

RESEARCH ON EMERGENCY LOGISTICS OPERATION MODE AND OPTIMIZATION UNDER EMERGENCIES

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Abstract: Public health emergencies often bring huge losses and damage to life and property, and emergency logistics plays a pivotal role in ensuring the timely supply of materials. In the face of major public health events, China's emergency logistics still shows a series of problems, such as the information of material transport is not correct, the transparency is not high, and the capacity is not enough[1]. In view of these problems, it is proposed to establish a more efficient emergency logistics operation mode to promote the construction of China's emergency logistics, so as to better cope with sudden social and public crisis events.

Keywords: Emergency logistics; Block chain; Epidemic prevention and control; Smart logistics

1 INTRODUCTION

1.1 Background and Significance of the Research

At the beginning of 2020, in the face of the sudden outbreak of new coronary pneumonia, China reacted swiftly, taking measures such as isolation, "sealing off the city" and delaying the resumption of work, effectively stopping the large-scale spread of the epidemic. General Secretary Xi Jinping emphasized in the 12th meeting of the Central Committee for Deepening Reform that "we should improve the unified emergency material security system, make emergency material security an important part of the construction of the national emergency management system, and improve the relevant working mechanisms and emergency plans as soon as possible in accordance with the principles of centralized management, unified allocation, service in times of peace, emergency at times of disaster, combination of collection and storage, and economy and efficiency". At the same time, the meeting also proposed that "we should encourage the use of big data, artificial intelligence, cloud computing and other data technology to better play a supporting role in the epidemic monitoring and analysis, virus traceability, prevention, control and treatment, resource deployment and other aspects." This provides a clear direction for the construction and development of emergency logistics.

In the fight against the epidemic, especially when the city was "closed", the delivery of fresh fruits and vegetables, masks, alcohol and other daily living materials and medical supplies posed a great challenge to the traditional material transport system, but there were still problems such as incomplete development and slow development[4]. According to the data (see Figure 3), after mid-March, Shanghai's truckload traffic index showed a precipitous drop, and poor logistics naturally led to a lack of supplies[12]. Residents are unable to go out or buy their own supplies online, relying more on emergency supplies from government departments and donations from outside the city[10]. At the same time logistics vehicles face layers of government and respective closures on motorways, and operating revenues have fallen sharply (see Figure 1). There are too many checkpoints on the highway to prevent epidemics, many highway exits are closed, there are passes that don't allow you to get off the highway, the service area doesn't allow you to stop, and you can't unload your goods at the place. Even after the successive opening of express transport, a number of companies distribution shutdown, a number of headline companies have shown negative growth in shareholder profits (see Figure 2), and many couriers who were isolated in the community can not deliver packages. The last kilometre of distribution has become a problem[3].

