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Construction of Emergency Logistics Coping with the COVID-19

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ABSTRACT. *Coping with the COVID-19, logistics plays a very important role, but it also exposes many problems of emergency logistics. Through the analysis of the characteristics of emergency logistics in the process of epidemic prevention and control, it is found that the problems of emergency logistics are mainly manifested in the risk of chain break between emergency materials and production and living materials, the dilemma of socialized logistics, the lack of professional logistics enterprises, the lack of national emergency logistics management system, the low level of emergency logistics informatization, and the lack of grassroots emergency logistics management plan. Based on this, we should improve the emergency logistics system, build the emergency logistics information system and strengthen the application of emergency logistics technology to promote the construction of emergency logistics in China, so as to better respond to the unexpected social public crisis.*

KEYWORDS: *Emergency logistics, COVID-19, information technology, blockchain*

1. Introduction

Since the outbreak of the COVID-19 in January 2020, whether in the short term or in the long run, it will have a greater impact on China's economic and social development. Due to the high infectivity of the COVID-19 and the high population mobility during the Spring Festival, the government has adopted a series of strong measures to avoid the movement of people in order to effectively prevent and control the spread of the epidemic, such as traffic closure, home isolation, restrictions on going out, delayed resumption of work by enterprises and so on, which also resulted in a significant reduction in consumption. Due to the reduction of a large number of economic and social activities, social demand has been curbed, which has a huge impact on China's logistics industry.In terms of road freight, road transportation in some provinces and cities was directly cut off, and the recovery rate of road logistics was extremely low after the Spring Festival, and the nationwide road freight volume showed a cliff like decline. As of February 13, the recovery rates of LCL Logistics and VL after the Spring Festival were only 0.9% and 19%, far lower than 92% and 87% of the same period in 2019. In terms of port

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throughput, the COVID-19 led to the closure of international routes, which further affected the substantial reduction of China's port throughput. In addition to the decline of cargo transport volume of coastal ports, ports along the river and inland rivers, especially Zhejiang, Hubei, Chongqing and other places, suffered serious setbacks, and Wuhan's inland trade and water transport was hit hard.According to the data from the platform of the Chinese Academy of Sciences, the container throughput of the eight coastal container trunk hub ports decreased by about 16% during the Spring Festival, and the container throughput of the Yangtze River trunk ports decreased by more than 20% year-on-year. The logistics industry is the basic and strategic industry supporting the development of national economy, and is also one of the important elements of national emergency system. With the rapid development of the logistics industry in China, the construction of emergency logistics has also achieved some stage results, which has played an important role in many emergencies. Emergency logistics plays a decisive role in the effective prevention and control of public health events, natural disasters and major accidents[1]. In the process of preventing and controlling the COVID-19, the logistics industry has played an important role. Whether it is the supply of key materials for the prevention and control of the epidemic situation, such as medical masks, protective clothing, goggles and killing materials, or the daily supplies needed to maintain the production and life of the epidemic area, emergency logistics has played a very important role. However, from the beginning of the outbreak to the continuous spread of the COVID-19, emergency logistics has been exposed to a lot of problems, such as information asymmetry, non-standard management, low transparency of the process, poor accountability, the authenticity of the destination of donated materials of difficult to guarantee,etc. Thus,from the perspective of this epidemic, emergency logistics and emergency logistics management systems will be worthy of in-depth study, no matter from a short-term perspective or a long-term development perspective.

2. Literature Review

After SARS in 2003, the concept of emergency logistics emerged. It was earlier proposed by He Mingke in China, and it was believed that emergency logistics refers to emergency logistics needs generated by unexpected factors and emergency logistics supply activities to meet these logistics needs[2].With the development of emergency logistics research, emergency logistics is recognized as a kind of special logistics activity which can guarantee the emergency supply of the material, personnel and fund demand of various sudden events[3-5]. Not only that, emergency logistics is a complex system, its connotation is more extensive, including the organization and command of emergency logistics, the raising, procurement, storage, transportation and distribution of emergency materials, the construction, operation and auxiliary decision-making of the emergency information platform, the construction of the emergency logistics center, the building of emergency logistics support capacity, the construction of emergency support mechanism and so on[6].

