

Influence of COVID-19 Epidemic on China and Global Supply Chain and Policy Suggestions

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Abstract

The global COVID-19 outbreak at the beginning of 2020 has had a great impact on many global industrial chains, and triggered a systematic risk of chain breakage. By studying the actual supply chain strategy and the change trend of supply chain strategy in representative countries and enterprises, this research predicts the short-term, medium-term and long-term impact of COVID-19 epidemic on global supply chain. Among them, the short-term and medium-term impacts include encouraging enterprises to improve the flexibility of supply chain by constructing supply chain digital platform, supply chain diversification system and supply chain early warning system; in the medium and long term, the global supply chain layout will change from globalization to regionalization, and some high-end manufacturing industries will have a backflow trend. Our government needs to establish an early warning system of industrial supply chain security as soon as possible in the short term, promote the industrial Internet platform in the short and medium term, continuously support the healthy and efficient development of the supply chain, and adjust the industrial layout in the medium and long term to cope with the global supply chain adjustment.

Keywords

Global Supply Chain, COVID-19 Epidemic, Supply Chain Flexibility, Industrial Transfer

1. Introduction

Since December 2019, a number of pneumonia cases of unknown cause with a history of exposure to seafood markets in South China have been detected in some hospitals in Wuhan, Hubei Province, which have been confirmed as acute respiratory infections caused by Novel Coronavirus infection. On 11 February 2020, Director-general Tedros Adhanom Ghebreyesus of the World Health Or-

ganization (WHO) announced in Geneva, Switzerland that the novel coronavirus pneumonia was named “COVID-19” (Anonymous, 2019). On February 22, China’s National Health Commission (NHC) issued a notice revising the English name of COVID-19. On 11 March, WHO decided that the current COVID-19 outbreak could be called a global pandemic.

The COVID-19 outbreak, a major public health emergency, will have a significant impact on the production and operation activities of the supply chain. In the face of the current COVID-19 outbreak, the level of supply chain management is also put forward higher requirements, forcing relevant enterprises to improve their own management level to deal with major emergencies. China is a major manufacturer, consumer, logistics and hub of the global supply chain. The continuous outbreak of COVID-19 at home and abroad has a great impact on China’s supply chain, especially on the resumption of production, logistics and markets at all levels of the supply chain.

This paper divides the impact of COVID-19 on the supply chain into short-term, medium-term and long-term, and provides corresponding suggestions to reduce the impact of COVID-19 on the supply chain in these three terms.

2. Literature Review

Oldekop (2020) pointed out that the rapid spread of the new crown epidemic has also significantly accelerated the digitalization process in different sectors, which has greatly helped reduce the spread of COVID-19. They also emphasized that online work and digital supply chains have alleviated the negative impact of COVID-19.

Ye (2021) pointed out that Europe and the United States under the background of high incidence of disease, the stagnation of production activities to reduce, logistics transportation, the influence of such factors as Europe and the United States exports have plunged in main countries, the outbreak of the global economy, especially under the impact of the global manufacturing, highlights the fragility of the global supply chain, and on the outbreak era’s layout and reconstruction of global supply chains have profound influence. At present, the second rebound of the epidemic and the further aggravation of the epidemic in the United States undoubtedly cast a new shadow on the recovery of the global manufacturing industry.

Aviso (2020) pointed out that the emergence of a global supply chain system puts the industry and economy facing risks that transcend national boundaries. Unlike other natural and man-made disasters, the world is not prepared for a pandemic like COVID-19.

Araz et al. (2020) believe that coronavirus-related damage has caused a large-scale global crisis, leading to the collapse of many global supply chain systems.

Handfield et al. (2020) found that COVID-19 response measures have brought an unprecedented bullwhip effect in the manufacturing industry and used the laws of physical structure to guide the future global supply chain system.

Rapaccini et al. (2020) identified a four-stage crisis management model (disaster, fast and dirty, restart and adaptation). Manufacturing companies can implement this model to respond to the pandemic and improve their position after the crisis.

