

Analysis and Optimization Plan of Supply Chain Management in Chinese Electric Vehicle Manufacturing Industry

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Abstract: Supply chain management is the treatment of the entire production process of goods or services to maximize quality, delivery, customer experience, and profitability. Although the theoretical research on supply chain management in China's manufacturing industry has achieved certain results, how to properly utilize supply chain management in such a rapidly developing society is still an urgent issue. In addition, in China, electric vehicles have gradually replaced traditional fuel vehicles to gradually increase the market share and become the first choice of consumers to buy cars. Thus, the purpose of this paper is to explore the problems in the construction of supply chain management systems for Chinese electric vehicle enterprises through theoretical analysis, put forward suggestions for improvement, and choose Guangzhou Automobile Group as a case study. The difficulty of supply chain and supplier management caused by the multi-level supply chain, as well as the product problems of the enterprise, also exacerbate the exposure of its problems in supply chain management. Therefore, it is necessary to optimize the management system to balance the customer's demand and the company's supply capacity, as well as to strengthen the logistics supervision system.

Keywords: supply chain, new energy vehicles, supply chain management, Guangzhou Automobile Group, electric vehicle industry

1. Introduction

In recent years, in order to promote the protection of the environment and the development of new energy companies, China has implemented different subsidy policies for the manufacturing and purchase of new energy vehicles. For example, suppliers reduce taxes for new energy vehicle companies, while consumers can enjoy unlimited behavior in some cities. At the same time, with the rapid development of the times and the increase in oil costs caused by inflation, electric vehicles have gradually replaced traditional fuel vehicles, becoming the first choice for people when buying cars. When people's demand for new energy vehicles increases, how to improve the production, transportation, sales, and after-sales service of automobiles has become an urgent problem that enterprises need to solve. The general representative of the full process of this raw material manufacturing to the final consumer of the product is the supply chain. Therefore, in order to promote the development of the new energy vehicle industry and protect the rights of consumers,

electric vehicle companies should find the most suitable supply chain construction and management methods. More importantly, in this rapidly developing society, people have more concerns about health issues, part of which is environmental pollution. With an in-depth understanding of environmental protection and low-carbon economic concepts and the continuous enhancement of awareness of environmental protection, China has vigorously developed green energy-saving electric transportation and products in recent years to meet the growing needs of domestic consumers. The development of new energy vehicles will also become an important promoter of world economic growth and the manufacturing technology revolution. Therefore, in the field of new energy vehicles, the competition between supply chains and traditional fuel vehicles will be even more intense.

This article will conduct data processing and analysis based on the GAC Group's production and sales reports in recent years to study the problems in its supply chain management, so as to provide suggestions for the improvement of the supply chain of China's new energy vehicle industry and contribute to its development. It is hoped that it can have a positive impact on promoting the development of supply chain management.

2. Literature Review

2.1. Supply Chain in Manufacturing Industry

Lambert and Coope mentioned that the competition in modern manufacturing is no longer a competition among individual enterprises but for enterprises to form a supply chain for competitors [1]. The article mentioned that modern manufacturing can use the SCM framework when managing the supply chain, that is, logistics outside the company. The SCM framework consists of three closely related elements: supply chain network structure, supply chain business processes, and supply chain management components. A core supplier group can form a long-term strategic alliance. The improvement of the information network structure of the supply chain can save resources, so the rings in this alliance have achieved their own goals. Therefore, improving the SCM structure is very helpful for the development and formation of the supply chain.

According to Zhang, the inventory management model in the SCM mode is different from the traditional inventory management model [2]. In the manufacturing industry, enterprises should establish a high-efficiency information transmission system to increase the coherence and coordination of all aspects of the supply chain. For example, suppliers must effectively supervise and supply the inventory of distributors and wholesalers, and can establish a sales network management system. In this way, the cost of all aspects of the supply chain can be effectively reduced, and the overall competitiveness of the supply chain can be provided.

