

Construction and optimization strategy of urban emergency logistics system

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ABSTRACT

Emergency logistics has special logistics attributes, which will provide necessary emergency supplies for sudden public health events and natural disasters, reduce the degree of disaster losses, and pursue the maximization of time efficiency. Due to the characteristics of urban population distribution, the construction of efficient and orderly urban emergency logistics management mechanism is an important research field of emergency management system in the new era. Therefore, this paper first defines the concept and characteristics of emergency logistics, describes the constituent elements of emergency logistics, and deeply analyses the problems existing in the urban emergency logistics operation system, and finally conducts an in-depth exploration of the optimization strategy for the construction of urban emergency logistics system. It is hoped that it can provide certain reference for the relevant government departments, social enterprises and other parties involved in emergency logistics.

KEYWORDS

Emergency logistics; Emergency management; Optimization strategies

1. INTRODUCTION

Cities are areas where human beings, wealth and industries are densely concentrated, and with the accelerated pace of urban modernization and urbanization, a large number of city clusters have been formed, such as the Bohai Rim, the Yangtze River Delta and the Pearl River Delta. However, in recent years, China has been hit by frequent natural disasters, serious industrial accidents and sudden public health incidents, which have caused great harm to people's lives and property safety. The more densely populated a city is, the greater the risk of disasters and emergencies it faces; emergency logistics can quickly provide supplies to disaster areas in an emergency and reduce the impact of disasters. Therefore, in order to respond more effectively to emergencies, cities need to accelerate the construction of emergency logistics systems and ensure the timely and accurate supply of emergency supplies, so as to improve the city's ability to prevent, mitigate and respond to disasters.

China's government departments have attached great importance to emergency logistics since 2003, and with the Wenchuan Earthquake, the southern snowstorms, the Lushan Earthquake and other emergencies, a more mature management mechanism has been established in emergency logistics. The development of emergency logistics is also supported by national policies. The National "14th Five-Year Plan" and "2035 Vision Outline" emphasizes "scientific adjustment of emergency material reserve categories, scale and structure, and improve the rapid deployment and emergency transport capacity", which points out the direction of development for the future work of emergency logistics. However, in the management of urban emergency logistics, there are still problems such as insufficient material reserves, slow supply speed, and unclear authority and responsibility, etc. How

to build an efficient and orderly emergency logistics management mechanism has become an important issue that needs to be solved urgently.

2. OVERVIEW OF EMERGENCY LOGISTICS

2.1. Concept of Emergency Logistics

Emergency logistics refers to the logistics activities in order to make a better response to public emergencies, match the emergency management needs of government departments, reasonably integrate modern logistics resources according to the requirements of emergency response, cross the space-time barriers at the fastest speed, and deliver the emergency supplies to the area of the incident in a timely and accurate manner.

2.2. Characteristics of Emergency Logistics

Research on emergency logistics in domestic and international literature basically points out that emergency logistics has the following characteristics.

(1) Suddenness: Emergency events such as fires and floods are difficult to predict when and where they will occur, and furthermore, the causes of emergencies are not all the same. Therefore, it is difficult to predict and procure the emergency materials needed for disaster relief beforehand, and it is impossible to accurately predict the content of emergency logistics activities.

(2) Urgency: When an emergency occurs, emergency logistics is usually required to deliver materials to the accident site in a timely manner, and within the scope of emergency logistics, the materials that are usually transported through the system are living materials, medical materials, engineering materials and so on.

(3) Non-profit: General logistics is a kind of production service centred on the upstream and downstream of the supply chain, and it is an important production service to ensure the production and operation of enterprises in the supply chain, and thus it is also of a profitable nature. Emergency logistics has the nature of public welfare, it is used to ensure the supply of materials in emergency situations, therefore, even some of the materials that must be purchased at the expense of the government, its price, profitability are very low, profitability is not the primary attribute of such logistics.

(4) Multi-subjectivity: In an emergency, the mission requirements of emergency logistics cannot be completed independently by a single organization. It requires a collaborative network involving multiple levels and departments to achieve. This network not only includes the guidance and management of the government, but also covers the efficient operation of enterprises, the flexibility and extensive mobilization capacity of social organizations, and the love and resource support of charitable groups. Through such a diversified cooperation system, emergency supplies can be smoothly transported from their production sources or stockpiling centers to disaster-stricken areas and quickly and effectively distributed to people in urgent need of help. Comparing the two types of logistics, emergency logistics and general logistics, the differences are shown in Table 1.

