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A Case-study on Tesla Inc. Based on the Value Chain Theory

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Abstract: *This paper applies Michael Porter's value chain theory to analyze the competitiveness of Tesla within the new-energy vehicle (NEV) industry. It first examines the transformation of the NEV value chain in China, highlighting the shift from traditional procurement-driven models to technology-driven structures. Through a case study approach, the research explores Tesla's unique position, emphasizing its strengths in technological innovation, vertical integration, production systems, and customer-oriented services. The study further compares Tesla with traditional automobile manufacturers and other NEV enterprises to identify sources of sustainable competitive advantage. Findings suggest that Tesla's competitive edge is grounded in its R&D investment, brand value, and distinctive sales model, supported by its global logistics and service network. The paper concludes that continuous innovation in technology, autonomous driving, and energy services will remain critical for Tesla to sustain its leadership in the NEV market.*

Keywords: *Tesla; Value Chain; New-Energy Vehicle; Competitive Advantage; Technological Innovation*

1. Introduction

The first section of this paper systematically summarizes and analyzes the environment and industrial chain of new-energy vehicle (NEV) industry in China, and it confirms the characteristics of the current automobile industry reform pattern. Also, the actual competitive situation of new energy automobile enterprises is studied.

The second part of this article conducts a case study of Tesla. According to the actual competition pattern of the current new energy vehicle market, and based on the analysis of supply chain value competitiveness, the competitiveness of two types of new energy vehicle companies, traditional car companies and new car manufacturers, are compared. Furthermore, a qualitative research methods will be used to obtain Tesla's unique differentiated competitiveness comparing to other NEV enterprises.

The research aim is to evaluate a series of value chain activities of Tesla as an leading international manufacturer in the NEV industry focusing the value creation, and to provide a supportive advise to assist Tesla with gaining competitive advantages in the industry and maintain its leading edge. It will use Michael Porter's value chain theory as a theoretical base. It will use case study method.

2. Theoretical framework: Michael Porter's value chain theory

According to Michael Porter's value chain theory(1985), the value chain at the enterprise level is a combination of various activities of an enterprise in a certain industry, such as product design, production, marketing, delivery and other various behaviors that affect the product [1]. As shown in Figure 1, value activities can be divided into two categories: primary activities and support activities [2]. The primary activities, shown at the bottom of the diagram Figure 1, are the various activities including the supplier, production, sale, delivery and after-sales service of products. Support activities are complementary to primary activities and support each other by providing various functions such as outsourcing, technology, and human resources. The arrows in the figure indicate that human resource management, technology development and procurement are all linked to various specific primary activities and support the entire value chain. Although the infrastructure of an enterprise is not associated with a particular primary activity, it acts more on the manageral level of the company that it integrates the various value chain parts of the enterprise into a whole, which includes strategy, culture, organizational structure, and finance [2].

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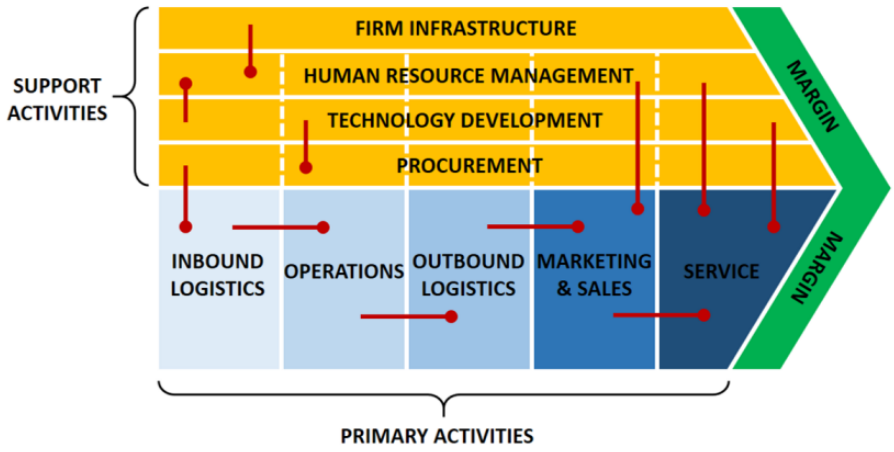