2.2. Research of Supply Chain in Electric Vehicle Industry

Through research on the supply chain of new energy vehicles, Kumar et al. proposed that new energy vehicles are still in the development stage [3]. In its supply chain, the supply of batteries is the most important. In order to ensure the sustainable development of the electric vehicle supply chain, enterprises should enhance the quality supervision of batteries and change the management strategy of the electric vehicle supply chain. Due to the battery manufacturing process, there are many problems, such as lack of standardization and pollution of raw materials in the environment. Different sizes of batteries and charging piles of different specifications have brought a lot of trouble to enterprises and users. At the same time, because many batteries are composed of scarce chemicals, their supply often faces a shortage, which also has a negative impact on the development of the environment. Lithium, according to Egbue and Long, as one of the important elements in battery production, has not found effective alternatives [4]. However, with the support of

governments in various countries, new energy vehicles have developed rapidly, and the demand for lithium batteries is also increasing. Therefore, how to ensure that the battery can be supplied to new energy vehicle manufacturers for a long time is a very severe problem.

In response to these problems, da Silva et al. proposed a cycle that can increase the battery manufacturing chain [5]. The article mentioned that blockchain technology can be used to reduce the waste of lithium by recycling batteries. A safe distributed system such as blockchain will bring many benefits to the manufacturers of the automotive industry. Its transparency and traceability can help automakers eliminate existing obstacles.

But the above is only a small part of supply chain management. Different enterprises are facing different management systems, and different scholars have different prospects for the future of the car supply chain.

2.3. Expectation of Supply Chain

In the future forecast for supply chain management, Ketchen and Giunipero mentioned the relationship between strategic management and supply chain management [6]. Strategic management can be distinguished from other organizational sciences by its emphasis on identifying, explaining, and predicting the determinants of organizational performance. Porter is concerned about the analysis of business managers' behavior at the macro level [7]. He surveyed the position of individual companies in the industry and found that a company wanted to increase its profits to the greatest extent and needed to occupy a prosperous strategic group in the industry. As a strategic organization, the supply chain is considered the key to the company's victory in the industry. Therefore, most people think that promoting the exchange of strategic management and supply chain management, and finding the intersection is critical to the development of the enterprise. A supply chain organization is a relatively enduring interfirm cooperative that uses resources from participants to accomplish the shared and independent goals of its members [8].

According to the observation of the SCM life cycle and structure, Wang and Ter Chain Tan have a short- and long-term prediction of the enterprise supply chain. SCM and interest are closely related [9]. For enterprises, in the short term, they need to achieve a certain profit goal, and they also need to ensure the sustainable development of the supply chain. For consumers, getting the products they need is always the purpose. In this article, the author predicts the expectations of SCM according to the expectations of SCM. Many stakeholders have different expectations and goals for the management of the supply chain, and their satisfaction with each other is also connected. Therefore, corporate managers should consider the goals of each link in the supply chain when making decisions in order to ensure that the overall satisfaction is improved. The SCM expectation value is the best reflection of supply chain management efficiency.

3. Analytical Methods

3.1. Data Collection

Interviews are the main data sources in this study, mainly for the following two reasons: first of all, when studying the change and development of the electric vehicle industry, employees have the most direct feelings and views. Secondly, the terminal of the supply chain is customers, and all services are to give customers a better experience. Therefore, whether the customer's service and products are satisfactory can also reflect whether the supply chain is complete and what else needs to be improved. During the research, the author went to many stores and interviewed sales staff and customers. The keywords for interviews include after-sales service, changes in production raw materials, factory work efficiency, etc. This article also quotes the financial report of GAC Group,

including the sales and changes of fuel vehicles and new energy vehicles under GAC Group in the past five years, and analyzes it by comparing its changes and sales.

3.2. Processing

This process included organizing the data in the interview draft and research from the Internet and listing it as a form. Some data in the report is ineffective because it has not been updated yet. In order to identify the true figure, this paper only adopts the specific sales figure as the major indicator of revenue. The revenue data is authoritative as all of the revenue forms were sent to the tax bureau. However, due to the epidemic, the production and income of many companies have been affected. In order to avoid the influence of epidemic variables in the data comparison results, the article also compared the sales of fuel vehicles and new energy vehicles during the epidemic.

