicle batteries were lead-acid batteries with lower energy density. Its main raw material is lead, which is contaminated. The most advanced electric vehicle battery nowadays is lithium-ion battery, which has improved the energy density of the battery by an order of magnitude.

In comparison to lead-acid and nickel-hydrogen batteries, lithium batteries exhibit a much greater energy density. Lithium-ion battery technology won the Nobel Prize in 2019 [3]. Katis C. and Karlis A. highlighted autonomous driving as a contemporary driving technology, where vehicles autonomously perceive their immediate surroundings and navigate designated lanes without requiring human intervention. These autonomous vehicles employ a range of sensors, including laser radar systems, cameras, and mapping applications, to map and traverse their routes. Furthermore, they are equipped with complementary safety systems, such as automatic shutdown mechanisms, adaptive cruise control (ACC), blind spot and forward collision warning systems, active brake assist, and lane-keeping assist, to enhance safety and driving assistance [4].

At the same time, the development of electric vehicles also faces some challenges. An effective thermal management system is crucial for ensuring battery safety, optimizing energy utilization, and extending vehicle lifespan. Dan et al. contend that despite the promising potential of electric vehicles, their progression is hindered by formidable thermal hurdles, encompassing the maintenance of cabin thermal comfort, the safeguarding of battery thermal safety, and the resilience of motors against heat. Addressing these challenges necessitates the implementation of innovative thermal management strategies to bolster the safety, dependability, and overall performance of electric vehicles [5]. Alanazi F. emphasized that the escalating costs of oil and carbon emissions have fueled the growing popularity of electric vehicles (EVs). Nonetheless, the advancement of EVs continues to confront a series of obstacles, including the substantial expenses associated with infrastructure development, the scarcity of charging stations, the constraint of limited driving range or range anxiety, as well as challenges related to battery performance [6].

After comparing key metrics such as share prices, market shares, annual sales volumes, annual production outputs, raw material prices, global sales ranges, and net profits between Tesla and BYD, Yan, taking into account current market dynamics and national policies, deduced that the market share of electric vehicles will vastly surpass that of fuel-powered vehicles in the foreseeable future, thereby becoming the dominant mode of land transportation. Furthermore, it was advised that electric vehicle companies should capitalize on this opportunity to carve out their competitive niche, with specific mention that both Tesla and BYD should intensify collaboration with governments and nations to secure policy incentives and financial backing that better align with their developmental aspirations [7]. Li conducted a SWOT analysis of Tesla, an electric vehicle company, and analyzed its financial situation from 2017 to 2021, and found that Tesla's current strengths outweigh its weaknesses. Tesla has grown considerably in the past five years. When juxtaposed against Toyota,

which is in a stable phase of its development, and BYD, which is still in its nascent stages, Tesla's current financial position exhibits greater potential for expansion and has consistently demonstrated robust growth trajectories [8]. Dai, Li, and Pang analyzed the innovative marketing mode and technological innovation of Tesla's new energy vehicles, such as lithium battery technology, wireless upgrading technology of automobile systems, automatic driving technology, supercharging stations, etc. These give Tesla a unique competitive edge [9].

Haghani M. et al. used Web of Science (WoS) Core Collection and Visualization of Similarity (VOS) methods to analyze the research field of electric vehicles related to (i) charging infrastructure, (ii) electric vehicle adoption, (iii) thermal management systems, and (iv) routing problems has become a clear trend topic in recent years [10]. Naseri H. and his colleagues endeavored to unravel the determinants shaping individuals' preferences toward electric vehicles by employing a discrete choice experiment methodology. To gather data, an online survey was administered in Canada, yielding a valid response count of 2062. The findings underscored that environmental stance and the purchase price emerged as the two most potent factors influencing consumers' willingness to opt for electric vehicles [11].

This article explores the development history of the electric car industry, particularly by analyzing the financial performance of Tesla, a leader in the industry, revealing the key elements behind its success and its implications for the future development of the electric vehicle industry. By analyzing Tesla's financial indicators such as net profit, research and development expenses, asset turnover ratio, asset-liability ratio, and current ratio in different periods. This article aims to provide strategic insights for the sustainable development of the electric automobile sector., as well as valuable references for investors, policymakers, and industry practitioners.

