

Study on the optimization of Chinese automotive supply chain under unstable environment

Xiaoran Zhu*

Department of Logistics Management, Shanghai University of International Business and Economics, Shanghai, China

*Corresponding author: 20024059@suibe.edu.cn

Abstract. As a pillar industry of the national economy, the automobile industry is one of the fundamental forces in driving domestic demand and promoting economic growth. With the spread of the epidemic worldwide, various parts of the automotive supply chain have been disrupted. The current “supply cut-off” crisis in the auto industry has begun to receive widespread attention, and the impact on the global auto industry chain has already started to emerge. In the face of the increasingly unstable environment, it is worth exploring what impact the epidemic has had on the automotive supply chain, what risks are there for vehicle manufacturers and component manufacturers, and what insights this epidemic has for the upgrading and long-term development of corporate supply chain systems. Based on this, this paper will share some preliminary thoughts on the short-term supply chain response suggestions and long-term supply chain system construction in light of the epidemic from the supply chain perspective.

Keywords: Unstable environment; Automotive Supply Chain; Optimization Measures.

1. Introduction

The international logistics company counterparts have long recognized the automotive logistics industry as the most complex and professional territory. The automobile supply chain is a complex and huge system containing various suppliers, manufacturers, logistics providers, sellers, etc. The main body is the material supply system such as parts. The automobile industry is a kind of “integrated” enterprise, and having a complete and powerful automobile supply chain is one of the essential characteristics of an automobile powerhouse. The competition among automobile enterprises is essentially between supply chain and system capability. Establishing an efficient and coordinated supply line system with competitive advantages is a prerequisite for each automobile enterprise's healthy development and regular operation. Since this year, the new crown epidemic has significantly impacted China's economic and social development, making the auto industry, which was already in a period of speed reduction and adjustment, suffer a huge hit. The whole auto industry chain has been deeply affected, and there has been a widespread delay in the resumption of work and production in the supply chain. Enterprise revenues have plummeted, and many companies are in a complex crisis.

2. Literature Review

There is already literature related to 'The impact of the global epidemic on the automotive supply chain', “Reflection and countermeasures of enterprise logistics supply chain in the post epidemic era” and “The 2021 Automotive Supply Chain Conference”[1]. The available research results mainly analyze the impact of the epidemic on China's automotive supply chain and the measures that companies can take from a short-term and long-term perspective. Undoubtedly, the available research results show that there are already available initiatives to face the automotive supply chain crisis, but there is less analysis on the new wave of the epidemic situation in 2022 and the sales and supply chain situation of the latest car companies. Moreover, there is a lack of description of the real relationship between car companies and the supply chain at a deeper level. This topic attempts to fill this area's gap with its research results.

3. Organization of the Text

3.1 Current situation of Chinese automotive companies during the epidemic

For every country, the automotive manufacturing is a reflection of the country's manufacturing capabilities. According to industry statistics, a car has about 20,000 parts assembled or supplied to the OEM by suppliers at all levels upstream of the supply chain. In comparison, the OEM is directly responsible for assembling up to 2,000 parts[2]. There are about 30,000 parts on a car, and it takes tens of thousands of suppliers to work with them, from machining to fabrication.

Recently, Tesla submitted its 10Q statement to the U.S. Securities and Exchange Commission (SEC), and the document detailing the company's specific performance in major markets.

The document shows that Tesla's revenue in the second quarter of this year was \$16.934 billion, including \$16.068 billion from its automotive business; revenue in the U.S. market was \$9.614 billion in the second quarter, compared with \$5.205 billion in the same period last year; revenue in the Chinese market was \$3.787 billion in the second quarter, compared with \$2.859 billion in the same period the previous year, an increase of 32.45% year-on-year, but a decline of 18.56%, which is the first time since Tesla went into production at its Shanghai super factory in 2019, a year-over-year decline; the rest of the market's second-quarter revenue totaled \$3.533 billion, compared with \$3.894 billion in the same period last year.

For its part, Tesla said that in the second quarter of this year, Tesla's production process continued to face challenges such as shutdowns and global supply chain disruptions, which also limited the factory's ability to continue operating at total capacity. Moreover, Tesla has no inventory vehicles, and its direct model allows vehicles to be sent directly from the production line to customers. Therefore, when Tesla's Shanghai mega-factory stops production, deliveries will also stop.

Also, a Shanghai-based car company, SAIC announced its April production and sales snapshot, showing that it received the impact of the epidemic and its sales fell by more than 60% year-on-year. Among them, April vehicle production was 158,000 units, down 62% year-on-year. April sales were 167,000 units, down 60.3% year-on-year[3].

No matter what car brand, customers are likely to turn to other brands because of the long waiting time for a car. Having no cars to sell is a huge disservice to any brand.

