

Risk Management Strategies for Chip Supply Chain Disruption: Case Study of R Automotive Manufacturing Company

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Abstract: This article addresses the chip supply chain problems faced by the global automobile industry, takes R automotive manufacturing company as a case study, and thoroughly researches the risk of the out-of-supply of the key raw material, chips, in the automobile manufacturing industry and its impact on the production of the enterprise. The article explains the importance of supply chain management in modern enterprises and points out supply chain risks. Taking the automotive manufacturing industry as the background, the article discusses in depth the importance of micro-control units as the electronic control units of automobiles, analyses the competitive advantages of R enterprises in the new energy vehicle market, analyses the risk characteristics of chip out-of-supply as well as the challenges faced by R enterprises under the influence of the global epidemic and market uncertainty, and proposes the strategies for R enterprises to cope with the risk of chip out-of-supply, including the strengthening of supply chain cooperation, formulating a reasonable procurement mechanism, establishing a good supplier relationship, and promoting independent research and development of chips. Finally, the findings of this paper are summarized, and relevant suggestions are provided for automotive manufacturing enterprises to avoid the risk of chip supply shortage.

Keywords: chip supply chain, automobile making, supply chain risk

1. Introduction

The development of the national economy and the progress of science and technology have improved people's living standards, making people's demand for material more diversified, thus putting forward higher requirements for products in addition to quality and service. At the same time, the external market competition has intensified, and the competition between enterprises has gradually transformed into the competition between supply chain and supply chain [1]. In this situation, supply chain management is crucial for developing enterprises and industries; effective management and monitoring of the supply chain and ensuring its normal operation can guarantee overall profitability [2]. In various uncertain external factors, supply chain management also brings risks. Therefore, controlling the supply chain risk plays an important role in developing enterprises and industries.

Many scholars have put forward different insights and come up with different research results for supply chain risk. Hu Jinhuan et al. proposed that, based on the cooperation system of the supply

chain, for the development of enterprises, the supply chain can bring scale benefits but also may bring cooperation risks [3]. It believes that supply chain risk arises due to the existence of a variety of unpredictable and difficult-to-avoid uncertain risk factors in the production and operation process of supply chain enterprises, which leads to the possibility that supply chain enterprises may not be able to obtain the expected benefits, and then the possibility of loss. Jiang Huihua stressed that with the development of economic globalization, the links between supply chain enterprises have become increasingly close. With the frequent occurrence of emergencies in recent years and the serious consequences they have brought about, it is believed that supply chain breakage has become the primary risk of today's enterprises [4].

For the automotive manufacturing industry, the production of automobiles requires a large number of parts and components, many of which are from different countries and regions of the supplier [5]. Automobile manufacturing also requires the coordination of production, assembly and transport, etc.; any key components that need to be replenished promptly may cause automobile manufacturing to be affected [6]. Therefore, how to reasonably control the key components that are difficult to replace has a significant impact on automobile manufacturing.

Micro-control unit (MCU) is an indispensable chip in automotive manufacturing, known as the automotive electronic control unit of the operation of the brain, according to the Gai Shi automotive information data show that the micro-control unit accounts for about 30% of the number of automotive semiconductors, the traditional fuel car single-vehicle average of 70 micro-control unit, new energy vehicles single-vehicle needs 300 micro-control unit. China's automobile production is increasing yearly, and the demand for micro-control units is increasing. Since 2020, the micro-control unit has been in a short-supply situation [7]. With the trend of automobile endeavors (electrification, network connectivity, intelligence, sharing) becoming more and more significant, the micro-control unit as a car from the traditional fuel vehicle to the development of new energy vehicles, the key chip, whether it can be a stable supply of China's automotive industry directly affects the development of China's automotive industry.

R enterprise represents the transformation of traditional automobile enterprises to new energy vehicles; in recent years, it has attached great importance to controlling raw material procurement risk and has gained certain experience. This paper takes R enterprise as the research object to study how traditional automobile enterprises can avoid the problem of raw material supply risk to provide theoretical inspiration for Chinese enterprises to deal with the supply risk of key components under the new development pattern.