## 2. History and Key Points

The electric vehicle development can be divided into the pregnancy period, the first Golden age, the decline period, and the revival period, as shown in Table 1.

Table 1: The Development History of Electric Vehicles.

Time	Era	Representative Developments/Milestones
19th Century	The pregnancy period	In 1828, the Hungarian physicist Ányos Jedlik pioneered the creation of the first electric engine. Subsequently, in 1834, the American mechanic Thomas Davenport constructed the first electric vehicle propelled by a direct current (DC) motor. Then, in 1873, the British chemist Robert Davidson achieved a milestone by producing the world's first functional and purely electric-powered vehicle.
Late 19th Century - 1920s	The first golden age	Pure electric vehicles have gained recognition in European and American markets due to advantages like low price, simple operation, fast speed, and quietness. Key technological breakthroughs include improvements in battery technology (e.g., lead-acid batteries) and motor efficiency. Gradual surpassing of electric vehicles by gasoline vehicles due to internal combustion engine advancements and decreasing gasoline costs.
1920s - 1990s	The decline period	Decline of pure electric vehicles due to stagnation in battery technology, high manufacturing costs, and improvement of internal combustion engine technology. Electric vehicles largely disappeared from European and American automotive markets.
1990s - Present	The revival period	The oil crisis and increased environmental awareness prompted a refocus on new energy vehicles. The emergence of new battery technologies like lithium batteries drives the commercialization of pure electric vehicles. The rise of electric vehicle companies like Tesla leads to the rapid development of the pure electric vehicle industry.

## 2.1. Initial Stage (2003-2010)

**Establishment and Financing:** Tesla was founded by Martin Eberhard in 2003, and Elon Musk joined and invested \$6.3 million in 2004 as the company's chairman.

**MASTERPLAN Plan:** Musk has developed Tesla's development plan, including creating sports cars, and affordable cars, and achieving zero-emission electric vehicles.

**ROADSTER sports car:** The first pure electric sports car Roadster using lithium-ion batteries was launched in 2006, but production was halted in 2012 due to supply chain and technical difficulties.

**Financial challenge:** Tesla faced serious financial pressure at this stage and raised funds through financing and listing many times.

## 2.2. Growth Period (2010-2019)

**Model S Series:** In 2010, Tesla went public and raised \$184 million, starting production of the Model S series. Delivery began in June 2012, and sales were good, driving Tesla's stock price up and its first quarterly profit.

**Model 3 Series:** Released in 2016, Model 3 has been delivered since 2017 at a lower and more affordable price, becoming a key model for Tesla to achieve larger-scale production. In 2018, the MODEL 3 series ranked first in sales in the mid-size luxury sedan market in the United States and became the world's best-selling model in 2019.

**Shanghai Super Factory:** In 2019, a super factory was established in Shanghai to reduce costs and increase production capacity, further promoting Tesla's global development.

**Financial performance:** During this stage, Tesla achieved multiple quarterly profits, but the annual losses still exist. The gross profit has remained positive, but operating expenses (especially marketing and operating expenses) are high, resulting in a negative net profit.

## 2.3. Expansion Period (2019 -Present):

**Model Y series:** Added mass production Model Y (popular mid-size SUV) to further enrich the product line.

**Global Production and Supply Chain:** Achieving globalization of production and supply chains, improving production capacity and yield, and reducing costs.

**Stock price surge:** Tesla's stock price has continued to soar in recent years, with a significant increase in market value, making it one of the world's most valuable automotive companies.

**Financial stability:** With the expansion of production and sales scale and the reduction of costs, Tesla's financial situation is gradually stabilizing and is expected to achieve annual profitability.

### Summary of Key Nodes

In 2003, Tesla was founded, marking the rise of emerging forces in the electric vehicle industry.

In 2010, Tesla went public for financing, laying the foundation for subsequent expansion.

In 2012, the delivery of the MODEL S series drove Tesla's stock price up and its first quarterly profit.

In 2016, the MODEL 3 series was released, becoming a key model for Tesla to achieve larger-scale production.

