Research on the planning and configuration of emergency storage facilities in urban areas under extreme disaster scenarios

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Abstract: With the continuous occurrence of global extreme disasters, urban emergency storage facilities have become an important component of urban emergency management systems, providing faster delivery of emergency supplies for sudden events. This paper aims to examine the planning and configuration of urban emergency storage facilities from the perspective of resilient city infrastructure planning, taking into account the current management status of mega-city infrastructure. By revealing issues such as inadequate reserves of emergency supplies and unscientific planning of storage facilities, this study utilizes methods such as data mining, N-Gram statistical analysis, and site selection planning. It addresses issues related to the scale, location, and institutional mechanisms of urban storage facilities, proposing a series of measures to strengthen management, optimize site selection, and improve configuration strategies. Furthermore, it suggests improvement plans to address existing problems in storage facilities, with the ultimate goal of enhancing the timeliness of urban emergency rescue and ensuring the rapid and accurate delivery of emergency supplies to the corresponding areas.

Keywords: Extreme disasters, Emergency supplies reserves, Storage facility planning

1. Analysis of the current status of urban emergency supplies and storage facilities

In recent years, global natural disasters and man-made disasters have been frequent, and our country has also suffered many major disasters. These disasters are difficult to avoid and have a serious impact on normal production and life, causing enormous losses to the country and its people. China is also one of the countries in the world that suffers the most from natural disasters[1]. Therefore, in order to better respond to emergency rescue work under the coupling of multiple disasters, the coordination and allocation of emergency supplies are particularly important. Emergency supply reserve is an important preparatory work for the government to respond to emergencies. It plays a key role in all stages of pre-disaster, during disaster, and post-disaster, and is an important prerequisite and basic guarantee for successful emergency rescue and post-disaster reconstruction. Through field visits, in-depth discussions, and data analysis, it has been found that various departments of urban emergency management have different degrees of problems, including serious fragmentation, insufficient basis for material reserves, lack of coordination in social reserves, relatively single reserve models, unscientific planning of reserve facilities, lack of emphasis on logistics emergency attributes, and lack of information technology construction[2]. Therefore, it is necessary to conduct systematic research, analyze the characteristics of urban emergencies, accurately identify problems from the perspective of material reserve supporting emergency management, and provide support for the construction of urban emergency material reserve facilities and the improvement of supply and allocation capabilities.

Aiming at the impacts faced by urban emergency supplies and storage facilities in sudden disaster events, we used methods such as data measurement and data mining, and selected well-known domestic databases and foreign Web of Science databases[3]. We searched the literature for the period from 2020 to 2023, focusing on relevant data resources such as basic emergency response, storage facilities, extreme disasters, and material reserves. Relevant lexical analysis was carried out using N-Gram statistics, which can help us understand the correlation between words and contextual information. By counting the frequency of N-Gram, we can get the combinations of words that appear frequently in the text, thus revealing the customary usage, phrase collocation and language patterns of some specific languages or domains. The formula of the N-Gram statistical model is as follows Equation (1) :

$$P(wi \mid wi-1) = count(wi-1 \quad wi) / count(wi-1) \qquad (1)$$

Where $count(wi-1\ wi)$ indicates the number of times $wi-1$ has appeared before and wi has appeared after in the text; and $count(wi-1)$ indicates the number of times $wi-1$ has appeared in the text. This formula indicates what is the probability of the current word appearing when the previous word is known. And when $N = 1$, it is Unigram model, the probability of occurrence of each word is only related to itself.The formula of Unigram model is as follows equation (2):

$$P(wi) = count(wi) / total\_count \qquad (2)$$

Where $count(wi)$ denotes the number of times wi has appeared in the text and $total\_count$ denotes the total number of words that have appeared in the text. This formula indicates what is the probability that a word wi occurs given a text.

Then, in R x64 3.5.2 software, we have analyzed the data statistically using R language. By applying algorithms such as PageRank, we extracted the key features of the data and revealed the research patterns and cutting-edge dynamics, as well as clarified the focus of the research. In addition, we applied statistical methods to assess the importance of relevant word frequencies and extracted key features and high-frequency words in order to analyze the trend and temporal characteristics of the research. Finally, we generated a word cloud map of the current status of urban emergency supplies and storage facilities as shown in Figure 1, which visualizes the research results.