Existing literature has studied the impact of COVID-19 on supply chain systems in different industries, but has not broken down the stages of impact. This research divides the impact of COVID-19 on global supply chains into three stages: short term, medium term and long term. There are two main research methods in this paper. One is based on existing literature, magazines and journals, and the other is based on the author's observation.

3. Importance, Contributions, Limitations and Innovations of the Research

3.1. Importance of the Research

COVID-19 in early 2020 has had a variety of negative impacts on all industries, the most important being the inability of businesses to produce, difficulty in turning around products, uneven supply and, finally, the inability of consumers to consume as much as they should. This a few months since the party and the country has established strict epidemic prevention measures, after the country united against SARS to already was basic control in our country, all walks of life are ready to return to work and production, but the global outbreak still didn't get good control, foreign epidemic is still serious, at home and abroad for the influence of the supply chain is very big, It also deepens social concerns about the future survival and development of enterprises.

3.2. Contributions of the Research

This research analyzes the impact of COVID-19 on domestic and international supply chains from short-term, medium-term and long-term perspectives. At the same time, suggestions are provided for eliminating these influences and creating a more stable supply chain system.

3.3. Limitations of the Research

It only analyzed the impact of COVID-19 on global supply chains between early 2020 and May 2020, and did not study the impact of COVID-19 on global supply chains after a small or large recovery in some regions in 2021. In addition, this research does not study the specific impact of COVID-19 on the supply chain of specific enterprises. Finally, researchers in this research may have biases due to their cultural background and personal opinions on specific phenomena, which may affect the rationality of the research.

3.4. Innovations of the Research

This research divides the impact of COVID-19 on supply chains into three different stages: short term, medium term and long term. From the perspective of

globalization, this research puts forward suggestions on the construction of supply chain system under the COVID-19 pandemic, such as industrial migration and construction of digital supply chain system.

4. The Development Characteristics of Global Supply Chain and the Degree of Integration between China and Global Supply Chain

At present, the global production form, resource allocation mode and industrial chain have gradually taken shape since 1990s. Due to the development of informationization and the perfection of global logistics system, developed countries such as Europe, America and Japan have transferred some capital-intensive enterprises to countries with good industrial foundation and developed science and technology, such as China. With the deepening of the division of labor and the complexity of the value chain in the global supply chain, the levels of the global supply chain are increasing, and the higher the manufacturing industry chain (such as automobiles, electronics, etc.), the longer the supply chain; These supply chain systems are often distributed in industrial clusters in different regions, and a wide variety of raw materials and semi-finished products need to be brought together for reprocessing and reproduction through continuous and rapid logistics systems, so as to finally form finished products. At the same time, with the continuous scientific and technological innovation, business increase and industrial integration of core enterprises in the supply chain, the global supply chain has also changed from pyramid mode to complex network structure mode. With the importance of some supply chain nodes gradually appearing, the supply chain network presents obvious hierarchy and inequality.

Taking China as an example, under the above-mentioned globalization trend, as an industrial undertaking country in the industrial transfer of developed countries and regions such as Europe, America and Japan, China has become the profit-maker of technology spillover effect in developed countries. At present, China is the only country in the world with all the industrial categories in the United Nations industrial classification, and has formed several world-leading industrial clusters of high value-added industries, becoming a veritable “world manufacturing center”. Bloomberg reported that in 2019, 32.7% of the world GDP growth came from China. According to the “Global Trade Data and Prospects” report released by the World Trade Organization, China’s total import and export volume in 2018 accounted for 11.75% of the total global import and export volume; in the first three quarters of 2019, it will continue to be the world’s largest trader of goods. At present, more than 50,000 enterprises in the world have first-class suppliers in China, which shows the global dependence on Chinese manufacturing industry. The China-World Economic Dependence Index compiled in McKinsey’s February 2019 report “China and the World: Understanding Changing Economic Connections” shows that China’s dependence on the world economy in the three key dimensions of trade, technology and cap-

ital has dropped from 0.9 in 2007 to 0.6 in 2017; However, the dependence of the world on China's economy increased from 0.4 in 2000 to 1.2 in 2017.