In 2019, a Shanghai super factory was established and put into operation, further promoting Tesla's global development.

In recent years, Tesla's stock price has skyrocketed, its market value has increased significantly, and its financial situation has gradually stabilized.

### 3. Financial Analysis

The development stage of Tesla can be divided into the start-up stage, the growth stage, and the expansion stage.

#### 3.1. The Start-up Stage

As shown in Table 2, financial indicators present a difficult time for Tesla.

Table 2: Important financial indicators of Tesla from 2007 to 2009(In million)

Time	2007	2008	2009
Net profit	-0.7816	-0.8278	-0.5574
Research and Development expenses	0.6275	0.5371	0.1928
Asset turnover	0.0021	0.29	0.86
Asset-liability ratio	147.85%	290.52%	49.63%
Current ratio	0.43	0.36	1.75

##### 3.1.1. Net Profit

As shown in Table 2, in 2007, the net profit was -0.7816 billion US dollars, mainly due to R&D and production bottlenecks caused by gearbox issues, as well as management errors and cost overruns. In 2008, the net profit further decreased to -0.8278 billion US dollars. Although the Roadster sports car was officially delivered that year, its economic benefits were limited by product positioning and audience limitations. At the same time, the financial crisis and inadequate cost control exacerbated the company's financial difficulties. In 2009, the net profit loss narrowed to -0.5574 billion US dollars. Through the launch of the Model S program, strategic investments from traditional car companies such as Mercedes Benz and Toyota, and successful listing, a series of positive measures have gradually improved the financial situation.

##### 3.1.2. Research and Development Expenses

In 2007, the research and development cost was \$627.5 million, which was related to the high-cost Tesla invested in the development of a two-speed gearbox for the release of the Roadster sports car at that time. In 2008, research and development expenses slightly decreased to \$53.71 million. Musk takes measures to cut unnecessary expenses as CEO. In 2009, research and development expenses significantly decreased to \$192.8 million. At the end of 2008, the global financial crisis had a serious impact on Tesla's financial situation, and Tesla was on the brink of bankruptcy, with no spare capacity to invest in research and development.

##### 3.1.3. Asset Turnover

In 2007, the asset turnover rate was 0.0021. The Roadster sports car launched has experienced significant delays in production progress due to supply chain and core component technology bottlenecks causing production costs to spiral out of control. In 2008, the asset turnover rate increased to 0.29, although still relatively low, showing a certain improvement trend, which may be related to the delivery of the Roadster. In 2009, the asset turnover rate significantly increased to 0.86, indicating a significant improvement in the company's asset utilization efficiency. This was due to the launch of the Model S program, the acquisition of strategic investments, and the funding and market recognition brought about by the successful listing.

### 3.1.4. Asset-liability Ratio

In 2008, Tesla's asset-liability ratio soared from 147.85% to 290.52%, reflecting the company's predicament of bankruptcy during the financial crisis.

In 2009, the asset-liability ratio significantly decreased to 49.63%, indicating that the company effectively reduced its debt level and significantly improved its financial situation after obtaining strategic investments and successfully going public.

### 3.1.5. Current Ratio

In 2007 and 2008, the current ratio was very low, and Tesla did not have much revenue or capital injection at that time. In 2009, the current ratio significantly increased to 1.75, thanks to strategic investments from traditional car companies such as Mercedes Benz and Toyota, as well as the successful listing of Tesla.

## 3.2. The Growth Stage

As shown in Table 3, the financial performance became better.

Table 3: Important financial indicators of Tesla from 2014 to 2017 (In millions)

Time	2014	2015	2016	2017
Net profit	-2.940	-8.887	-7.730	-22.41
Research and Development expenses	4.647	7.179	8.344	13.78
Asset turnover	0.78	0.58	0.46	0.46
Asset-liability ratio	83.36%	85.98%	73.92%	80.32%
Current ratio	1.51	0.99	1.07	0.86

### 3.2.1. Net Profit

In 2015, the net loss expanded from \$294 million to \$888.7 million. The intensification of losses this year may be related to Tesla's increased investment in the research and production preparation of Model X, while the increase in Model S delivery volume has brought in revenue but has not fully covered costs.