Figure 1 The generic value chain (Porter, M. E. 2001, p52)

Value can be interpreted as the price a buyer is willing to pay for a product. The value chain refers to the value base in the minds of consumers formed through a series of specific material and technical value activities and profit margins within the enterprise. In the process of realizing value creation for customers, the supporting activities and main activities of the enterprise can be identified and classified and filled accordingly in the Porter value chain diagram as shown above. Different enterprises will obtain different value chain maps due to their different resource combinations. In this paper, managers can understand which activities of the company have advantages and which have not by comparing the individual value chain map with the value chain map of competitors, or by comparing it with the industry value chain map at a macro level. Obviously, the competitive advantage of an enterprise lies not only in its value chain that creates value, but also in its ability to create value continuously.

3. The Case Study: Tesla value chain analysis

3.1 About Tesla

Elon Musk, CEO of Tesla, has stated that Tesla's goal is to "accelerate the world's transition to sustainable energy." [3]. This big vision indicates that the company focus on the sustainability and environmental conservation, which is a view that is advocated by high-end customer groups with higher education and better affordability. At present, Tesla has become the new energy car company with the highest market value in the world. In addition, Tesla is also deployed in the new energy industry, producing and selling solar panels and various energy storage equipment.

Tesla officially released its first electric car, the Roadster, in 2008. In 2012, Tesla's second new energy vehicle, the Model S, came out. Deliveries of the third Model X all-electric SUV began in September 2015. The next car, the Model 3, made its public debut in March 2016 and began deliveries in late 2017.

Outside of the new energy sector, Tesla acquired Solar City, a US solar power system supplier, on November 17, 2016. Since then, Tesla has become the world's first new energy company with vertical integration capabilities, providing customers with end-to-end clean energy products including Power wall energy walls and solar roofs.

3.2 Maco-level analysis: a shift from procurement to technology development on the NEV value chain comparing to the traditional automobile value chain

For the traditional automobile manufacturing industry, material suppliers, equipment suppliers, and patent suppliers located in the upstream link of the external value chain of automobile enterprises play an important role in the value-added of automobile enterprises [4]. Parts manufacturing and vehicle manufacturing are important key node in the value chain of automobile enterprises. First of all, in terms of traditional automobile assembly, manufacturing, injection molds, parts process manufacturing, etc., the integrated module production link at the high end of the production value chain can achieve important value-added value. At the low end of the value chain of automobile production and manufacturing is the production of mechanical products, which mainly includes various production

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activities such as the manufacture and molding of various switches in automobiles, parts and components.

However, for the NEV industry the value chain has been changed. Due to the revolutionary technologies that are integrated to the cars that improve the driving experience, which are preferred by customers, the R&D and design of core components is now at the upstream of the industry chain [5]. The manufacturing of parts and vehicles is at the middle of the industry chain, while the after-sales service and emerging services are at the downstream of the industry chain. This means that the traditional parts production and supply in the middle reaches of the industrial chain and the stamping, welding, painting, and final assembly of the entire vehicle will contribute less to the profit contribution of the value-added process and the commercialization process.

The R&D and design link becomes a key node in the value chain of an automobile enterprise, including the R&D and design of complete vehicle products, the R&D of automobile production equipment and the R&D of auto parts. In the entire value chain of the automotive industry, the R&D link occupies an important position in multiple value chain nodes. The research and development of key components plays a vital role in the value-added of automobiles. Under the development trend of intelligentization of the automobile industry, the value of auto parts with core technologies is gradually enlarged, gradually occupying the high-end link of the value chain.

With the changes in the value system brought about by industrial transformation, compared with the value curve of traditional automobile enterprises, the profits of the upstream, midstream and downstream of the industry chain in the value chain rate allocations will change correspondingly. The profit value of the core technology link in the upstream of the industrial chain and the after-sales market and emerging service links in the downstream of the industrial chain have been greatly improved.