4. Data Results

4.1. Sales of Traditional Fuel Vehicles

Since 2019, new energy vehicles have gradually entered the public's field of vision and replaced traditional fuel vehicles as the first choice. As one of China's major automobile production companies, GAC Group has also been greatly affected. Under the tone of the acceleration of new energy transformation, joint venture car companies generally face greater survival pressure. At the same time, traditional OEMs have fallen in market competitiveness due to backward transformation. The backwardness and lack of raw materials have caused a break in the supply chain. Many traditional fuel vehicle brands of the GAC Group are facing the crisis of bankruptcy. Take GAC Mitsubishi, a joint venture by GAC Group, Mitsubishi Auto Industry Company, and Japan Mitsubishi Automobile Business Company, as an example. According to the production and sales express report released by GAC Group, from 2019 to 2022, GAC Mitsubishi's sales were 133,000 vehicles, 75,000 vehicles, 66,000 vehicles, and 33,600 units, which decreased by 7.64%, 43.62%, 11.99%, and 49.13% year-on-year, respectively. By 2022, its capacity utilization rate was only 17.75%. Such a low sales volume has caused the company's operations to fall into trouble. In the context of industry change, GAC Mitsubishi operating levels and shareholders have carefully discussed and officially entered the temporary suspension stage in June.

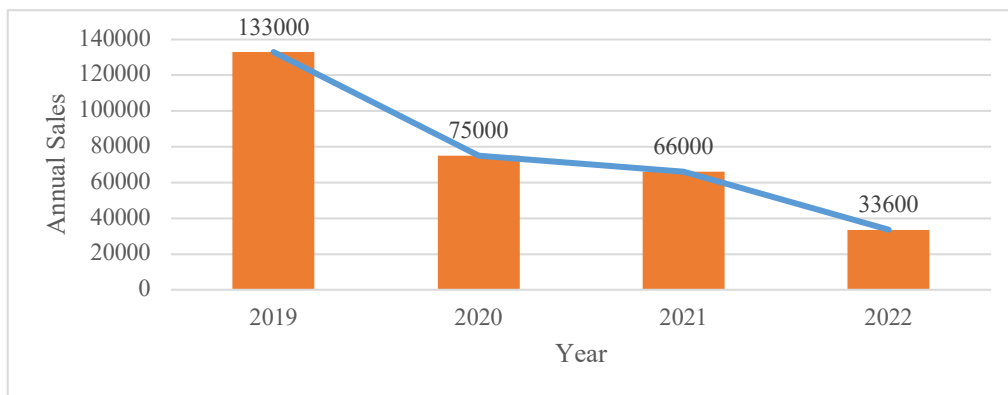


Figure 1: Annual Sales of GAC Mitsubishi from 2019 to 2022.

4.2. Sales of New Energy Vehicles

On the contrary, GAC Aion, the most mature brand of the GAC Group in the new energy market, is facing a completely different situation. At present, the market for pure trams and hybrid vehicles

has developed rapidly. As the power source of new energy vehicles, the electric drive system is an indispensable core component. Regardless of what kind of electrical technology path or battery type is adopted, new energy vehicles need electrical drive systems to achieve power output and control. In order to obtain a better electric drive system, GAC Group announced in 2022 that the independent IDU electric drive system and the GMC hybrid electrical coupling system industrialized project construction. The total investment in the project was 2.16 billion yuan, of which the registered capital of the project company was 900 million yuan. The source of funds is raised by each enterprise. Realize the self-development of the IDU electric drive system assembly and core components, and the GMC hybrid electrical coupling system, which has a profound impact on the sustainable development of the enterprise.

In the context of the continuous recovery of the automobile supply chain, GAC Group's output reached a new high in July. According to the production and sales express, the output in July was 23,600 units, an increase of 42.69% year-on-year, and a month-on-month increase of 0.49%. In July, sales also showed a good situation in the off-season, close to the level of the peak season at the end of the previous year. According to the production and sales express, the company's car sales in July were 220,100, a year-on-year increase of 21.93%, and a decrease of 6.1% month-on-month. The cumulative sales volume from January to July was 1.37 million units, an increase of 13.50% year-on-year. Among them, the sales of new energy vehicles were 27,000 units, an increase of 127.26% year-on-year. Hybrid models also performed well, with sales of 42,400 units, an increase of 80.52% year-on-year, higher than the growth rate of fuel vehicles.

According to the above data, it can be seen that independent development and production of batteries have greatly alleviated the tension in the supply chain. As one of the most basic supply chains, the improvement of the original quality of production can increase the production volume of the enterprise, thereby bringing higher sales and better services. This is why GAC New Energy Motors still maintains high sales even when the fuel vehicle company encounters a bankruptcy crisis.

5. Discussion

In the GAC Aion supply chain, GAC Aion Company's core position is the entire supply chain through its own position and coordination of the operation and progress of the entire supply chain. Driven by demand information, various node companies, through the division of labor and cooperation of the supply chain, use capital flow, logistics, and service flow as the medium to increase the entire supply chain's value.