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There are many related achievements in emergency logistics, and it is found that the research focuses on the following aspects: (1)Emergency Logistics Network, such as L.D.Zhao(2007) studied the emergency logistics network of major urban crisis sources[7]; T.T.Nie and Y.Xu(2011) thought that the emergency logistics network is an important part of emergency logistics research under unconventional emergencies, and put forward the topology structure of emergency logistics network from three levels: the emergency logistics support base, the emergency logistics center and the emergency material reserve base[8]. L.S.Wu and Q.M.Tan(2012) studied the stability of emergency logistics network[9]. J.X.Zhu et al.(2018) proposed an emergency logistics network cascading failure survivability assessment method based on CI-TOPSIS fuzzy multi-criteria group strategy[10]. (2)Emergency Logistics System,such as Q.Cheng and J.Yun(2009)[11], X.H.Zou(2010)[6] and D.Zhu(2011)[1]studied the construction of emergency logistics system; Q.Cheng(2010) studied the operation of emergency logistics management system[12]; Ch.P.Song and Y.M.Qi(2010) analyzed the construction of emergency logistics of American, Russian, British and Japanese armies[13]; (3)The Location-Path,The Scheduling and Other Issues in Emergency Logistics, such as Y.Dai and Z.J.Ma (2012)[14], Ch.S.Liu and G.Kou (2015)[15] studied the problem of location-path in emergency logistics system; Zh.K.Lou(2017) studies the location and transportation route of emergency logistics distribution system from the perspective of double-layer planning model[16]; L.Wang et al.(2017) studied the emergency logistics scheduling problem of multi-objective demand[17]. The global outbreak of the COVID-19 at the end of 2019 and the beginning of 2020 reveals that there are still many deficiencies in the emergency logistics system in China, and the existing research has not yet analyzed it. After SARS in 2003, although emergency logistics has developed to a certain extent, the current economy, society and technology have undergone many changes compared with 2003. How should emergency logistics construction adapt to the development of the times and meet the needs of new sudden social crises, and it is still a research topic with many marginal contributions.

3. The Impact of the COVID-19 on China's Emergency Logistics

3.1 In the early stage of the epidemic, all kinds of materials were severely disconnected, and the future risk was high

At the beginning of the outbreak, the COVID-19 spread rapidly from Wuhan and Hubei to the whole country and even the whole world. Up to now, there has been a shortage of medical and protective materials such as masks, goggles, protective clothing and disinfectant. The phenomenon of broken chain of medical and protective materials occurred not only in the worst-hit areas such as Hubei, but also in other non-epidemic areas of our country. At one time, a mask was difficult to find. Agricultural and sideline products, necessities of life and other materials in the epidemic areas and non-epidemic areas once appeared imbalance between supply and demand. In particular, in order to prevent the spread of the virus, all localities

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are strengthened the flow of people, traffic control, coupled with the Spring Festival holiday, Chinese government has delayed the resumption of work, which exacerbated the risk of all kinds of materials broken chain. Due to the shortage of medical and protective materials, the production projects of these materials have been launched all over the country, and many automobile enterprises have also transformed their production lines to produce masks and other materials. On the one hand, it effectively alleviates the shortage of medical and protective materials during the epidemic period. On the other hand, as these logistics belong to low value-added products, the risk of material overstock in the later stage of the epidemic situation increases, especially for some materials with long production cycle. Due to the delay in resuming work and increased pressure on factory production, in addition to insufficient supply of various raw materials, all regions are facing soaring prices during the epidemic, which will inevitably increase the production costs of various materials and lead to higher prices of materials. After the epidemic, if the production costs of various materials cannot be lowered, then the risks of these companies after the epidemic will not be ignored.

3.2 Production and living materials are facing greater challenges from the supply chain to the logistics chain

In the early stage of the epidemic, medical and protective materials were given priority to ensure supply, followed by necessities of life and many other industries, including production needs, encountered huge problems in the supply chain, logistics chain and demand chain. For example,during the beginning of the epidemic, some chicken farms in Hunan faced a feed gap, fruits such as sugar tangerines were severely unsold and vegetables lacked logistics and transportation resources, which led to festering and so on. During the period of epidemic prevention and control, logistics resources were already in short supply, and the limited logistics resources could only give priority to epidemic prevention and control materials and necessities. The Spring Festival holiday is originally a low season for the supply of production and living materials. The need for epidemic prevention and control has highlighted problems such as the delay in resumption of work and shortage of workers. The supply gap of raw materials for upstream production continues to increase. These situations are especially prominent in the hardest-hit areas such as Hubei. Metallurgy, automobiles, textiles, building materials and other industries are Hubei's advantageous industries. These industries affected by the epidemic are facing greater problems and will affect the upstream and downstream industries of these industries.The epidemic has lasted for nearly two months, and it is still unclear when it will completely end. The COVID-19 has become a global public health event. South Korea, Iran, Italy and other countries have become the hardest hit areas of the epidemic. With the integration of the global economy, various materials between countries have formed a closely related supply network system. The spread of the COVID-19 on a global scale has exacerbated the risks in the supply chain, logistics chain and demand chain of production and living materials.