2. Case Description

Since 2020, the global automotive industry has been affected by multiple factors such as the New Crown epidemic, fire accidents at the world's largest automakers, such as Renesas Electronics Corporation, and extreme storms of ice and snow in the United States, which have led to problems in the global supply chain of automotive chips, which in turn have had a major impact on the production of many automotive manufacturers [8]. According to Auto Forecast Solutions, an automotive industry forecaster, global automotive production will be reduced by 3,829,400 units in 2022 due to chip shortages, highlighting the critical importance of the automotive chip as a key production factor throughout the entire automotive manufacturing process and that its shortage will result in automotive production coming to a temporary standstill.

R enterprise is a company mainly engaged in the research, development, production and sales of automobiles and is committed to meeting the industry trend of the popularity of new energy vehicles under the new development pattern. In addition to its traditional automotive business, the enterprise is actively promoting new energy vehicles and conducting in-depth research in areas such as driverless driving. According to the data released by R Enterprises, the total sales volume of

automobiles for 2022 will reach 1.6 million units, of which the sales volume of new energy vehicles will occupy 600,000 units. It is particularly worth mentioning that the sales of a new energy MINI passenger car under R Enterprises exceeded 554,000 units in 2022, making it the world's top-selling MINI passenger car of the same type. This MINI passenger car has won the recognition and praise of many families with its affordable price and stable quality.

However, for a long time, although the enterprise regarded this MINI passenger car as its core product and was the sales champion of the same type of car for many years in a row, the production volume of the MINI passenger car remained at a stable level because R enterprise had to use part of the raw materials of the chip for the research and development and production of other car models as it continued to expand its business areas. The balance between business expansion, chip supply and distribution, and sales became a real problem that R enterprises urgently needed to solve. The fundamental solution to this problem lies in strengthening chip supply security.

3. Risk Analysis of Chip Supply Interruption

Chip supply cut-off is characterized by suddenness, conductivity and long-term impact. As a key raw material for automobile manufacturing, if a sudden event leads to a long-term supply cut-off without replenishment, it will affect the manufacturing process of R enterprises, which will not only cause direct economic losses to the enterprises, but also may make the credibility of R enterprises in the supply chain damaged, and may even lead to the compensation arising from the failure to deliver the vehicles in time to the extent that it finally reduces the enterprise's market share. The impact of a chip supply cut-off is far-reaching and long-lasting. During the supply cut-off period, the enterprise will have to adjust its chip usage plan. It may have to reduce the manufacturing of other models to prioritize the production of certain more representative models or even suspend some next-generation models already being developed as a result. Even if the chips are supplied by the supplier after some time, it will take a long time for the enterprise to resume operations, such as the readjustment of production schedules and the reconfiguration of personnel. It will take a long time to repair and re-establish the trust of the customer relationship damaged by the delayed delivery of orders.

Chips have a wide range of applications, and at the same time, many automakers may have different supply needs for the same chip supplier. Once a chip supplier needs to fulfill an urgent order from a strategic or another important customer for production insertion, it may lead to a delay in the order from R enterprise, which may delay the supply of chips.

China is a major manufacturer and consumer of automobiles and has ranked first in the world in production and sales for 12 consecutive years up to 2020 [9]. However, since 2018 and continuing until 2020, China's car sales have declined for three consecutive years. As a result, before the outbreak of COVID-19, it was widely believed by automobile manufacturers and various companies supplying raw materials needed for automobile manufacturing that domestic automobile sales had gradually leveled off. Several organizations also predicted that it would take much work for China's automotive market to reproduce the explosive growth trend of the past. This has led chip manufacturers to adopt a cautious attitude toward the market environment and a strategy of reducing production, further leading to generally low chip inventories in the industry. However, after the domestic epidemic improved in the second quarter of 2020, the sales of new energy vehicles climbed rapidly, driven by the incentive policies for new energy vehicles in China. However, due to the long delivery cycle and tight chip supply, R companies were also affected to some extent, with production cuts for most models, and even the development of some next-generation models had to be forced to be suspended.