However, the global supply chain network born under the trend of pursuing efficiency and lean production also lays the foundation for the fragility and potential crisis of the supply chain: on the one hand, the intricate network supply chain structure improves the difficulty of visualization and transparency of the supply chain; On the other hand, the nonlinearity and feedback loop of complex systems make the impact of external shocks on the supply chain unpredictable. Therefore, once an important node of the supply chain is in crisis, the whole supply chain system will have a chain reaction and even be partially paralyzed.

The COVID-19 outbreak is a stress test on the current global supply chain system. As many nodes in the supply chain are affected, the global supply chain system will be impacted in both short and long term.

5. The Impact of the Epidemic on China's Domestic Supply Chain

5.1. The Supply of Intermediate Goods Is Blocked, and the Global Supply and Production Have a Great Impact

Under the influence of the epidemic, China's strict blockade measures inevitably led to the export of various intermediate products and primary products. As the key of the global supply chain, it affects the economic development of other countries and regions, which makes the supply chain of other countries slow. This transmission and superposition effect eventually leads to the serious stagnation or even stop of the global supply chain at the peak of the epidemic in Europe and America.

5.2. The Spread of the Epidemic Has Caused a Serious Impact on the "Triangle Trade" Supply Chain in East Asia

In some areas of Japan, China and Southeast Asia, a relatively complete industrial chain structure has been formed, and one of the industrial circulation modes in typical manufacturing regions has been formed. Among them, Japan and the former Four Little Dragons in East Asia are mainly responsible for providing some sophisticated products or parts with relatively high technical content, while China and coastal Southeast Asia are mainly responsible for assembly work. Subsequently, these accessories were sold to America, Europe and other regions.

The impact of the epidemic makes it difficult to carry out the "triangle trade" activities in East Asia in an orderly manner, and the production and supply of electronic components, which are intermediate products of many electromechanical manufacturing industries, are in a difficult position, which has a comprehensive impact on the manufacturing and supply of electromechanical industries including heavy equipment manufacturing.

5.3. The Impact and Influence of the Epidemic on the Heavy Equipment Manufacturing Industry

Heavy equipment manufacturing industry belongs to “big country and heavy equipment”. With the transfer of advantages of production factors such as technology, capital and manpower, the heavy equipment manufacturing industry has shifted from Europe and America to Asian countries represented by China step by step in this century. Among them, China has undertaken and developed the most rapidly, including typical heavy equipment manufacturing industries such as engineering and mining machinery, transportation machinery, port machinery, shipping and marine heavy industries, and China has gradually become the provider of main end products and the leader of the industry. And gradually evolved into an industrial cycle mode in which traditional manufacturing powers such as Europe and the United States provide design, software systems, core components or subsystems, and countries such as China and South Korea occupy terminal advantages, producing finished products and selling them to global markets including developed countries such as Europe, America and Japan. Based on the consideration of industrial upgrading and supply chain security, in recent years, major domestic industry leaders, including Sany, Xugong, Zhenhua Heavy Industry, China Merchants Heavy Industry, etc., are constantly promoting the research and development and application of domestic core components, and then upgrading occupies the absolute advantage of the whole industrial chain.

The epidemic has brought continuous impacts on the heavy equipment manufacturing industry from the production of key imported accessories, logistics and transportation, technical services, etc. At the peak of the epidemic, many European and American manufacturers either reduced their manufacturing scale or closed their factories directly, resulting in a sharp decline in production capacity, and “sealing the city and the country” directly led to the stagnation or even stop of logistics and transportation. However, due to the strict travel ban and the stop of personnel exchanges in various countries, many projects under construction have to be postponed or suspended due to lack of foreign technical service support. Thus, it brings great impact and influence to the global manufacturing industry, especially the production, transportation and delivery of heavy equipment manufacturing industry in China.

6. The Impact of the Epidemic on Global Supply Chains

The impact of COVID-19 epidemic on global supply chain has gone through the following two stages.