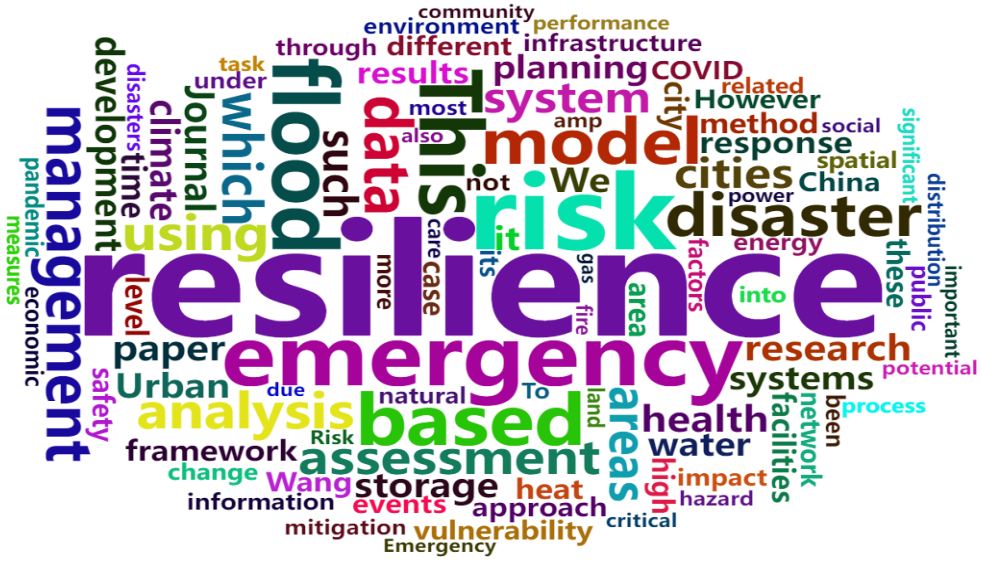

Figure 1. Word cloud of the current status of urban emergency supplies and storage facilities

Through the N-Gram statistical method, in the N-Gram statistical model, the larger the value of N, the higher the complexity of the model, the N-Gram statistical method to predict the probability of a word only need to find the corresponding frequency, without the need for complex calculations. As can be seen from the above figure, for the status of urban emergency supplies and storage facilities, keywords such as "urban disaster mitigation, urban emergency management, emergency storage facilities, urban resilience, emergency planning" are the focus of the current research on the status of urban emergency supplies and storage facilities, and through the analysis of data

and the analysis of the status of urban emergency supplies and storage facilities, we can Through the data analysis and the analysis of the current situation of urban emergency materials and storage facilities, it is found that for the resilient city, the complete urban emergency materials and storage facilities are one of the important components to protect the operation of the city. Table 1 shows the word frequency statistics after searching and analyzing.

Table 1 word frequency table

Keywords	Frequency	Keywords	Frequency	Keywords	Frequency
Resilience	589	Facilities	131	High	99
Risk	370	Storage	126	Method	97
Emergency	305	Research	125	These	97
Materials	273	Climate	123	Approach	96
Mitigation	271	Development	123	Program	95
Flood	261	City	123	Safety	95
Based	248	Systems	121	Wang	95
Reserve	222	Assessment	120	Case	94
Disaster	210	People	119	Model	94
Managerial	201	Import	118	Area	93

As can be seen from the above table, the frequency of the keyword "resilience" is the most frequent, with a frequency of 589 times, which appears in more than 50% of the 1,000 retrieved documents, which shows its importance. The current situation of urban emergency supplies and storage facilities has an important impact on the resilience of cities. By increasing material reserves, improving storage facilities, and incorporating them into the city's resilience planning, the city can improve its ability to respond to disasters and emergencies, better protect its residents and maintain social stability. The next most frequent keywords are "risk", "emergency", "materials", and "mitigation", with a frequency of 370 times respectively. The frequency is 370 times, 305 times, 273 times and 271 times respectively. These keywords are also the keywords that frequently appear in the current research on the status of urban emergency supplies and storage facilities, which also indicates that there is a close connection between "risk, emergency, supplies and mitigation" and the status of storage facilities. Understanding the current state of storage facilities can help urban planners assess risks, develop emergency response strategies, meet material needs, and mitigate the effects of disasters and emergencies. Improving the current state of storage facilities can enhance a city's ability to respond and protect the safety and well-being of its residents.