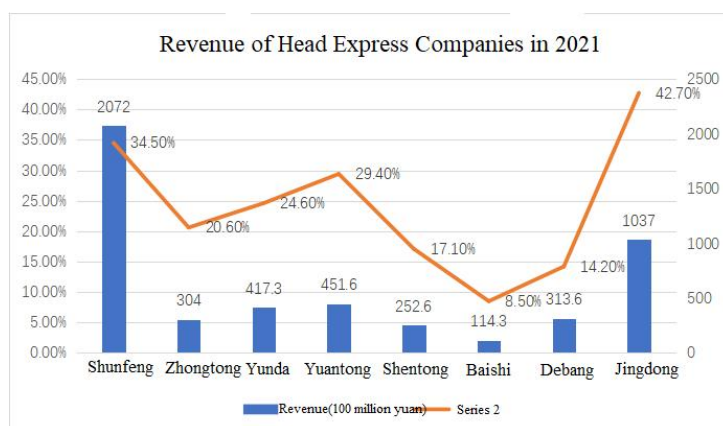


Figure 1 Revenue of Head Express Companies in 2021

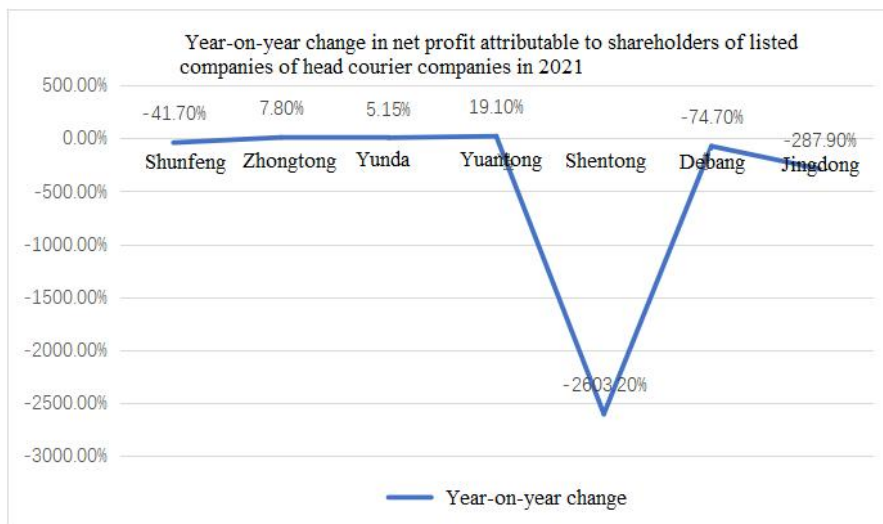


Figure 2 Year-on-year change in net profit attributable to shareholders of listed companies of head courier companies in 2021

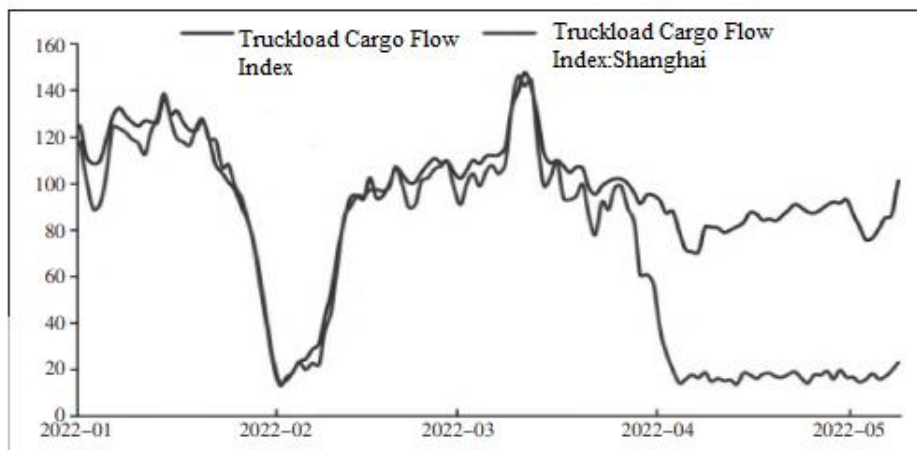


Figure 3 Comparison of the whole truck freight traffic index during the epidemic in Shanghai and the whole country

1.2 Research Purpose

In the face of the future epidemic normalized prevention and control measures and the urgent demand of the society for emergency logistics, the establishment of a perfect emergency logistics system has become an important guarantee for the normal operation of the society, and it has a pivotal role in responding to public emergencies[2]. In recent years, the concept of block chain technology has gradually become popular, and its decentralization, smart contracts, tamper ability, peer-to-peer transmission and other technological superiority have an important value for the construction of China's emergency logistics system.

2 PROBLEMS OF THE CURRENT EMERGENCY LOGISTICS SYSTEM

Building an emergency logistics system is an important measure for a country to respond to emergencies. Since the occurrence of the new crown pneumonia epidemic, people all over the country have been donating money and goods, the government has also sent a large number of human, material and financial resources to the serious areas of the epidemic. Such intensive emergency logistics distribution has brought great challenges to China's emergency logistics system, and also exposed the shortcomings of the imperfect and incomplete domestic emergency logistics system.

2.1 Higher Cost of Emergency Logistics

Due to the high efficiency of emergency logistics, high-quality special needs, its cost is relatively high. At the same time, emergencies are generally sudden and unpredictable. When the emergency logistics system is not perfect, the rush to deal with the transportation of a large number of emergency materials will increase decision-making errors and work errors, thus increasing the cost of emergency logistics. In addition, the quality of materials and some force majeure factors are also one of the reasons for the high cost of emergency logistics.