The first stage is from the end of 2019 to the middle of March 2020, and the epidemic situation in China has progressed from a large-scale outbreak to effective control. At this stage, China’s supply chain was shut down, the supply side was in serious crisis, and the utilization rate of upstream production capacity of

the supply chain was seriously insufficient, resulting in delayed delivery and shrinking orders. Therefore, the interruption of China's domestic supply chain has a one-way negative impact on the global supply chain. Taking the automobile supply chain as an example, more than 80% of the world's automobile parts are closely related to China's manufacturing industry, and Hubei, one of China's four major automobile production bases, is the hardest hit by the epidemic. At the beginning of February 2020, due to the suspension of production in China's automobile industry due to the epidemic situation, nearly 50% of the global automobile manufacturers suffered from the shortage of parts and components, and the production lines of Hyundai, Nissan and Toyota even stopped production in large areas in China.

The second stage is from mid-March to May, 2020. Although China resumed work and the operating rate recovered rapidly, Japan, South Korea, Europe and North America all faced epidemic outbreaks, resulting in lower operating rate overseas, sluggish market demand and shrinking orders. The above negative impacts began to "pour back" China, impacting the safety and efficiency of China's supply chain. Affected by the epidemic, many countries adopted the strategy of "sealing the country", which led to the shortage of shipping and air transport capacity, and made it difficult for domestic manufacturers to deliver to overseas customers. Taking air transport as an example, the freight rates of flights from China to ASEAN and European and American countries have increased by two times and one time respectively, which seriously affects the delivery cost and performance ability of key parts in the supply chain.

As the epidemic is controlled in various countries, its impact on the supply chain gradually fades, and the growth rate of China's import and export has recovered from a steady decline in the second quarter of 2020 (-0.2%) to a comprehensive rebound in the third quarter (+7.5%); However, with the second round of epidemic around November 2020, which is in a state of counterattack in the world, especially in North America and some European countries, the world will face the biggest economic recession since World War II. Therefore, the impact of the epidemic on the global supply chain will probably enter the third stage-the short-term enterprise supply chain management concept and the medium-and long-term national supply chain globalization layout strategy will be affected.

7. The Short-Term and Medium-Term Impact of the Epidemic on Global Supply Chain Management

The adverse impact of the COVID-19 epidemic on the global supply chain forces enterprises to guard against the risk of supply chain interruption and ensure their competitiveness from the perspective of resilient supply chain management. The so-called "elasticity" is an organization's dynamic ability to resist risks, and the resilient supply chain is a comprehensive embodiment of the robustness and recoverability of the supply chain. Resilient supply chain contains

two important factors: resilience and resilience, namely, the ability to ride smoothly with minimum loss when the supply chain is interrupted, and the ability to respond quickly and find an effective recovery path to return to a stable state. In the post-epidemic era, enterprises will have the motivation to transform their original supply chain model in the following three aspects, establish a flexible system of supply chain, and improve the resilience and resilience of the supply chain when the supply chain partially fails.

7.1. To Build a Digital Supply Chain Platform to Enhance the Flexibility of the Supply Chain

Strengthening digital ability is the only way for enterprises to enhance the flexibility of supply chain. Digital ability is not through simple ERP system, financial system and other information tools, but need to form an end-to-end, whole-process visual and traceable supply chain digital platform, so that enterprises have the ability to sort out upstream multi-level suppliers and downstream multi-level customers, and realize the supply chain disintermediation and transparency, so as to shorten the supply chain as much as possible and be closer to upstream sources and end customers.

For example, in the first quarter of 2020, when the MRO supply chain was at risk of supply interruption due to the difficulty of factory resumption, Gu'anjie (China), the head enterprise of MRO e-commerce, was able to get closer to upstream suppliers (rather than N-level distributors) than competitors based on its industry-leading digital supply chain capability (rather than employees occupying upstream resources), thus taking precedence over other competitors, obtaining scarce inventory of suppliers and ensuring smooth supply chain. At the same time, the company can accurately predict the purchasing time of various products by downstream customers through long-term accumulated data, so it can prepare goods in advance, thus greatly improving the customer experience.