Using these keywords as derivatives, it can be seen that these related research topics, such as "urban disaster mitigation, urban emergency management, emergency storage facilities, urban resilience, and emergency planning", are also closely related to the current research on the current state of urban emergency supplies and storage facilities. Understanding the situation of existing facilities and storage levels can provide an important basis for emergency planning, helping to formulate reasonable resource requirements and facility planning, and improving the city's emergency response capability and resilience. Proper planning and management of emergency storage facilities can help improve a city's emergency response capability and ensure a smooth supply chain of materials to effectively support the city's emergency management and disaster response efforts. By understanding and planning for urban emergency supplies and storage facilities, it is possible to improve a city's emergency response capability, reduce the damage caused to the city by a disaster, and provide the necessary support for post-disaster recovery. Understanding and planning for urban emergency supplies and storage facilities improves a city's ability to respond to disasters, reduces the damage caused by disasters, and enhances the safety and resilience of the community. By understanding the research on the topics of urban disaster mitigation, urban emergency management, emergency storage facilities, urban resilience, and contingency planning, we can see a strong connection with the current state of urban emergency supplies and storage facilities. Understanding the current situation can provide basic data and a basis for disaster mitigation, emergency management and planning, helping cities to improve their ability to cope with disasters and enhance their overall resilience.

2. Problems with urban emergency stockpiles and depots

2.1 Analysis of the problem of the types and quantities of emergency supplies in stock

(1) The types of emergency supplies in stock are not full enough. Emergency supplies are the concentrated manifestation of people's basic needs in emergency events. Emergency supplies should cover the seven basic aspects of people's lives, namely: food, clothing, housing, transport, rescue, defence and construction. As the name suggests, "rescue" refers to all aspects of materials and equipment required for the rescue of disaster victims; "prevention" includes both protection of personal safety in times of disaster and prevention of secondary events; and "construction" refers to post-disaster relief. "Prevention" includes both personal safety protection and prevention of secondary events during a disaster, while "construction" refers to post-disaster reconstruction. All kinds of materials related to the above seven aspects need to be stockpiled. From the research data, emergency supplies and equipment can only be said to have basically completed the form of reserves, from the point of view of the type of storage, far from meeting the city's heavy emergencies when the demand for material protection, for example, medical emergency supplies only see a small number of first aid vehicles, first aid kits, emergency packages, the reserves of first aid supplies of the type of a relatively single. At the same time, some new high-tech emergency products, we did not collect relevant information in the research, such as water life-saving robots, large payload industrial drones and so on.

(2) Lack of standards for the quantity of emergency supplies in reserve. For a long time, various departments have determined the quantity of reserves on the basis of experience and capacity. Take the disaster relief materials stockpiled by the former Civil Affairs Bureau as an example, at that time, they were stockpiled according to the standard of protecting 1% of the resident population. The demand for emergency supplies is affected to a certain extent by a combination of factors such as the size of the population, economic and traffic conditions, the type and extent of the disaster, etc. It should be based on the extent of the impact of previous emergencies of the same kind, or analogous to the extent of the impact of disasters in similar areas to establish the appropriate mathematical models, scientific calculations and derived from the internationally rated emergency response team on the material and equipment is equipped with standards. The research found that most of the units (warehouses) in the emergency stockpile types and quantities are not based on (e.g., the rescue teams under the Housing and Construction Commission are basically self-procurement; the Commerce Bureau reserves the determination of the types of materials are also not based on). Only a very small number of rescue teams have a basis for the type and quantity of emergency supplies or have passed an assessment.