As a result, the value chain of NEV enterprises shows a U-shaped distribution as a whole. For primary activities for the overall NEV enterprises, the uper stream of leading technologies in the production activities will be of high value, including PACK, battery, vehicle intelligent system, assisted driving system, etc. Where other primary activities of inbond and outbond logistics, marketing and sales, and service of NEV enterprises will be considered with no less value creation comparing to other traditional automobile activities. (As shown in Figure 2)

<table>
<tr><td rowspan="4">support activities</td><td colspan="5">Firm infrastructure: Strategy,culture, finance, organizational structure</td><td rowspan="4">Margin</td></tr>
<tr><td>procurement plan</td><td>space and traffics</td><td>supply plan</td><td>equipment deployment</td><td>equipment maintenance</td></tr>
<tr><td>hire the right manager</td><td>R&D group</td><td>proper organizational structure</td><td colspan="2">training and recruitment</td></tr>
<tr><td>technical solutions</td><td>configure technician</td><td>production and operation guarantee</td><td>NEV technical data guarantee</td><td>NEV technical support and intellectual properties</td></tr>
<tr><td></td><td>Raw material input, battery, PACK, core components, charging infrastructure</td><td>smart factory,production, trial operation,R&D capabilities</td><td>finished product output, strategic cooperation, logistics</td><td>market research, marketing system construction, marketing effect and secondary sales</td><td>pre-sales and after-sales service system construction</td><td>Margin</td></tr>
<tr><td></td><td colspan="5">primary activities</td><td></td></tr>
</table>

Figure 2 The generic value chain of NEV industry in China

3.3 Internal value chain analysis of Tesla: Value chain analysis

3.3.1 Technology development

Although techonology development in Porter’s value chain serves as support activities, however, Tesla's technological innovations are widely credited as a core reason with leading the global market in terms of sales. A large number of traditional automobile manufacturers are limited by factors such as technology and cost when entering the field of new energy vehicles. They often adopt the route of replacing oil with electricity at the beginning of the development of electric vehicles. On the contrary, Tesla has a unique native electric platform technology, all components are based on the underlying structure design of the battery pack, superimposed on the company's own understanding of industrial integration, and the product has the characteristics of low cost and high performance. Combined with the company's accumulation in power generation and energy storage/battery factory/charging pile construction, etc., it forms a complete electric vehicle industry closed loop.

In terms of intelligent driving, Tesla is currently the only car company that has self-developed and produced all aspects of intelligent driving technology. Tesla has created a comprehensive autonomous driving architecture including perception, computing, and control through software and hardware technologies such as data, computing power, and chips.

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3.3.2 Inbond and outbond logistics

Tesla innovatively sorts out the sources of material supply from a large number of suppliers around the world, especially for the effective allocation of procurement and storage activities of suppliers involving key raw materials, thereby forming an accurate and flexible resource allocation system and effectively improving production efficiency. Therefore, the relationship between technology suppliers that provide core technologies and components for car companies and Tesla has changed from a supply-demand relationship to a cooperative relationship, forming a new value chain system together. Due to the restructuring of the supplier's value chain, the internal value chain of automobile manufacturers no longer occupies the core position of the automobile industry chain alone, and the importance of the supplier's value chain that masters core technologies in the entire chain is getting higher and higher.

For Tesla, the most important battery technology and PACK technology are controlled within the company, and the layout of super factories can be carried out in different regions according to logistics and market conditions. Tesla has manufacturing plants in Fremont, California, Lathrop, California, Tilburg, the Netherlands, and Shanghai, China to save logistics costs and achieve fast outbond logistics.

3.3.3 Production

Tesla produces and assembles many core components by itself, including battery packs, BMS systems, charging interfaces and equipment, motors, etc. The biggest feature of this model is that the industry chain is highly vertically integrated, and it is not easy to be "stuck" by suppliers in terms of core technologies and components. However, mastering a large number of core technologies will inevitably bring a large amount of R&D investment in the early stage.