In 2017, Tesla's total annual revenue reached \$11.8 billion, a year-on-year increase of 55%. However, the net loss further expanded to 2.241 billion US dollars, mainly due to serious production bottlenecks and cost overruns encountered during the initial mass production of Model 3. Despite a significant increase in total revenue throughout the year, the sharp rise in production costs resulted in huge losses.

### 3.2.2. Research and Development expenses

From 2014 to 2017, Tesla's research and development expenses continued to grow, increasing from \$464.7 million to \$1.378 billion. This indicates that Tesla has invested significant resources in technological innovation and product development to maintain its leading position in the fields of electric vehicles and autonomous driving technology. With the launch of new models such as Model 3 and Model Y, as well as the continuous upgrading of autonomous driving technology, research and development costs are expected to continue to increase.



### 3.2.3. Asset Turnover

The asset turnover rate has been decreasing year by year, from 0.78 in 2014 to 0.46 in 2017. This reflects Tesla's decreasing asset utilization efficiency, possibly due to the company's accumulation of a large number of fixed assets (such as production equipment, research and development facilities, etc.) during rapid expansion, which has not been fully converted into sales revenue in the short term.

### 3.2.4. Asset-liability Ratio

The asset-liability ratio slightly increased between 2014 and 2015, but after a significant decline in 2016, it rebounded in 2017. This indicates that Tesla has made adjustments to its financial strategy, using debt financing to support its expansion plans. However, as issues with the initial production of Model 3 are exposed, Tesla may need more funds to address production challenges and cost overruns, leading to a rebound in its asset-liability ratio.

### 3.2.5. Current ratio

The current ratio decreased from 1.51 in 2014 to 0.86 in 2017, indicating that Tesla's short-term solvency is weakening. This may be related to the significant capital investment required for the initial production of Model 3, increasing the company's short-term cash outflow.

## 3.3. The Expansion Stage

As shown in Table 4, Tesla has entered a stage of rapid development.

Table 4: Important financial indicators of Tesla from 2020 to 2023(In million)

Time	2020	2021	2022	2023
Net profit	8.620	56.44	125.9	149.7
Research and Development expenses	14.91	25.93	30.75	39.69
Asset Turnover	0.73	0.94	1.13	1.02
Asset-liability ratio	54.49%	49.17%	44.26%	40.34%
Current ratio	1.88	1.38	1.53	1.73

### 3.3.1. Net Profit

Tesla's net profit has significantly increased from \$862 million in 2020 to \$14.97 billion in 2023, especially in 2021 and 2022, with a leap in net profit growth, which may be related to the launch of new Tesla models, improved production efficiency, and strong demand in the global market.

### 3.3.2. Research and Development Expenses

Tesla's research and development expenses have also shown a trend of increasing year by year, from \$1.491 billion in 2020 to \$3.969 billion in 2023. This indicates that Tesla attaches great importance to technological innovation and product development, and continues to increase investment in areas such as autonomous driving and battery technology.

### 3.3.3. Asset Turnover

Gradual increase followed by a slight decrease: Tesla's asset turnover rate gradually increased from 0.73 to 1.13 between 2020 and 2022, indicating an improvement in the company's asset utilization efficiency. However, there will be a slight decrease to 1.02 in 2023, which may be related to Tesla's

significant investments in capacity expansion and new technology research and development. These investments may not be fully converted into sales revenue in the short term, resulting in a slight decrease in asset turnover. However, overall, Tesla's asset turnover rate remains at a relatively high level.

### **3.3.4. Asset-liability Ratio**

Continuous decline: Tesla's asset-liability ratio has continued to decline from 54.49% in 2020 to 40.34% in 2023. This may be related to Tesla raising funds through stock issuance, bond financing, and other means to support its expansion plans.

### **3.3.5. Current Ratio**

Tesla's current ratio remained relatively stable and fluctuated slightly between 2020 and 2023. Although there was a decline in 2021, there was a rebound in the following years. Overall, Tesla's current ratio remains at a relatively high level. This helps Tesla cope with short-term funding needs and payment pressures, and maintain financial stability.