2.2 Analysis of problems in the current state of emergency materials management

(1) The quality management of emergency supplies lacks a basis. At present, the problem of quality management of emergency materials is more prominent. Firstly, there is a lack of access system for emergency materials[7]. There is no basis for the procurement of emergency materials, that is, there is a lack of institutional support for the procurement of what kind of equipment on what basis, the quality is uneven, the performance is very different, and the price is very different. Secondly, there is a lack of exit mechanism for invalidated materials. Emergency supplies have plans and objectives to exit the warehouse, is to give full play to the value of the material itself, to avoid the waste of material important practices, especially food and drug materials. In addition, there is no corresponding system to guarantee the reasonable withdrawal and replenishment of reserve materials. Third, the maintenance of emergency supplies is not in place. Due to emergency supplies most of the time in the idle state, electrical energy-driven instruments and meters, fuel engines and pumps, mechanical tools and vehicles need regular maintenance, in order to ensure the normal use of emergency. Many warehouse managers for the equipment assembly cannot be completed, maintenance is only stay on the surface of the level of wiping.

(2) emergency supplies storage conditions are simple. Lack of space in the warehouse management, especially large equipment, are basically open storage, no large equipment warehouse, some large equipment for many years, rust and corrosion. Some warehouses materials are stacked randomly, and even years have not yet opened the box[8]. Most of the emergency stockpile warehouses are not well supported by infrastructure, fire, moisture, flood control, security and so on. Warehouse mechanised equipment is less, the handling of reserve materials are still pulled by the shoulders of the original way of working is mainly, greatly reducing the loading and unloading of emergency supplies and handling efficiency.

(3) the lack of information management tools. The application of emergency supplies is characterised by the word "emergency", which must be done in the event of a disaster to "find, transfer, use well". To do so, all involve a key issue, that is, the information management of emergency supplies. Except for the Fire Services Bureau, the units under study generally lack information management tools[9]. In terms of information storage, there is no information system for recording and storing inventory materials; in terms of on-site management, there is no information equipment for protection (such as electronic signage, video monitoring, etc.); in terms of material circulation, there is no information networking and sharing of scheduling means. It can be said that at present, the city departments of emergency supplies reserve management information technology is still in the blank zone, not to mention the unified management, coordination and linkage of emergency supplies information platform, the flow of emergency supplies in times of disaster, supervision, use, accounting problems are very serious.

(4) emergency supplies and vehicles on the road is difficult[4]. Emergency vehicles without licence plates available is very common, but also the relevant emergency departments have a common problem[5]. Most of the vehicles are on the road that is illegal, and many drivers have their driving licence points withheld. Large lorries carrying emergency supplies are also unable to enter the inner ring of the city on a regular basis, causing difficulties in transport, so providing a complete system of transporting emergency supplies and regulations is very much needed.

2.3 Analysis of emergency material storage problems

(1) Warehouse distribution is not reasonable. The current existence of the warehouse structure, is based on the characteristics of the industry management of the deployment of the distribution of the professional direction of the warehouse storage materials are also naturally subject to the characteristics of the management of the block. Here is not to say that this kind of warehouse storage material professional direction configuration is not right, but to say whether there is more reasonable, more reflect the efficiency of the warehouse storage material professional direction configuration programme to follow. From the point of view of the city's overall warehousing materials, should be divided into professional, focused on selecting the geographic location of warehouses, targeted configuration of warehousing materials, professional direction, so that it is in the transport, logistics, logistics protection, co-ordination and deployment can be in line with the timing, geographical location and the people and the various warehouses complement each other to complement each other and co-ordination and unity in order to play the best overall efficiency. This situation has not been positively affirmed in this research[6].

(2) Warehousing classification is not clear enough. At present, in the emergency supplies reserves, municipal reserves and district reserves, respectively, reserve their respective needs of emergency supplies, and to maintain the characteristics of the "block and block". The overall relationship between the two levels of warehouses is not closely related to each other, and there is a lack of clarity in the responsibilities of the material reserves. Because of the current "who set up, who equip" method of stockpiling emergency supplies by department and by level, it will inevitably lead to the dispersal of emergency supplies, and it is difficult to draw a definite conclusion as to whether the total amount and types of emergency supplies are able to cope with the needs of large-scale emergencies.