And recently, the 2022 China Automotive Supply Chain Conference and the first China New Energy Intelligent Networked Vehicle Ecology Conference were held in Wuhan, Hubei[4-5]. At the conference, industry experts and scholars discussed significant issues affecting the future development of the supply chain, such as the core challenges faced by China's automotive industry chain and the change of the automotive supply chain system model under the transformation of electric intelligence, arguing that the automotive industry needs to strengthen core technological innovation at the critical stage of entering the new energy and intelligent network connected new track, strive to crack the supply chain chokepoints, breakpoints and blockage points, and make every effort to build the automotive industry chain New ecology.

With the emergence of "black swans" and "gray rhinoceroses" such as the epidemic, international situation, rising raw material prices and chip shortages, many unstable factors have repeatedly hit the Chinese auto industry chain and supply chain[6]. China's auto industry is facing the following unprecedented challenges.

3.2 The unstable environment in the supply chain of Chinese auto companies

3.2.1 The epidemic caused many parts of the supply chain to stagnate

After the resurgence of the epidemic in Shanghai and Guangzhou, numerous automotive supply chain companies received the impact of the epidemic. As a result, an unstable supply environment spread among Chinese automotive companies. Such a situation undoubtedly adds insult to injury in a period when there is already a shortage of chips.

Shanghai, for China, is the gathering and development center of the automotive supporting industry. From the perspective of logistics supply, Shanghai port is located at the mouth of the

Yangtze River and carries vast import and export trade projects of auto parts. Therefore when any auto part is not delivered to an auto company in a timely manner, the whole vehicle cannot be manufactured. Such a slowdown in production pace has dealt an unbearably heavy blow to the auto industry. Most importantly, the lack of chips is a problem that emerged as early as 2020. As the electronic progress of new energy vehicles continues to accelerate, automotive chips and the original cell phone chip industry compete for production capacity. But under the influence of the epidemic, not many companies dare to expand production capacity as a result and choose to face the risk of shutdown at any time. This has led to the automotive chip still being in short supply. The upstream industry chain of the automobile industry includes steel, machinery, rubber, petrochemicals, electronics, textiles, and other industries.

In contrast, the downstream industry chain includes insurance, finance, distribution, maintenance, gas stations, logistics, restaurants, hotels and other industries. Therefore, the automotive industry's supply chain is very long[7]. Thus, this round of the epidemic has made the entire automotive supply chain in China suffer a severe blow and damage.

3.2.2 Serious shortage of core auto parts

China's imports of automotive parts from abroad, mainly domestic can not produce or can not meet the demand for systems, parts, materials, and virtual devices. Germany, Japan, South Korea, the United States, and other countries are China's main sources of automotive parts [8]. Europe and the United States have monopolized the global automotive chip for a long time. Europe, the United States and Japan and South Korea as representatives of the developed countries occupy 37%, 30%, and 25% of the market, respectively. Forward Industry Research Institute statistics, the automotive semiconductor market size of about \$46 billion in 2020, China's independent automotive chip industry scale accounted for only 4.5%, the import rate of more than 90%, including the core devices of the automotive industry, including MCU, power supply, sensors, power devices, and many other chips. Due to the heavy dependence of China's automotive chips on overseas markets, the security and reliability of the automotive supply chain will be directly affected. Among them, MCU is the most severe shortage of automotive-grade chips. There are still few domestic MCU manufacturers in the automotive field, and they must pass strict certification. Once there is a shortage of cores, a broken supply of automotive-grade chips will seriously damage the healthy development of China's automotive electronics industry. 2021, the cumulative reduction in the global automotive market reached 11.324 million units, of which the incremental decrease in China's automotive market is about 2.148 million units

3.2.3 Cash pressure from upstream and downstream industries in the supply chain is too high to develop

Under the impact of the epidemic, most offline marketing activities have been canceled one after another, and vehicle manufacturers' new vehicle launch plans will be affected in the short term. They may incur additional losses due to the disconnection between R&D, production, promotion, and sales. At the same time, most of the second, third, and fourth-level parts suppliers upstream of the auto supply chain are small and medium-sized enterprises. The epidemic brought about by the shutdown and the front-end vehicle production and sales of the short-term downturn will inevitably have a "backlash" on suppliers. Small and medium-sized parts suppliers face liquidity risks. Financial and operational risks will be magnified, bringing additional long-term supply security risks downstream.

In addition, "cutting off" the sudden change in demand may also bring potential "beer game effect" risk. In the current situation where some upstream suppliers' capacity is restricted, some downstream companies may ensure regular operation by increasing order quantity, starting backup supply, increasing inventory, and other mechanisms. However, this may also lead to a certain amount of overstocking. And this distorted demand information is amplified by passing along the supply chain, which will bring a corresponding impact to the whole chain. After a certain period, the risk of excess capacity in the upstream, misalignment of supply and demand, and inventory build-up of downstream components can quickly occur.

3.3 Existing strengths of Chinese auto companies

Of course, the strengths of China's traditional manufacturing industry can also be seen in the period of response to the epidemic.