Table 1. The Difference between Emergency Logistics and General Logistics

	General logistics	Emergency logistics
Logistics unit subjects	Users, Suppliers, and Manufacturers	Material demand points, Distribution points, and Emergency points
Objectives of logistics operations	High Profit + Low Cost	Fastest emergency response
Characteristics of logistics facilities	Fixed facilities	Facilities fixed + Facilities not fixed
Logistics planning cycle	Long-term strategic planning	Short-term contingency planning
Logistics and Distribution Process	Circulation + Round trip	Round trip

2.3. Components of Emergency Logistics

(1) Organizational structure: Emergency logistics activities require the concerted operation of various subjects and the cooperation of multiple departments, each of which undertakes different emergency tasks to provide organizational safeguards for emergency logistics. Government departments undertake the tasks of formulating and rehearsing emergency plans, stockpiling emergency supplies, commanding and coordinating, issuing emergency decisions, and formulating emergency logistics plans. Industry associations are responsible for assisting government departments in formulating policies and norms related to emergencies, and are responsible for the organization and management of emergencies. Social organizations, charities and volunteers mainly assist government agencies in social mobilization, loading and unloading, transportation, distribution and other emergency supplies. Social enterprises can stockpile large quantities of emergency supplies and provide the necessary personnel, equipment and tools for transport and distribution to reduce the pressure on the government.

(2) Facilities and equipment: Facilities and equipment are the key support factors for emergency logistics, which are composed of emergency transport network, emergency logistics facilities and emergency logistics equipment. Emergency transport network refers to the route from the place of supplying emergency materials to the place of receiving, and usually carries out multi-route planning to avoid affecting the efficiency of emergency logistics. Emergency logistics facilities include emergency logistics centre, emergency distribution centre, emergency material reserve, whose layout is reasonable or not directly affects the performance of emergency logistics. Emergency logistics equipment includes transport vehicles, loading and unloading equipment and communications equipment.

(3) Information transmission channels: Emergency logistics information is composed of emergency material demand information, disaster area environment information, logistics enterprise resource information, storage information, transport route information, etc. The accuracy and rate of information transmission will be directly related to the length of time for emergency materials to arrive at the disaster area, and will have an important impact on the reasonableness of the quantity of emergency materials. The acquisition of information depends on the level of information technology, the higher the level of information technology, the faster the transmission of information, the more accurate the acquisition of information, the stronger the level of emergency logistics.

(4) Emergency supplies: Emergency supplies are material materials used for life-saving and life-support. Life-saving emergency materials mainly include life detectors, shovels, medicines and medical equipment. Life security emergency supplies mainly include food, pure water, quilts, tents and so on. After the occurrence of a sudden incident, the first thing to do is to send life-saving

emergency supplies to the disaster area, and then send life-supporting emergency supplies to the disaster area, so as to help the disaster area to resume normal life.

3. PROBLEMS OF URBAN EMERGENCY LOGISTICS OPERATION SYSTEM

3.1. Lack of Coordination in the Emergency Logistics System

Emergency logistics work involves a number of fields and departments, and it is necessary to strengthen collaboration between the leadership and various departments and sectors in order to ensure the supply of materials in public emergencies. But in most cases, emergency logistics organizations are established temporarily, so there is a lack of linkage and systematicity between teams, which can easily lead to problems with smooth connection between work mechanisms and management systems.

3.2. Disorderly Management of Emergency Supplies

At present, China's emergency material reserve management institutions have not yet been unified, and disaster relief materials are managed by multiple departments. Emergency response, medical care, public security, firefighting and other departments, because of their respective responsibilities for their own emergency material reserves, and the norms of material reserves in each region do not play a complementary role in terms of strips and blocks, leading to relative excesses and shortages of reserve materials. Many grass-roots units in cities and counties rely excessively on the central and provincial reserves of emergency supplies, severely restricting the supply of emergency supplies. Decentralised management and separate storage of relief supplies can lead to problems such as slow transmission of information on relief supplies, irrational allocation of resources and difficulty in scheduling.

3.3. Lack of a Professional Emergency Logistics Information Platform

At the level of informatization, although the State has begun to build information platforms related to logistics, the development of these platforms is still focused on general logistics, and the services and information in emergency logistics are very limited, failing to satisfy the sudden, temporary and urgent characteristics of emergency logistics and resulting in the functioning of these platforms not being performed to the best of their ability. In addition, the few information platforms that include emergency logistics services have not yet been closely linked to national resource information systems (such as geographic information systems and earthquake forecasting systems), which has resulted in a lag in emergency logistics information and has prevented the efficiency and rapidity of emergency logistics from being brought into full play.

3.4. Lack of a Specialized Legal Regime

A sound system of laws and regulations is fundamental to promoting the continuous forward development of emergency logistics. Although, China has introduced a number of laws and policies, such as the "Emergency Regulations on Public Health Emergencies", "Emergency Response Law", "Regulations on Natural Disaster Relief" and so on. However, there is still a lack of special laws and regulations in the field of emergency logistics, which leads to the main body involved in emergency logistics can not get the correct legal guidance, which is also an important factor restricting the development of China's emergency logistics. Therefore, to explore the legal policy system specialized in emergency logistics should become the subject of attention and research by our legislative department.

3.5. Lack of Emergency Logistics Management Professionals

In the past, the emergency response to natural disasters and accidents and calamities often relied on the State Council and government emergency response offices at all levels to temporarily build teams for rescue and post-disaster disposal. With the establishment of China's emergency department, the status of emergency management is also increasingly prominent, emergency management has also begun to move towards the road of specialization, but the training of emergency management professionals and the gap is still huge, especially in emergency logistics professionals.