(3) Reserve methods are not diverse enough. Research found that the city's emergency supplies reserves are mainly the government's physical reserves as the main, supplemented by the agreement reserve reserve mode, this reserve mode certainly has its important role, but also lacks a certain degree of flexibility. Should be improved on behalf of the storage method and production capacity reserve method and other reserve methods. At the same time, the physical reserve will cause huge financial pressure, adding to the already insufficiently invested emergency supplies reserve. In today's developed information society, the reserve of emergency supplies is not even limited to the city, the field of emergency supplies, in the case of fully grasp the status of information, can be incorporated into a virtual reserve mode.

(4) Warehousing logistics is not advanced enough. Emergency logistics system in the packaging technology unit and loading and unloading handling technology unit of mechanisation/automation/information technology degree, the degree of intelligent identification and sorting of delivered materials there is a substantial increase in space; mobile shelves, automated conveying equipment, three-dimensional conveying warehouse equipment basically does not have, not to mention the use of special delivery equipment (aircraft, railway locomotives, ships, automobiles). Progress in warehousing and logistics technology will save time, space and capital costs for China's

emergency logistics system, and significantly improve the energy efficiency of emergency logistics support system for emergency response.

3. Analysis of urban emergency storage planning strategies

Cities face the threat of various emergencies and natural disasters, including earthquakes, floods, torrential rains, fires and so on. In these cases, the supply and deployment of emergency supplies is crucial. The analysis of urban emergency storage planning strategy can ensure sufficient emergency supplies reserves, and reasonably plan their storage location and quantity to meet the needs of emergency response. The analysis of urban emergency warehousing planning strategy helps rational management and use of resources. Through scientific planning, it can avoid duplication or waste of emergency supplies, and ensure the effective use and saving of supplies. Reasonable planning can also improve the efficiency of the material supply chain and reduce transport and storage costs. The analysis of urban emergency storage planning strategy is one of the important means to improve the urban emergency response capacity. By analysing the actual needs and disaster risks, and formulating scientific planning strategies, it can enable cities to respond quickly and orderly when emergencies and disasters occur, and effectively control and reduce losses. The analysis of urban emergency warehousing planning strategy can ensure the rapid deployment of materials and the enhancement of rescue capacity by optimising the layout of warehousing facilities and logistics and transportation networks. This can minimise the rescue response time, send urgently needed materials to the disaster area quickly, save lives and reduce losses.

Currently, research has focused on system construction, government role, mechanism improvement and emergency planning. In the process of disaster relief, most rescue operations use the administrative centre as the emergency logistics distribution centre, but there are fewer studies on the establishment of emergency distribution centres. Meanwhile, the location of the emergency distribution centre is crucial to emergency management, because a reasonable location not only reduces the cost, but also ensures the timely supply of emergency materials, thus reducing the losses caused by disasters. For this reason, this paper proposes a mixed-integer planning model to determine the optimal siting scheme for emergency logistics distribution centres and to solve it.

3.1 Emergency Logistics Distribution Centre Location Model Establishment

Problem description: Assuming that there are L emergency material supply points to provide emergency materials for the distribution centre, and n disaster-stricken points to accept emergency materials distributed by the distribution centre, and there are q candidate distribution centres in total, and assuming that the number of material supply points and disaster-stricken points are fixed constants, the problem is transformed into a transportation problem in operations research by minimizing the transportation cost of emergency materials to the distribution centre, the transportation cost of the distribution centre to the disaster-stricken points, the management cost of the emergency materials in the distribution centre, and the fixed cost of the distribution centre to meet the supply and demand requirements between each layer. The fixed cost of the distribution centre is minimized to satisfy the supply and demand requirements between the tiers, and the problem is transformed into a transport problem in operations research for solving. The site selection problem is completed by selecting a number of distribution centres that satisfy the constraints from q candidate points.

Problem assumptions:(1) The emergency time requirement is satisfied, i.e., the effect of time on the emergency distribution system is not considered;(2) The unit transport prices of emergency supplies to the distribution centre and the distribution centre to the affected point are known;(3) The total number of emergency supplies is known;(4) The storage capacity of the distribution centre and the number of units are limited;(5) The demand at each disaster site is known;(6) Distribution centre costs are fixed for known, unit overheads are constant.