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3.3 Social logistics has great difficulty in the trunk branch and terminal distribution

During the period of epidemic prevention and control, the social logistics has encountered great challenges in trunk, branch and terminal distribution. This is mainly due to the over-implementation of the restrictions imposed by the municipalities and the one-size-fits-all measures. Although the Ministry of Transport has also issued documents to expressly stop the abuse of traffic control measures, digging pits and breaking roads, but limited to the interpretation of specific documents and excessive epidemic prevention and control in various places, the national emergency logistics and transportation network has not been unblocked. Moreover, street community village and residential areas in the circulation of living materials and distribution efficiency are also significantly reduced. For social logistics, it faces varying degrees of administrative rigid management in terms of trunk line transportation, branch line transportation, warehousing and terminal distribution, which affects the operational efficiency of shipping, transportation, warehousing, distribution and demand, and then leads to low efficiency of whole process logistics. Not only that, the government has strong mobilization capabilities at the level of emergency logistics, but it has failed to form a synergy with the huge social logistics service capabilities, which in turn exacerbates the dilemma of social logistics in the main, branch and terminal distribution.

3.4 Professional logistics enterprises and distribution enterprises fail to maximize their effectiveness

During the epidemic, professional logistics and distribution companies played an important role in the supply of emergency materials, such as JD Logistics, SF Express, Hema, Jointown,etc. As important components of emergency logistics in epidemic prevention and control, these companies guaranteed the circulation of medical, protective and living materials in epidemic and non-epidemic areas. Transportation enterprises, warehousing enterprises and distribution enterprises belong to different nodes of logistics chain, although they play a role in emergency logistics, their advantages are different. From the actual operation of professional logistics companies and distribution companies during the epidemic, most of these companies operate independently and lack the necessary unified scheduling. There is still a lot of room for integration in terms of information sharing, resource scheduling and route optimization, and they have not formed a cross-border chain and cross-regional synergy.

3.5 There is still a lack of a unified and efficient national emergency logistics management system

After the outbreak of the epidemic, although the central government and local governments have set up leading groups for the response to the epidemic, they have also incorporated material security into the scope of their work. However, from the

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perspective of specific operations, under the guidance of the central working group, provinces and cities differ greatly in response speed and management methods, and a unified and efficient national emergency logistics management system has not yet been formed. The imperfection of the national emergency logistics management system is not only reflected in the vertical level of emergency logistics management at the central, local and grass-roots levels, but also in the horizontal emergency logistics management of the development and reform, industry and information technology, drug supervision, transportation, commerce, government, military and enterprises. At the same time, it is also reflected in the emergency logistics chain level such as national reserves, social donations, enterprise production, raw material procurement, material financing, material distribution and recycling. In terms of the collection, storage, dispatch and distribution of emergency supplies, it failed to form the cross-subject and cross-regional coordination. In addition, the emergency logistics system also has shortcomings in waste logistics and reverse logistics. It has not formed an effective unified recycling and centralized treatment mechanism for medical waste or domestic waste in epidemic areas, and has not yet achieved designated recycling, timely recycling and the harmless centralized treatment. Not only that, there are even phenomena such as garbage trucks transporting living supplies.

3.6 Emergency logistics management plans for districts, counties, towns and villages still need to be improved

Compared with big cities, counties and rural areas have disadvantages in terms of resources, technology, thinking and management. It is difficult for the grass-roots government to manage public health emergencies to balance safety and smoothness, and tend to sacrifice smoothness to ensure safety. As a result, the operation system of logistics and distribution enterprises is disturbed by the local epidemic prevention pressure and excessive prevention and control measures. In addition, the districts, counties, towns and villages themselves are disadvantaged areas of the logistics and distribution network with low population density, poor transportation networks and few logistics distribution resources, which in turn intensifies the effective coverage of emergency logistics in the districts, counties, towns and villages. Even in urban areas, the closed isolation of communities stimulated residents' short-term demand for emergency supplies, but the need for epidemic prevention and control has restricted the timeliness of urban distribution and community-based delivery. Therefore, emergency plans for the supply of materials in districts, counties, towns and villages need to be improved.