5.1. Structure of Supply Chain of GVC Group

This part is analyzed based on the characteristics and structure of the new energy supply chain of GAC Group.

First of all, the structure of the GAC supply chain is layered. From the perspective of organizational boundaries, although each business entity is a member of the supply chain, they can be expressed through different organizational boundaries. These entities are legally equal, and there are layers in business relations, which is consistent with the level of product structure.

Secondly, GAC's supply chain avoids unnecessary competition. Since the battery and other raw materials required for the production of new energy vehicles are derived from the factory inside the group instead of being outsourced, the raw materials can be provided more in line with the requirements. This can ensure the continuity of production, avoid poor information, and ultimately ensure the overall optimality of the supply chain system.

Furthermore, the supply chain of GAC New Energy is multi-level. The relationship between the two adjacent levels shows a "sales-purchase" relationship. This can ensure the integrity and timeliness of the GAC supply chain.

5.2. Problems of Supply Chain of GVC Group

Analyzing and managing supply chains usually starts with three dimensions: horizontal structure, vertical structure, and focal enterprise. From the perspective of horizontal structure, the supply chain of GAC Group is multi-level, which will cause management to be more difficult. Multi-level will cause the extension of the supply chain, and the company's management requirements will be higher. For example, the supply chain of the car includes the host factory, dealer, and car owner. And GAC Group added multiple suppliers. This may cause difficulties in corporate management.

In addition, different companies have different supply chains and different focus companies. The managers of each enterprise in the supply chain regard their company as the focus company, and their views on the network structure will be different. Therefore, there may be conflicts of management. For example, GAC Group and investors have certain contradictions about the positioning of the brand when they were founded. Some people define Aion as a low-end electric vehicle, and believe that there is no need to establish additional raw material factories in batteries, while others want to improve Aion's quality and price and use better raw materials to attract high-end customers.

5.3. Suggestions

In order to address these issues, there needs to be a shift from managing a variety of functions to integrating activities into key supply chain processes. Traditionally, upstream and downstream supply chains have been relatively divided, interacting as disconnected entities. However, in order to improve the monitoring and management of the various parts of the supply chain, there is a need for a continuous flow of information to facilitate the information and requirements of the various parts of the supply chain to meet the needs of the customer [10]. This is because the customer, as the last link in the supply chain, is the main focus of the whole process [10]. To achieve a good customer-centric system, it is necessary to process information accurately and in a timely manner.

First, enterprises should confirm brand positioning and customer needs. As mentioned earlier, GAC Aion is not clear enough for the positioning of the company and the brand, which has led to the manager's loss of some links in the supply chain. It is clear that the characteristics and needs of the customer can help arrange the appropriate factories and after-sales services to improve the supply chain.

Secondly, strengthening the supervision of logistics is also necessary. Logistics, as a connection and a link in the supply chain, needs to ensure its timeliness and security. Most of GAC Group's factories are concentrated in Guangdong, to a certain extent, which reduces transportation time. However, when traffic in Guangdong encounters problems, the entire logistics system may be affected. Therefore, GAC Group can set up factories nationwide to provide components required in automobile manufacturing in time.

In addition, a good demand management system is required to balance customers' needs and the company's supply capacity. For example, GAC Group should choose batteries and other components that can pay their costs to reduce the uncertainty of key customers. At the same time, GAC can also be placed in charging piles in various places to facilitate buyers charging of the car and improve after-sales service. This will also increase their demands.

6. Conclusion

This article compares the sales of traditional fuel vehicles and new energy vehicles to analyze the effectiveness of the measures taken by GAC Group in supply chain management and puts forward suggestions for improvement. As one of the most representative companies in China's automobile industry, GAC Group's improvement of supply chain management will not only bring more profits to itself, but also improve buyers' sense of use. Therefore, it is crucial to continuously reconstruct and improve the supply chain. Electric vehicle companies can help the supply chain continue to improve by clarifying customer needs, increasing demand management, and improving after-sales services. Supply chain management should exist in theory, but more importantly, companies need to try different methods.

Nonetheless, this article still has some limitations. First of all, the article is relatively single in case selection. Secondly, the data selection range is small. The article inquired about the financial reports of GAC Group in the past five years and deleted some data. Therefore, it is necessary to further understand the supply chain industry in detail and collect more information to optimize the analysis process of the article.

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