Decision-making problem: emergency logistics distribution centre site selection problem is in the disaster point near the area of all the storage of materials in the collection of alternative point addresses to select a certain number of address points to establish a distribution centre, so that the establishment of a series of emergency distribution area, the realization of the distribution of the various disaster points, so as to achieve the minimum total logistics costs of the entire emergency logistics distribution system.

Parameter definition: the meaning of specific parameters is shown in Table 2 parameter definition below.

Table 2 Parameter Definition

Parameterisation	Hidden Meaning
y_{ki}	Indicates the cost of a unit of emergency supplies from supply point k to distribution point i.
w_{ki}	Indicates the volume of shipments from supply point k to distribution point i.
y_{ij}	denotes the cost per unit of material from distribution point i to disaster point j.
w_{ij}	denotes the volume of transport from distribution point i to disaster point j.
G_i	Indicates the management cost of emergency supplies per unit at distribution point i.
f_i	Indicates the fixed cost of distribution point i.
γ_i	Indicates a 0-1 variable that takes 1 when distribution point i is selected and 0 otherwise.
p_k	Indicates the total amount of production at distribution point k.
D_j	denotes the demand of the affected point j.
H_i	denotes the maximum storage capacity of distribution point i.
Q	denotes the maximum number of distribution points selected from the candidate distribution centres.

objective function

$$minZ = \sum_{k\in K}\sum_{i\in I} y_{ki}w_{ki} + \sum_{i\in I}\sum_{j\in J} y_{ij}w_{ij} + \sum_{k\in K}\sum_{i\in I} G_i w_{ki} + \sum_{i\in I} f_i\gamma_i \quad (3)$$

$$s.t.$$

$$\sum_{i=1} w_{ki} \leqslant p_k, k \in K \quad (4)$$

$$\sum_{j\in J} w_{ij} = \sum_{k\in K} w_{ki}, i \in I \quad (5)$$

$$\sum_{i\in I} w_{ij} \geqslant D_j, j \in J \quad (6)$$

$$\sum_{k\in K} w_{ki} \leqslant H_i\gamma_i, i \in I \quad (7)$$

$$\sum_{i\in I} \gamma_i \leqslant Q \quad (8)$$

$$w_{ij} \geqslant 0、\ w_{ki} \geqslant 0, i \in I, j \in J, k \in K \quad (9)$$

(3) formula for the objective function, emergency supplies to the distribution centre i transport costs, distribution centre i to the disaster point j transport costs, emergency supplies in the distribution centre i management costs and distribution centre i fixed costs to reach the minimum; (4) - (9) formula for the constraints, where: (4) formula that from the material supply point k to provide emergency supplies to the distribution centre i can not be more than the total amount of its own; (5) Formula denotes the equilibrium of supply and demand, i.e., the amount of materials provided by material supply point k to distribution centre i and the amount of materials delivered by distribution centre i to the disaster-stricken point j are equal; Eq. (6) denotes that the amount of materials demanded by the disaster-stricken point j are all satisfied; Eq. (7) denotes the capacity limitation of distribution centre i; Eq. (8) denotes the constraint on selecting the number of distribution centres i; and Eq. (9) denotes the non-negativity of the relevant parameter variables.

3.2 Urban emergency storage planning strategy

By setting the cost of emergency materials per unity_{ki}, $y_{ij}$and fixed cost $f_i$in the objective function of the emergency logistics distribution center site selection model in 3.1 above, an address optimization model with the cost of emergency materials per unit y_{ki}, y_{ij} and the fixed cost f_i of the emergency logistics center as the objective is established, so as to realize the problem of establishing a distribution center by selecting a certain number of addresses from the set of addresses in the vicinity of the disaster site for storing materials. The problem of establishing a distribution center by selecting a certain number of address points from the set of addresses. In this way, a series of emergency distribution areas are established to realize the distribution to each disaster-stricken point, thus also realizing the minimization of the total logistics cost of the whole emergency logistics distribution system. This satisfies the need for many unexpected events, and if emergency relief materials are delivered to the disaster area in the process of disaster relief, the efficiency of the emergency relief work can be improved, and the damage can be minimized as much as possible.