2.2 Imperfect Emergency Logistics Operation Mechanism

2.2.1 Emergency response is too passive

In the face of the epidemic surge in material transport demand, the emergency response system is too passive. Emergency logistics organizations in the event of emergencies are mostly set up on temporarily, i.e. emergencies occur first, and then emergency logistics preparations are made. This kind of emergency logistics organization has relatively little cooperation and organizational experience, and lacks co-ordination when responding to emergencies, which leads to low efficiency and quality of emergency logistics.

2.2.2 Lower efficiency of emergency logistics

Previously, China's emergency logistics system lacked a special organizational system, and the government and third-party enterprises have insufficient information about the demand side and the supply side of the materials, and the prediction and early warning of emergencies and coordination capabilities need to be improved, resulting in a long response time and low efficiency of emergency logistics, which is not conducive to a rapid response and an efficient and high-quality response to future public emergencies.

2.3 Existence of Information Asymmetry

2.3.1 Information asymmetry between supply and demand sides

China's emergency logistics system lacks information channels connecting supply and demand, resulting in asymmetric information, unclear demand and directionless supply[11]. This causes a large-scale waste of resources, but also leaves the demand for emergency supplies in areas with serious epidemics unmet, thus greatly reducing the efficiency of the fight against epidemics. In the long run, the information asymmetry between supply and demand sides greatly impedes the development of emergency logistics in China.

2.3.2 Information asymmetry within the emergency logistics system and the society at large

Ensuring the openness and transparency of logistics information is one of the important measures to maintain the operation of emergency logistics system[5]. The information asymmetry between the emergency logistics system and the public mainly points to the phenomenon of opacity of emergency logistics information, including lagging material information, ambiguous direction of emergency materials, and unclear progress of material transport[7].

2.4 Inadequate Material Management Organization

In the process of fighting against the new coronary pneumonia epidemic, the whole country is actively donating money and materials to make its own contribution to the prevention and control of the epidemic. However, a large number of emergency materials in the management is not satisfactory. Insufficient human resources for material management and imperfect working mechanism have led to repeated problems such as incomplete material information and lagging material distribution, which is also a shortcoming of China's emergency logistics system. At the same time, due to the lack of logistics information sharing system, the direction of the donated materials, the transparency of the emergency logistics process, and the efficiency of material information disclosure have not been reflected[6]. In addition, due to the lack of large-scale material storage centers, it is easy to cause temporary shortages of emergency materials.

2.5 Lack of Standardization and Supervision of Emergency Material Management

At present, China has built a basic emergency logistics legal protection system, but there are still low degree of standardization, unclear responsibility of the main body of logistics management, government compensation and subsidies are not timely and other problems. Emergency logistics system construction lacks the corresponding support, norms and supervision.

3 Feasibility analysis of emergency system model combining block chain technology and third-party logistics

3.1 Block Chain Technology has a High Degree of Compatibility with Emergency Logistics

Block chain has the characteristics of decentralization, non-tampering, smart contracts, peer-to-peer transmission, etc., which are closely related to the needs of logistics system construction[9]. Block chain technology has a high degree of compatibility with the information management of emergency supplies in the epidemic, which is mainly reflected in the decentralization that makes the supply organizational structure compatible; smart contract meets the demand for efficient matching of information and coordinated deployment of supplies; sharing mechanism solves the problem of information asymmetry (see Figure 5); distributed ledger, consensus authentication, timestamps and other technologies not only provide completeness and security for the emergency logistics but also provide a means of information disclosure and guarantee of information openness and transparency in emergency logistics (see Figure 4). To a certain extent, this proves that block chain technology is highly compatible with the demand for high efficiency and high quality of emergency logistics system, and it is the right choice to apply block chain technology to the construction of emergency logistics system, which is conducive to the construction of China's emergency logistics system.