## **4. Outlook for the Future Development of Electric Vehicles**

### **4.1. Market Size and Sales Growth**

The electric vehicle market is experiencing a period of rapid growth. According to the latest data, global sales of new energy vehicles will reach 14.653 million units in 2023 and are expected to exceed 20 million units in 2024, demonstrating strong growth momentum. Holding the position of the world's premier consumer market for new energy automobiles, China will continue to contribute the main share of global sales, expected to account for over 60%.

The market share of electric vehicles will continue to increase, and it is expected that the market share of new energy vehicles will rapidly rise before 2026. Optimistically, it is estimated that the market share of new energy vehicles will reach 40% in 2024, close to 50% in 2025, and exceeding 50% in 2026 is a high-probability event.

### **4.2. Technological Innovation and Product Upgrading**

Battery technology is the key to the development of electric vehicles. At present, China's battery industry has taken a leading position globally, with the achievement of large-scale production of power battery cells boasting an energy density of 300 watt-hours per kilogram, the average driving range of purely electric passenger vehicles has surpassed 460 kilometers. In the future, with the development and application of new battery technologies such as solid-state batteries, the range and safety of electric vehicles will be further improved.

Electrification and intelligence will be closely integrated into the automotive industry, and smart cars will become the core of future competition. The continuous development and application of technologies such as autonomous driving, connected vehicles, and intelligent cockpits will make electric vehicles more intelligent, convenient, and comfortable.

### **4.3. Infrastructure and Policy Support**

Charging facilities are an important guarantee for the popularization of electric vehicles. With the continuous expansion of the electric vehicle market, the construction of charging facilities will also accelerate. In the future, infrastructure such as charging stations and battery swapping stations will be more complete, providing more convenient charging services for electric vehicle users.



Governments around the world will continue to introduce policy measures to support the development of electric vehicles, such as car purchase subsidies, tax incentives, and restrictions on driving and purchasing. These policies will effectively promote the growth and popularization of the electric vehicle market.

#### 4.4. Market Competition and International Development

The competition in the electric vehicle market will become increasingly fierce. As more companies enter the market, the variety and quality of products will continue to improve, and consumers will have more choices. At the same time, market competition will also promote technological innovation and product upgrades, driving the sustainable development of the electric car industry.

#### 4.5. Challenges and Coping Strategies Faced

The development of electric vehicles still faces some challenges, such as battery costs, insufficient charging facilities, and range anxiety. In addition, the uncertainty of the international trade environment may also have a certain impact on the export of electric vehicles.

To address the issue of battery costs, it is necessary to increase research and development investment and promote the development and application of new battery technologies; To address the issue of insufficient charging facilities, it is necessary to accelerate the pace of charging facility construction, improve the coverage and convenience of charging facilities; To address the issue of range anxiety, it is necessary to improve battery energy density and endurance through technological innovation; In response to the uncertainty of the international trade environment, it is necessary to strengthen international cooperation and communication, and jointly address trade barriers and challenges.

### 5. Conclusion

From initial exploration at the end of the 19th century, experiencing competition and silence from internal combustion engine vehicles, to regaining attention in the 1960s and 1970s due to energy crises. In recent years, with the advancement of battery technology and the strengthening of environmental awareness, electric vehicles have experienced rapid development, and the rise of companies such as Tesla has further promoted industry innovation and popularization. The prospects of electric vehicles are bright, but they come with challenges. Technological innovation will enhance battery life and intelligence, policy support will accelerate market penetration and intensified international competition will promote development. Electric vehicle development needs to overcome challenges such as battery costs, and charging facilities and strengthen international cooperation to address trade challenges. With the joint efforts of multiple parties, the electric vehicle industry will continue to develop healthily. But this study takes Tesla as an example. Although Tesla plays an important role in the electric vehicle industry, its development history and financial situation cannot fully represent the overall situation of the electric vehicle industry. Therefore, applying Tesla's experience and lessons directly to other electric vehicle companies may have certain limitations. Making up for the shortcomings by increasing research on other representative electric vehicle companies (such as BYD, NIO, Xiaopeng, etc.) based on Tesla.

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