Therefore, the establishment of a digital supply chain platform can help enterprises effectively manage high-quality suppliers and customers, and improve the supply chain's ability to respond quickly and perform contracts when the risk of supply interruption comes.

7.2. To Build a Diversified Supply Chain System to Enhance Supply Chain Redundancy

In the process of enterprise development and continuous adjustment of business, enterprises will constantly screen suppliers and warehousing and logistics providers, thus forming a stable supply chain system. In order to control costs, enterprises tend to adopt a single purchasing strategy for a single raw material, and form bargaining power for upstream and warehousing logistics providers by increasing purchasing volume and business volume. In this epidemic, many industrial chains are broken because of over-reliance on an enterprise or an industrial cluster in a certain region. Once these enterprises or industrial clus-

ters have the risk of supply interruption, the supply chain will be broken. In the post-epidemic era, enterprises will actively consider how to change from centralized and single industrial supply chain to distributed and diversified industrial supply chain, and strive to broaden the network of high-quality suppliers and fully tap high-quality alternative suppliers, such as maintaining cooperative relations with suppliers from many countries or regions, so as to reduce the risk of production suspension and supply interruption.

7.3. Build a Supply Chain Early Warning System to Improve the Recovery Ability of the Supply Chain

By building a digital platform of the supply chain and a diversified system of suppliers, enterprises can further form their own supply chain early warning system. By tracking the indicators of all dimensions of supply chain operations (including business flow, logistics, capital flow and information flow) in time, and according to the indicator changes and early warning triggers, they can seek supply chain alternatives in time to achieve rapid recovery.

In terms of business flow, the supply chain early warning system can not only help enterprises to quickly evaluate the direct upstream and downstream impact of emergencies on enterprises, but also help enterprises to take the lead in preparing supply chain alternatives through the changes of multi-level suppliers and customers in the early stage of emergencies, such as timely decentralized procurement, selecting alternative suppliers or changing inventory strategy, and changing from justintime production mode (JIT) mode to stocking mode, thus preventing the supply chain risk transmission of “taking the lead and moving the whole body”

In logistics, the early warning system of supply chain can help enterprises know the possible obstacles of warehousing and logistics in time. For example, in this epidemic, many warehousing and logistics hubs were blocked, and flights were cancelled, which seriously affected enterprises' performance ability. Therefore, enterprises need to adjust the supply chain plan before competitors through the supply chain early warning system and diversified supply chain layout, so as to obtain valuable resources for rapid recovery of the supply chain.

In terms of capital flow, the supply chain early warning system can prompt the changing trend of business cash flow and working capital, and help enterprises communicate with upstream and downstream or financial institutions in a timely manner; In the aspect of information flow, the early warning system of supply chain can comprehensively analyze the information of all parties, so as to enhance the flexible operation ability.

8. The Medium- and Long-Term Impact of the Epidemic on the Global Industrial Chain Layout

Although the impact of the COVID-19 epidemic on global supply chain has not

fundamentally changed the comparative advantages of various locations in the global industrial chain, it will make countries weigh supply chain efficiency and supply chain security more when considering industrial layout. At the same time, with the developed economies represented by Europe, America and Japan carrying out “state interventionism” one after another under the economic recession caused by the epidemic, attracting multinational companies to move back through financial subsidies will also affect their foreign investment considerations. Generally speaking, in the medium and long term, the restructuring of global industrial chain and the anti-globalization layout will be gradually opened, whether from the perspective of security of supply chain itself or political factors.

8.1. It Is Not Easy for the Mature Industrial System to Completely Move out of China, and the High Value-Added Part Will Be Retained

For consumer electronics, textile and other industries, China has a more complete industrial system, larger industrial scale and industrial agglomeration than other countries. It is undeniable that in recent years, these industries have been shifting to Southeast Asia: in terms of consumer electronics, Google has invested in the establishment of a smart phone supply chain in Southeast Asia in 2019. Since 2013, Samsung Electronics has gradually moved some mobile phone assembly plants to Vietnam; In the textile industry, compared with ten years ago, fast fashion clothing brands have gradually reduced their order share from over 40% to less than 1/3, while fabrics, bags and hats have formed a long-term transfer from China to Southeast Asia.