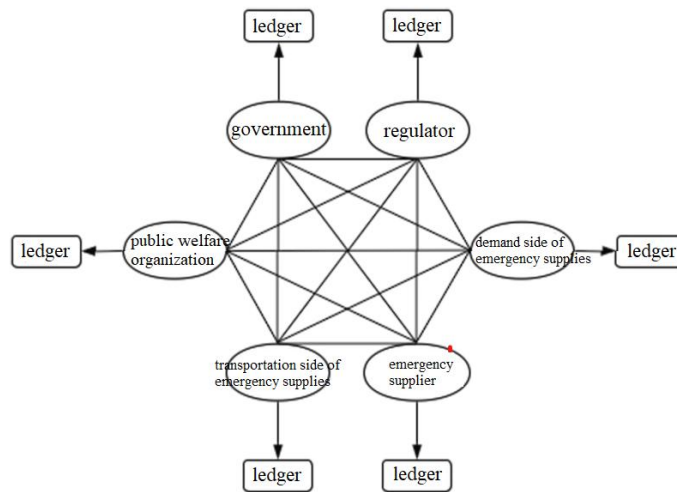


Figure 4 Bookkeeping network of distributed ledger

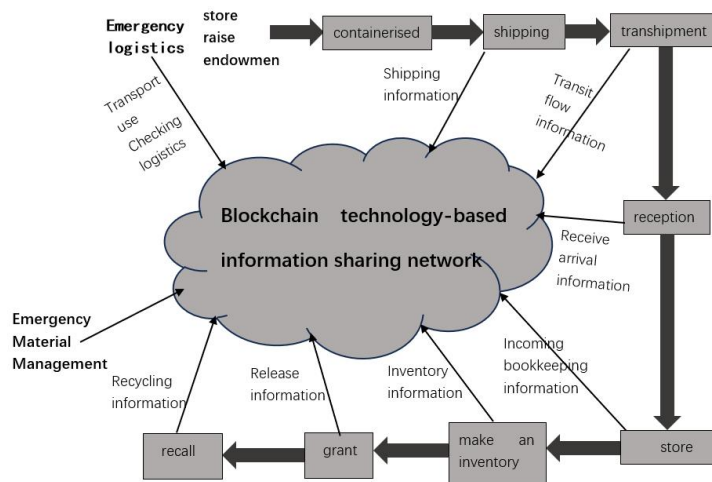


Figure 5 Emergency logistics model based on block chain technology

3.2 Third-Party Logistics Involved in Emergency Logistics System Construction Can Reduce the Cost of Emergency Logistics, Improve Logistics Efficiency

In recent years, China's logistics industry has been developing steadily, the scale is expanding, the total market continues to increase. Cost reduction and efficiency increase has become a major trend in the development of the logistics industry. Compared with the traditional logistics, third-party logistics operating costs and specialisation level is more advantageous, more in line with the trend of development of modern logistics industry. Therefore, the third-party logistics enterprises into the emergency logistics system construction can greatly reduce logistics costs, improve logistics efficiency, which also meets the demand for high efficiency and high quality of emergency logistics.

3.3 The Government-Enterprise Co-Operation Model has Certain Superiority

The government-enterprise cooperation in the construction of emergency logistics system means that the government provides financial subsidies and emergency data support, and conducts public-private partnership or implements positive industrial policies for enterprises, and the third-party logistics enterprises are responsible for the concrete implementation of emergency logistics. The superiority of this model lies in the following: on the one hand, the cooperation between the government and the third-party logistics enterprises can reduce the government's capital investment in the construction of the system, make reasonable use of the resources and services of the third-party logistics enterprises, and integrate the logistics enterprises into the construction of the emergency response system by means of the government's subsidy; on the other hand, the mode of cooperation between the government and the third-party logistics enterprises can promote the interaction of the government and third-party logistics enterprises in terms of resources and information, promoting the third-party enterprise's own development. In the long run, the establishment of third-party logistics emergency response system can promote the win-win situation for the government and enterprises, and at the same time, it can also guarantee the smooth operation of the emergency logistics system when an emergency occurs, so as to protect the people's life and social stability[8].

COMPETING INTERESTS

The authors have no relevant financial or non-financial interests to disclose.

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