Additionally, the urgent demand for chips in the global automotive manufacturing market has forced R enterprises to take on the cost risk of sourcing this key raw material. Due to the sharp increase in market demand for chips, chip makers' inventories are generally low; coupled with the impact of COVID-19, some factories are having difficulty resuming normal production, ultimately

leading to a serious imbalance between chip supply and demand. Chip manufacturers adopted a price increase strategy, and the prices of various chips soared to several times the original price [10].

In addition, before mass production of the cars, R Enterprises has organized a series of launches for the upcoming new generation models on multiple platforms to inform potential consumers about the car's performance, improvements and pricing. Some consumers have already started making bookings online and offline. Even if the price of the chip suddenly skyrockets at this point, since the selling price has already been announced, R enterprise cannot backtrack and raise the car's selling price to avoid triggering consumer dissatisfaction and lowering the creditworthiness of the enterprise. R enterprises would then have to bear the risk of the cost of the chip on their own.

4. R Enterprise's Strategies for Dealing with Chip Supply Shortage

The supply chain comprises different interests and decision-making bodies; under external uncertainties, the original contract and alliance relationship between enterprises will become fragile, and it isn't easy to play the original role of coordination and cooperation. Therefore, Enterprise R should reorganize, examine and evaluate the credibility and supply ability of each supplier, redesign the supply chain contract according to the actual situation, and strengthen the cooperation and information communication with suppliers, to solve the unexpected situation effectively and make the optimal decision.

Based on the supply risk of chips, R enterprises should improve the reasonable procurement mechanism, consult with chip suppliers on how long it is expected to resume supply in case of sudden supply cut-off and determine the suppliers' maximum production volume and transport capacity and transport time. In addition, need to establish a good relationship with the chip supplier to get priority supply, price reduction and other preferential treatment. And through long-term cooperation to obtain the supplier's high customer rating, to avoid the urgent need for chips in the supplier's other customers to cut orders and the impact of their supply cut-off.

As for the cost risk of the chip, R enterprises need to establish a long-term reasonable price mechanism with the supplier, to reduce R enterprises in the face of changes in the external environment caused by the surge in raw material prices to bear the risk. And this price mechanism has a certain degree of flexibility. Also, it allows the supplier to adjust the delivery strategy to share the risk of price increases with R enterprises and ultimately to ensure the optimal cost of long-term chip supply. In addition, due to the expansion of R&D and manufacturing business, R enterprises should also increase the safety stock level to reduce the chip supply shortage risk.

In addition to purchasing chips from chip suppliers, R enterprises can lay out chip suppliers to carry out in-depth integration and development and invest funds in chip suppliers to jointly develop chips so that the chip supply can be guaranteed and chips can be developed promptly to meet market demand. In addition, R enterprises should also increase the independent research and development of key chips, establish a database of chip use, and formulate alternative strategies according to the use of different chips. Firstly, they should decompose the chips' functions and analyze the chips' principles to achieve different functions according to the users' scenarios, to promote the process of self-development of the chips and ultimately reduce the dependence on the chip suppliers.

5. Conclusion

As a key raw material for automobile manufacturing, the shortage or even interruption of supply of chips in the wake of the epidemic has directly led to the disruption of production lines of many car companies. This brings economic losses to car companies and damages corporate reputation by failing to deliver vehicles on time. For key raw materials affecting automotive manufacturing, enterprises should formulate a reasonable safety stock strategy and establish a solid relationship with

suppliers to obtain accurate information about their production status, such as production line operation, production cuts or production stoppages. A good supplier relationship helps enterprises mitigate the risks of sudden raw material price spikes. It allows them to receive priority supplies from suppliers when the market is short.

Considering the significant impact of the chip shortage on various industries after the epidemic, coupled with the unstable trade relationship between the US and China and the US's suppression of China's high-end technology and other fields, China has also introduced a series of policies to guide and promote domestic enterprises to increase their investment in independently researched and developed chips, to cope with the situation of high-end technology that has been subjected to others for a long time. For the enterprises themselves, they should also strengthen the exploration of the chip field and take measures such as joint research and development with domestic chip makers or implementation of independent research and development by automobile enterprises to mitigate the risk of production line disruption due to the interruption of the supply of chips by suppliers.

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