However, this kind of industrial transfer is generally the transfer of low value-added manufacturing, and many important intermediate products and manufacturing equipment of Southeast Asian products still depend on China’s exports. China’s high-level manufacturing capacity, abundant core supplier clusters, convenient infrastructure, stable political environment and broad market demand all make it difficult for China’s manufacturing position to be shaken from the foundation. Taking the consumer electronics industry as an example, Ernst & Young analysts believe that its industrial chain is delicate and complex, and professional industrial clusters are needed to equip complete and efficient supply chains and skilled workers, so as to efficiently produce high-quality products, which is why Apple’s new mobile phones still choose to be produced in China under the background of trade war. It can be seen that the trend of industrial transfer in Southeast Asia in consumer electronics, textile and other industries still retains the extended characteristics of China’s industrial chain in the medium and long term, and it may be difficult to shake the characteristics that the high value-added part of the industrial chain remains in China; With the gradual popularization of industrial robots, China’s labor costs will be reduced, which will further delay the migration of these industries to Southeast Asia.

8.2. The Industrial System of Goods That Are Not Easy to Transport Will Shift from Globalization to Regional Layout

For the industrial chain of goods that are difficult to transport, such as automobiles, it will change from global layout to regional layout in the future, forming a regional production mode of the whole industrial chain for the market it serves, thus forming a responsive regional supply chain center. For example, a supply chain center will be established in Mexico to serve the North American automobile market, an industrial cluster will be established in Eastern Europe to serve the European market, and China will retain the automobile industry chain to serve the Asian market.

As a result, the global supply chain network will be effectively shortened, which can balance the factors of cost and risk, form a risk mitigation system and save costs as much as possible.

8.3. The High-End Manufacturing Industry Is Facing a Return to Developed Countries

Although the global cross-border investment will drop by about 40% in 2020, the growth rate of direct investment in China will not decrease, and even the actual use of foreign investment in high-tech services will increase by 19.2%; however, the anti-globalization trend of high-end manufacturing industry moving back to developed countries has been brewing for a long time. After the financial crisis in 2008, the Obama administration hoped to revitalize the US domestic economy and promote employment by promoting the return of manufacturing; However, the Trump administration adopted the policy of trade protection by political means, destroyed the multilateral trade and investment system centered on WTO, and constantly suppressed the trend of China's technological progress.

The impact of this epidemic on the global supply chain has further aggravated the concerns of developed countries such as Europe and the United States on supply chain security and the demand for control of manufacturing industry, and the rise of global trade protectionism has emerged. Many countries even restrict the foreign direct investment of domestic enterprises through legislation, and prohibit foreign enterprises from acquiring domestic enterprises in crisis. It can be predicted that for high-end manufacturing, the US, Europe and Japan governments will have the motivation to promote its return and strengthen localized production.

First of all, for the sake of national public health and even national security, the United States and Europe will probably take the lead in localizing the global supply chain for pharmaceuticals and medical care. In the epidemic situation, the shortage of medicines and respirators for epidemic prevention has become a major obstacle to the anti-epidemic work in the United States. According to Deloitte statistics, the offshore production of drugs in the United States has been going on for many years, and currently 80% of the APIs in the United States

need to be imported from China and India. In the context of trade war, the U.S. Defense Health Bureau has repeatedly suggested that the concentration of risks by this supplier will create hidden dangers to the national security and stability of the United States. It can be predicted that European and American governments will accelerate the localization of pharmaceutical and medical device industries.

Secondly, under the demonstration effect of localization of pharmaceutical and medical device industries, the United States and Europe will have the motivation to further curb the progress of China's high-tech industries including communication electronics and ICT technology by political means on the grounds of industrial security and information security, and accelerate the re-layout of the global high-tech industrial chain and the local return.