First, the Chinese automotive industry has a highly qualified and well-executed workforce with sufficient experience in dealing with emergencies. They can track the state of the market in a short period and quickly adjust business needs. At the same time, they can assess the economical situation for the whole year and change the forecast for the entire year to respond to the crisis quickly. This is where the whole of the automotive industry has a huge advantage. Secondly, the industry is highly risk-resistant and has a comprehensive quality assurance system. Even if many suppliers are currently unable to supply, there are still two or three supply can temporarily replace the supply. Many companies are equipped with the awareness of improving risk resistance. At the same time, the automotive R&D department is constantly challenged to try to catch up with the time when parts are out of supply under intense working conditions. Finally, the Chinese automotive industry is highly synergistic. The automotive industry is arguably the industry that has done the best digitalization in manufacturing. This is because, among other things, there are ERP/MRP/EDI systems to support the constant changes in demand during the epidemic. Enterprises can quickly calculate the demand through MRP and then notify each supplier through EDI in the first place to realize the supply chain synergy. The MES system on the production line monitors the production status throughout the process and enables efficient production management.

3.4 Future directions for optimization

But even so, the development of China's manufacturing industry is still slow. Therefore, in the future, China's automotive supply chain still needs to seek more development directions.

3.4.1 Implement closed-loop management and launch related coordination platform

In the future, for a short period, if the epidemic is eased and various car companies start to resume work, the logistics of the auto supply chain after the epidemic will be the key to whether the current supply crisis in China's auto industry can be solved. Several factories in the Pudong area of SAIC-GM have already achieved closed-loop production, which ensures the supply of materials to a certain extent. For car companies, it is not an easy task to resume full-scale production. To start production lines, not only do they need to have workers and production lines, but they also need to have raw materials and parts. This requires the joint efforts of supply, production, and logistics enterprises and, more importantly, the management and coordination of local governments and the overall national logistics situation[9]. At present, the relevant national units have set up a smooth coordination platform for the supply chain of the automobile industry chain. In the coming period, the appropriate platform will coordinate and carry out precise docking to ensure that the current supply and demand are met.

3.4.2. Innovate new ideas and accelerate new rhythms

The logistics can only solve a temporary problem. The absolute need to change China's auto supply chain is the relationship between car companies and the supply chain. From the perspective of the current market, if we keep following the previous principle of "supply according to their production rhythm and production demand", we can no longer keep up with the rhythm of the market. The entire industry chain needs to re-examine the JIT concept that has been in place for many years. In the past, car companies only considered the OEM, seemingly taking into account the inventory and lower costs, but putting it into the total cost of the entire supply chain, the JIT concept may not be the lowest cost approach. In addition to the ability to take into account the brand, the supply chain should be concerned not only about the internal closed loop but also about the external closed loop so that the formation of internal and external integration will be a new round of transformation.

3.4.3. Promote regionalization and localization of supply chain

Currently, the globalization of the industry chain is being challenged, so the regionalization and localization of the supply chain should be more urgent after the epidemic. The localization of the industrial chain is divided into three levels: the bottom layer contains localized assembly and production, which mainly focuses on the localization of personnel and facilities. The middle level is local R&D, which has R&D personnel, R&D system, R&D equipment, etc. The highest level is localized intellectual property, which mainly includes its own and partner intellectual property. To achieve the highest level of localization in China's auto industry chain, in addition to local parts enterprises seizing the development opportunities in the post-epidemic period and strengthening their capabilities, the state should also support them financially and in terms of policies. For the manufacturing and investment of local core parts products, the state should give emerging companies a chance to develop before they can make breakthroughs in core technology[10].

3.4.4 Enhance supplier risk prevention system and build an ecosystem

Improving suppliers' awareness of risk assessment and prevention is conducive to establishing a multi-dimensional risk warning mechanism to resist sudden production stoppages caused by local force majeure factors. Moderate construction of capacity redundancy is good for resisting risks and can also reduce inventory in general. The new redundant capacity should be geographically different from the existing capacity to resist the chance of local force majeure. At the same time, build an ecosystem to resist risks. Enterprises upstream and downstream of the auto industry chain can form an alliance of interests by constructing an ecosystem to enhance the ability to resist threats together. In times of crisis, they can lend each other strength through the ecosystem to form anti-risk capability. For example, during the epidemic, an OEM used industrial funds to take 10 initiatives to help auto industry chain partners tide over the difficulties together, including setting up a unique pool of funds, providing short-term cash flow solutions, and offering deferred repayment services and insurance protection programs.

4. Summary

In an environment where new auto companies are constantly being updated, traditional Chinese car companies are in crisis and not even sure what challenges they will face next. In the future, as auto companies and suppliers enter the stage of semi-resumption and resumption one after another, the strong auto companies will be braver and braver in the face of constant difficulties. And take this opportunity, under the guidance of government authorities and related policies, to work hand in hand with the chip and other core component industries to get rid of the archaic concept of traditional manufacturing and create a brand new situation. In this way, China's auto market may regain its vitality. We also need to embrace the recent changes and take positive countermeasures to help the auto industry recover as soon as possible and contribute to China's economy coming out of the shadow of the epidemic.

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