A professional emergency logistics team is the key to responding to public health emergencies, and emergency logistics personnel should have professional logistics knowledge and emergency response experience. At present, most of the managers involved in emergency logistics are temporarily transferred from other industries, such as government personnel, business personnel and some volunteers, etc. Most of them have not undergone professional training, or are even temporarily appointed in the absence of professional training, and it is difficult to carry out scientific co-ordination and planning, so there is a confusion in the management of materials, and it is inevitable that materials are divided into wrong groups and distributed in the wrong way.

4. OPTIMIZATION STRATEGIES FOR THE CONSTRUCTION OF URBAN EMERGENCY LOGISTICS SYSTEM

4.1. Improved Management Structure and Enhanced Management Effectiveness

First, a sound organizational structure. The perfect and refined emergency logistics organizational structure should be led by the government authorities, with the local emergency logistics command organizations as the core, social organizations and relevant departments to work together to form an organizational structure, with a rapid response, clear division of labour and collaborative participation and other distinctive features. Secondly, improve the management mechanism. A framework management mechanism integrating scientific, systematic and standardized management should be constructed, and relevant standards should be formulated and improved, so as to promote the development of emergency logistics management in the direction of scientific development, effectively reduce the negative impacts of various disasters on the country and on social stability, and effectively improve the country's emergency management capacity.

4.2. Establishment of an Emergency Material Deployment Centre

The establishment of an emergency materials deployment centre, a sound mechanism for the dispatch of emergency materials, and the improvement of specialization in the distribution of emergency materials. The emergency logistics deployment centre should be led by the state-established materials management department, and should integrate disaster relief materials reserve bases, contracted warehousing and other logistics enterprises, production enterprises, commercial supermarkets, pharmaceutical enterprises and so on, so as to achieve unified deployment and management of materials. In normal times, the emergency material deployment centre should also actively communicate with experts in the field of emergency logistics, and study emergency logistics management plans for possible sudden public events in the future.

4.3. Establishment of an Emergency Logistics Information Platform

In the context of the information age, China's emergency logistics system should also be adapted to build an integrated information platform with resource sharing, standard transparency, real-time updating of logistics and material information, and a multi-dimensional, all-encompassing perception, network-wide linkage and global optimization of the emergency logistics system. To build an

emergency logistics information platform, first of all, there should be reliable hardware and software support; secondly, there should be professional talents to manage and maintain the platform; finally, it is necessary to strengthen the interconnection and interoperability with the national resource information platform, so as to ensure that it can quickly grasp the information of emergencies so that all the parties can make a rapid response.

4.4. Establishment of a Sound System of Policies and Regulations

In the process of building the emergency logistics protection mechanism, a fully functional and effective supporting legal policy system is extremely important, and can provide the correct legal guidance for emergency logistics. Therefore, China should endeavour to increase legislative efforts, based on national conditions and the actual situation and needs of the emergency logistics system, the formulation of special legal policy system. From a macroscopic point of view, laws related to emergency logistics should include organizational laws, input laws, education laws, technical laws, etc. From a management point of view, they mainly include material deployment laws, material management laws and logistics evaluation standards. Specifically, firstly, on the basis of the existing legal system, the content related to emergency logistics should be increased, so as to achieve the organic integration of emergency logistics law and China's inherent legal system; secondly, the legal standards, rules and regulations and legal systems related to emergency logistics should be specially formulated, so as to regulate the development of the emergency logistics industry in an all-round way; lastly, laws and regulations of local nature should be introduced in combination with the actual situation of different regions, so as to gradually improve the local emergency logistics law and regulation, and gradually improve the local emergency logistics law. Finally, in conjunction with the actual situation of different regions, the introduction of local laws and regulations, and gradually improve the local emergency logistics legal system, in order to establish an effective emergency logistics protection mechanism to lay a good foundation.

4.5. Strengthening Emergency Logistics Personnel

Firstly, the State should make great efforts to cultivate logistics talents, strengthen the cultivation of emergency logistics professionals, actively explore the mode of "school-enterprise cooperation" in the field of emergency management, and cultivate all-round and diversified emergency logistics specialists. Secondly, set up emergency management majors in universities, revise the education system, and provide systematic training for them; on this basis, set up more "school-enterprise cooperation" courses, carry out special training related to emergency logistics, highlight the organic fusion of practice and theory, organize emergency logistics plan drills from time to time, and invest more scientific research in the field of emergency logistics. It also invests in more scientific research in the field of emergency logistics, designs and provides targeted emergency programmes, and enhances the practicality of the emergency logistics profession.

5. SUMMARY

To effectively build a perfect urban emergency logistics system, we should give full play to the functions of government departments, establish and emergency logistics related management system and standards, and play the value of non-governmental organizations and institutions, and promote exchanges and cooperation between the main body; at the same time, we also need to set up an emergency logistics information platform, improve the construction of the emergency material deployment centre, and reasonably use the Internet of things technology. In addition, the national legislature should also increase legislative efforts to improve the construction of the legal system of emergency logistics. Only in this way can all-round promotion of the development of emergency logistics, as soon as possible to improve the emergency logistics protection mechanism, to ensure the safety of the people's lives and the stability of social order.

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