To sum up, production decentralization or supply chain diversification will become an important direction of global supply chain adjustment in the future. The global production chain will develop to a smaller and more regional supply chain, and the key production processes will be concentrated in several major bases, so as to enhance the transparency of the supply chain and better hedge risks. Therefore, the "China-centered global supply chain system" may be broken in order to avoid the risk of centralized procurement from China, resulting in the passive decoupling of China's industrial chain from the global industrial chain and the risk of passive separation between China's economy and the world economy.

9. Policy Recommendations

9.1. Short-Term Suggestions: Establish an Early Warning System for Industrial Supply Chain Security

Industrial chain security concerns economic security and even national security, so it is very important to establish an effective early warning system for industrial supply chain security.

First of all, China needs to customize an effective supply chain security early warning quantitative system for each vertical industry as soon as possible. The government can organize core enterprises and think tanks in various vertical industries to conduct comprehensive research on supply chain security, analyze potential security vulnerabilities at key nodes related to the industrial chain, sort out risk lists of various vertical industrial chains (such as high dependence on foreign markets, concentration of suppliers or customers, etc.), and form a quantitative index system with vertical industry pertinence. In addition, China's industries (such as automobile, textile, chemical industry and machinery) and industrial clusters (such as Yangtze River Delta and Pearl River Delta) which are deeply involved in the global industrial chain will be monitored. After the supply chain security early warning quantitative system is completed, the government can consider the industrial support and adjustment plan according to the supply chain loopholes, and take precautions to prevent problems before they happen.

Secondly, China needs to establish a supply chain information data analysis platform and develop an efficient and accurate data analysis model. In the process of establishing the data analysis platform, the government can take the lead and cooperate with industry core enterprises, technology companies and scientific research institutions to provide a solid foundation for data analysis. In the process of model analysis, the quantitative indicators of supply chain security early warning need to be classified according to the characteristics of vertical industries, the industry cycle and life cycle of each industry should be considered, and different influence weights should be set for different events and industries, so as to obtain the personalized analysis system and alert value of each industry.

Finally, our government needs to establish an operational communication mechanism for collaborative management of industrial chain, and form a targeted early warning scheme for various risks. Because the industrial chain of some industries is long and complex, which may span many places, provinces and even countries, coordination and resource exchange mechanisms at all levels of government are needed when supply chain system risks occur. At the same time, when the government adopts the aid policy, it also needs to mobilize the financial, taxation, customs and other departments, and needs to form a collaborative mechanism among various government departments. Therefore, only when effective communication and coordination mechanisms and resource sharing mechanisms are formed between governments at all levels and government departments, it is possible to form an overall and systematic effective risk management early warning scheme.

9.2. Short-Term and Medium-Term Suggestions

Promote the development of industrial Internet platform and form supporting resources. In this epidemic, many enterprises, especially small and medium-sized private enterprises, suffered heavy losses. Small and medium-sized private enterprises are important participants in the supply chain, although they are small in scale and have little ability to resist risks. Although the government has introduced a large number of supporting policies, it is still difficult for the government to support accurately due to information asymmetry. Therefore, the government should make great efforts to promote the formation and development of industrial Internet platforms in various vertical industries with the help of scientific and technological achievements such as the Internet, big data, financial technology and blockchain in recent years, so as to better enhance the flexibility of supply chains in various industries and make government policies more targeted to provide resources for industries.

Industrial Internet, as its name implies, is an organic combination of “industry” and “Internet”, which is used to integrate, reconstruct and empower various vertical industries, and ultimately improve the efficiency of resource allocation in the industrial chain. The government can lead the core enterprises, Internet

enterprises or financial technology enterprises in the industry to build industrial Internet platforms in various vertical industries. The industrial Internet platform will directly connect the upstream supplier cluster and the downstream manufacturer cluster through the B2B trading platform, and empower the upstream and downstream by embedding the value-added service platform, financial technology platform, financial service platform and government industry management platform.

Through B2B trading platform, the upstream supplier cluster can be directly connected with the downstream manufacturer cluster, helping each vertical industry to sort out and shorten the supply chain, thus realizing transparency and disintermediation. With the expansion of transaction volume, upstream supplier clusters and downstream manufacturer clusters can gradually expand from domestic industrial clusters to overseas industrial clusters. When the supply chain is tight, it can help downstream enterprises quickly find more supply channels; when the demand of supply chain is insufficient, it can help upstream enterprises find more distribution solutions, thus enhancing the redundancy of supply chain.