Also, Tesla also deploys innovative production lines to resolve manufacturing problems. In order to solve the problem of uneven welding of the product body and reduce unnecessary welding, Tesla has adopted a large-scale parts die-casting equipment that is developed by Italian manufacturer IDRA, and it realizes and improves the Giga-press technology. Other than avoiding the welding Question, the realization of Tesla's body-integrated die-casting technology has helped Tesla's California factory save about 300 robots used for assembly of auto parts [6].

3.3.4 Marketing

As a key activity in the value chain, the pre-sales service system mainly includes sales, marketing, brand maintenance, after-sales service and other major marketing activities. Through sales, the value of the produced cars can be realized. Marketing is conducive to maintaining brand value and maintaining the value-added of auto companies. At present, most auto companies have established an operating model centered on OEMs, sales companies, regional agents, and dealers, while some new auto companies have widely adopted the sales model of setting up direct stores or agents under sales companies. In the key activities of the value chain in the brand marketing link, the role played by the sales and after-sales link is also very critical.

Unlike other NEV or traditional automobile companies, Tesla innovatively pursues the sales principle of "zero-dollar marketing" strategy. Tesla never advertises, but CEO Elon Musk has brought super high traffic and media exposure to Tesla by virtue of his successful creation of the "Silicon Valley Iron Man" character and Twitter interaction. The "BrandZ Top 100 Global Brand Value 2018" list shows that Tesla's brand value reached US$9.4 billion, surpassing old luxury car brands such as Porsche. At the same time, Tesla adopts a direct sales model instead of a traditional distribution system, and uses software + OTA to provide users with after-sales services throughout the vehicle life cycle to further improve user experience.

As far as service attitude is concerned, Tesla will not actively recommend to the market, will not release multi-channel advertisements and promotions, and even in physical stores, sales staff will not deliberately organize marketing language or openly market customers. The intention to choose and buy is held by "observation", "introduction" and "service". It is precisely because of this service attitude that many Tesla offline stores have become terminal stores for viewing cars, test drives, and applying for other services. As far as channel services are concerned, many car buyers habitually look at and experience cars at Tesla stores, while the online Tesla official website has become a payment platform for car purchases. In the platform, customers can preview products, place orders, apply for test drive experience and so on. With the cooperation of offline and online channels, the mode of independent experience of customers has been realized.

The direct sales model of traditional car companies, which will track and return customers while

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providing services. The seller keeps promoting the car under a positive framework throughout the entire presenting process until the transaction is completed. For consumers, buying a car requires careful consideration, which makes the transaction hard to be proceeding. Also, the external environment can easily affect the customers, making them feel conflicted when they want to buy a second car of the same brand. Oppositely, the channel service that Tesla provides for the majority of consumers, which is looking at cars offline and finishing transactions online, does not issue pressure on consumers as traditional car purchasing services, and thus the customers are more easily to complete the purchasing behavior online.

3.3.5 Service

Brand maintenance is an important value chain key activity in the after-sales service of automobiles. In addition, Tesla's value chain analysis will now include on-demand vehicle sources across the country to provide fast service. Tesla provides after-sales service at its service centers, which allows it to control the quality of service. On the one hand, service centers around the world provide customers with uniform and high-standard services; on the other hand, direct management of service centers can educate customers and keep them in good brand awareness.

3.4 Competitive analysis based on value chain

Considering Porter’s value chain, the components of enterprise competitiveness mainly include customer maintenance ability, procurement supervision ability, technological innovation ability, production service ability, quality maintenance ability, logistics service ability, marketing service ability, financial management ability and personnel management ability, which relates to both support and primary activities. As for the various management capability elements of its value chain activities, it can be seen that these types of key capabilities and the personnel management capabilities, financial management capabilities, technical management capabilities, production and operation management capabilities, and marketing service capabilities in value chain activities can basically be realized. This section adopts the principle of value matching, and combines the overall operating conditions of NEV companies to analyze the matching of Tesla's competitiveness with key activities in the value chain.