3.7 The level of emergency logistics information is low and lacks a national information platform

Since the outbreak of the COVID-19, various medical and protective materials have shown a problem of mismatch between demand and supply information. On the one hand, social donation materials have been backlogged, and the anti-epidemic

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effect cannot be fully exerted in time. On the other hand, many demanding units have a shortage of materials. There are also deviations in the docking of material information between epidemic areas and non-epidemic areas. Therefore, this situation often leads to the phenomenon that the supply is not demand. This fully shows that emergency logistics informatization capabilities need to be improved, and a national emergency logistics management information platform based on informatization methods is absent. In addition, the low level of emergency logistics informatization is also reflected in transportation communication certificates, community travel cards, personal health cards, material traceability documents and so on. There are shortcomings in the application of information platforms, and it is impossible to realize dynamic competition monitoring and regulation of the production, transportation and distribution of important production and life support materials related to epidemic prevention and control. There is still a big gap in the construction of an emergency logistics system with the comprehensive perception, network-wide connectivity and global optimization. In particular, information technologies such as the Internet of Things, cloud computing, big data, artificial intelligence and blockchain have not been effectively applied to the emergency logistics information platform required for epidemic prevention and control.

4. Construction strategies of emergency logistics in China

4.1 Reasonably plan and improve the emergency logistics system

In the short term, it is recommended that under the centralized and unified leadership of the Central Leading Group for Response to the COVID-19, with the Emergency Management Department as the core, a multi-dimensional emergency response should be established from the central government, local governments, industry associations and core enterprises; with the Ministry of Transport as the core, coordinate with China State Railway Group Co.,Ltd., CAAC, State Post Bureau and other departments to establish an emergency logistics plan. Relevant departments should give full play to the strong forces of the government, the military and large logistics companies to ensure smooth traffic, open green channels, do a good job in terminal distribution connections and pay special attention to emergency logistics in severely epidemic areas.

In the long run, the country should establish an emergency logistics response mechanism of "government-enterprise coordination, military-civilian integration", and build a national emergency logistics network with "the national central reserve as the main body, the national logistics hub carrier and large logistics parks as the backbone, and various logistics centers and distribution centers as supplements"; it is recommended to establish an epidemic prevention material reserve fund to increase the epidemic prevention material reserve; It is recommended that a national, regional and industry emergency logistics system plan be drawn up scientifically and reasonably in the 14th Five-Year Plan.

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4.2 Establish an efficient emergency logistics information system

It is recommended that the Ministry of Emergency Management take the lead, the logistics association is responsible, and the core logistics companies participate in the establishment of emergency logistics information systems or platforms to enhance the ability to communicate and share emergency logistics information, and to realize pre-epidemic early warning, dispatch during the epidemic and recovery after the epidemic. These recommendations are designed to ensure the supply of safeguards and reduce risks required for epidemic prevention and control. The country should comprehensively use modern information technologies such as the Internet of Things, big data, artificial intelligence and 5G to build a big data platform for emergency logistics management, and realize the functions of emergency logistics procurement, warehousing, deployment, traceability and information release, and realize the matching of supply and demand of emergency supplies across regions and industries. The emergency logistics information system should also be integrated into the national emergency logistics system, with particular attention to the synergy between the emergency logistics information system and other systems. In addition, the state also needs to apply blockchain technology to the construction of emergency logistics information systems, and build an intelligent and traceable logistics information system with the help of blockchain's decentralization, encryption algorithms and non-tampering advantages. Furthermore, it supports the realization of multi-regional, multi-level, multi-center standardized emergency logistics management, provides visualization, safety and traceability of emergency logistics information and comprehensively promotes the efficiency and anti-injury of emergency logistics management.

4.3 Strengthen the technical application required for emergency logistics

We should strengthen the application of new technologies, new equipment and new models of emergency logistics, especially focusing on the innovation and application of the big data, Internet of Things, cloud computing, blockchain, artificial intelligence and unmanned technology in the field of emergency logistics. The state should improve the automation, intelligence and network level of emergency logistics construction, which can not only reduce logistics costs, coordinate logistics resources and improve logistics efficiency, but also achieve scientific and effective emergency logistics management, so that limited materials can be efficiently used. The country should encourage the development and application of unmanned aerial vehicles, unmanned warehouses, unmanned vehicles, smart express cabinets and urban logistics brains, and make good use of machines to serve the logistics and distribution links. The mature black technology and its products are applied to emergency logistics related scenarios, especially the use of blockchain technology to realize the supply and demand docking of each link of the emergency logistics chain, contactless mobile payment, contactless distribution, electronic warehouse receipts and receipts, full monitoring and full traceability, etc.

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5. Conclusion

Emergency logistics plays a very important role in the prevention and control of COVID-19, but it also highlights many deficiencies in the construction of emergency logistics. This short board of emergency logistics is not only reflected in the insufficient construction of emergency logistics infrastructure, but also in the construction of emergency logistics system. The existing emergency logistics resources can not meet the needs of public health safety time, which needs to pay attention to and speed up the construction of emergency logistics system.

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