The value-added service platform will be embedded in the B2B trading platform to provide logistics solutions and processing solutions for the upstream and downstream of the vertical industrial chain. Taking logistics as an example, by introducing more warehousing and logistics service providers, it can ensure that more suppliers with capacity and warehousing ability can provide more alternatives when freight interruption and goods backlog occur in some warehousing and logistics hubs, thus improving the recovery ability of the supply chain.

The financial technology platform can help suppliers and downstream manufacturers achieve efficient matching through big data and AI technology, and intelligently calculate the optimal warehousing and transportation scheme to improve the efficiency of supply chain. The financial technology platform can also ensure the authenticity and non-tampering of transactions by introducing block technology, and cooperate with commercial banks, factoring institutions, micro-finance institutions, financing guarantee institutions and other funders introduced on the financial platform to provide upstream and downstream enterprises with Financial products based on real trade background; At the same time, the financial technology platform can guarantee the automatic performance of funds in the industrial chain through intelligent contract technology.

The introduction of the government's industry management department can make the government's understanding of the industry more intuitive and profound. When there is systematic risk in the supply chain, the government can effectively formulate precise industrial support policies, support the industrial resource system, including the dredging and introduction of overseas suppliers and demanders, support the financial services of small and medium-sized enterprises, and provide export goods transportation solutions in China and even

through the national international logistics docking mechanism.

On the whole, the government can help vertical industries improve the flexibility of the supply chain and better resist the systemic risks of the supply chain by guiding the construction of the industrial Internet system of each vertical industry.

9.3. Medium and Long-Term Suggestions: Adjust the Industrial Layout to Cope with the Adjustment of the Global Supply Chain

In view of the lessons of industrial chain breakage related to national security in various countries during the epidemic, China should actively adjust the industrial layout and guide the return of industries at key nodes of key industrial chains. For example, in the case of heavy dependence on commodities and raw materials of a certain country, the government can help the relevant industrial chains to be transferred or copied to China by means of subsidies.

In view of the possible trend of global supply chain decentralization and high-end manufacturing returning to developed countries in post-epidemic industries, the government needs to take the following three measures. First of all, the government needs to improve China's technological innovation system, promote China's innovation in key technologies and strategic technologies by means of capital guidance, and accelerate the upgrading of China's industrial value chain. Secondly, we should speed up the process of new infrastructure construction in China, recruit advanced scientific and technological teams from developed countries, and jointly build R&D centers with the help of the commissioning of major industrial chain projects, so as to promote global R&D cooperation and achieve breakthroughs in core technologies. Finally, take the initiative to transfer industrial chains with lower added value to Southeast Asian and Eastern European countries, so that these countries can become the industrial support and industrial extension of China's core industrial chain, which can reduce the production cost of enterprises and ensure the world leading of China's manufacturing technology.

10. Conclusion

With the continuous global economic recession and the escalation of vulnerability caused by the widespread use of lean supply chain management mode, how to quickly identify risks, formulate strategies and allocate resources in the rapid and turbulent environment of major emergencies has become the key for enterprises to obtain sustainable competitive advantages. The logistics service supply chain system should take the opportunity of COVID-19 remodeling, make a thorough diagnosis of its own risk management system and risk response capacity from an overall perspective, establish a new governance scheme to adapt to the normal epidemic prevention and control, and improve the governance capacity of modern supply chain. This paper discusses the logistics service supply chain

emergencies against the background of COVID-19, which not only improves the management content of logistics service supply chain emergencies and builds a governance framework, but also has important reference value for the upgrading governance measures of logistics service supply chain.

The epidemic will eventually end, but risks are always there. They are just a part of life. However, what we need to do is to learn lessons from COVID-19, build digital supply chain platforms, supply chain diversification systems and supply chain early warning systems, establish or improve risk supply chain management processes, and comprehensively enhance the resilience of enterprise supply chains.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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