3.4.1 Technological innovation capability analysis

First, the Tesla's competitiveness analysis is based on the dimension of technological innovation capability, which mainly includes four elements: independent research and development capabilities, R&D investment, number of R&D personnel, and number of core technologies. Among them, the independent research and development capability mainly evaluates the importance of independent property rights patents in the overall technology patent system for new energy automobile enterprises within a fixed period of time. R&D investment and the number of R&D personnel are mainly used to evaluate the actual investment of new energy vehicle companies in technical funds and personnel. The number of core technologies is mainly used to evaluate the degree of mastery of new energy vehicle companies in key core technologies of products.

R&D investment, number of R&D personnel can be reviewed from Teslas annual report. Although the R&D expenditure of Tesla has imporved since 2019 and keeps increasing, however, its R&D spending as a percentage of revenues remains the same around 5%. Tesla spends the most on R&D, spending more than $2,700 per vehicle, compared to R&D cost around $1,000 for gasoline-powered cars.

Other than production, Tesla also gain competitive advantages in accessories with improving technologies. In terms of charging pile technology for electric vehicle accessories, Tesla has an early layout and continues to iterate charging efficiency and safety, mainly to reduce charging costs and bring tangible benefits to consumers. Tesla's fast charging system has undergone three rounds of iterations, from the 105KW first-generation launch in 2012 to the current third-generation 250KW, which can travel 120 kilometers in 5 minutes. At the same time, Tesla's super charging stations are rapidly expanding around the world. Until 2022, Tesla has more than 43,000 super charging pilesaround the world. The charging network is larger and the cost of use is low, enabling Tesla users to access chargers with more convenience.

3.4.2 Customer maintenance ability analysis

Tesla creates electric vehicle products with Internet thinking, innovates in design and marketing models, closely follows the psychology of users, and maximizes customer value. Tesla can perform system upgrades (OTA) like a smartphone. The OTA of traditional car companies is limited to functions

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such as maps in the infotainment system (infotainment system), but cannot control the temperature, brakes, Functions involving vehicle components such as charging can be remotely controlled or upgraded. The deeper reason behind it is that the underlying electrical/electronic architectureis completely different. Tesla adopts a centralized electronic and electrical architecture, and it use the central processing unit to manage different domain processors and ECUs in a unified manner. This is called Vehicle OTA function and it enables Tesla users continue to improve vehicle functions through system upgrades, and the software realizes the functions of traditional 4S stores to a certain extent.

Software OTA gives the NEV products more vitality and brings better user experience. Since the launch of the Model S in 2012, Tesla's software system has undergone over 10 major updates, with an average of one small update every few months. It has accumulated more than 50 new and improved functions, including automatic assisted driving, battery warm-up, features such as automatic parking.

4. Recommendations

In the future, Tesla's leading edge in the field of electrification may be gradually narrowed, and its core competitiveness lies in intelligence, driverless technology, data and brand. The technology development remains as a core value chain creation factor for Tesla.

From the perspective of the history of smartphone development, the appearance and supply chain are very easy to be imitated, but Apple's profits exceed the sum of all competitors. The core lies in self-developed A-series chips, iOS systems, and building application ecology and high-end brands. Tesla currently has excellent track slots. Through self-developed self-driving chips and artificial intelligence algorithms, and with the largest number of fleets to continuously provide real road condition data for deep learning, Tesla will have a better track record than other competitors. The opponent has higher algorithm iteration efficiency. In the future, once Tesla's camera route is proven to be feasible, it will show a great cost advantage over the lidar route.

In the long run, auto services and energy services will become new growth points for Tesla. Tesla has established a global direct store and charging network, and continuously pushes new software and functions to users through OTA. Tesla is continuing to build a closed loop of online and offline, automotive and energy services. After fully automatic driving matures, Tesla will also build its own fleet to provide taxi services.

5. Conclusion

Considering the primary activities of Porter's value chain, Tesla has formed a balance in R&D design, logistics, manufacturing, marketing and service, and experience, and gradually built its core competitiveness. In the future, Tesla will gradually expand its user base while maintaining its brand image of environmental protection, technology, and high-end.

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