Urban emergency warehousing planning can help cities cope with the adverse effects of disasters and reduce the chaos and losses caused by disasters. By reasonably planning the location and quantity of storage of reserve materials, as well as establishing an efficient logistics and transportation network, rapid deployment of relief materials can be realized, and the efficiency and accuracy of disaster response can be improved. As in 3.1 Emergency Logistics Distribution Center Site Selection Model Establishment, Equation (5) $\sum_{j\in J} w_{ij} = \sum_{k\in K} w_{ki}$is set for the amount of materials supplied by material supply point k to distribution center i and the amount of materials transported by distribution center i to the disaster-stricken point j to be equal, thus ensuring the balance of supply and demand; as well as setting Equation (7) $\sum_{k\in K} w_{ki} \leqslant H_i \gamma_i$, is the capacity limit of distribution center i, thus making the model more realistic. Urban emergency warehousing planning can improve the rescue capacity of the city. Through scientific planning and optimization of the layout of storage facilities, it can ensure the rapid deployment of materials and the rapid response of rescue. This helps to shorten the rescue response time, send the urgently needed materials to the disaster area quickly, save lives and reduce losses. Urban emergency warehousing planning helps to rationally manage and utilize resources. By setting the total amount of production p_k, the material demand of each disaster area D_j, and the maximum storage capacity of each distribution point H_i, it makes the model more complete and reasonable. Through scientific planning, it can avoid duplication or waste of material stockpiling, improve the efficiency of material supply chain, and reduce transportation and storage costs. This can not only improve the efficiency of resource utilization, but also increase the sustainability of material stockpiling.

The implementation of urban emergency storage planning can increase public confidence in city managers and emergency response agencies. The public's knowledge that the city has a well-developed emergency warehousing plan and is able to provide the needed relief supplies in a timely manner during an emergency will increase the public's sense of security and trust. The significance of urban emergency storage planning is to safeguard public lives, cope with the impacts of disasters, enhance rescue capabilities, rationalize the management of resources, and increase public confidence in city administrators and emergency response agencies. These are important means of ensuring that cities can better protect public safety in the face of emergencies and disasters.

4. Summary

Disasters are highly destructive and unpredictable natural hazards, such as earthquakes, typhoons, and floods. This paper analyses the status quo of urban emergency supplies and storage facilities to understand the current lack of research in this area, and then through the use of data mining, N-Gram statistics to analyse the current problems of urban emergency supplies and storage warehouses, so as to propose the establishment of an emergency logistics and distribution centre site selection model to enhance the planning and configuration of urban emergency storage facilities for the safety of people's lives and property under extreme disasters. Importance of emergency storage facilities for the safety of people's lives and properties under extreme disasters. For cities, it is difficult to cope with such disasters without effective emergency response measures and material reserves. Therefore, the study of urban emergency storage facilities planning and configuration can improve the city's response ability and reduce casualties and property losses. In the planning of urban emergency storage facilities, factors such as the type, quantity and storage location of reserve materials need to be considered. Through

scientific planning and configuration, it can optimise resource allocation and utilisation efficiency to the maximum extent possible, and reduce resource wastage and duplication of reserves. The psychological pressure and sense of panic brought by extreme disasters to the public cannot be ignored. Urban emergency storage facility planning can provide the public with a sense of security and confidence, letting them know that the city government is fully prepared and responsive in the event of a disaster. Urban emergency storage facility planning is one of the most important indicators of a city's level of development and competitiveness. A city with a well-developed emergency storage facility plan can better attract talent and investment, and improve the city's image and competitiveness. It is of great significance to do research on the planning and configuration of urban emergency storage facilities under extreme disaster situations. This can not only improve the city's response capacity, optimise resource allocation and utilisation efficiency, enhance social security and confidence, but also improve the city's image and competitiveness, and contribute to the city's sustainable development.

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References

1. Wang Yanen,Ahmed Ammar,Azam Ali,Bing Du,Shan Zhang,Zhang Zutao,Tariq Muhammad Kashif,Sultana Jakiya,Mushtaq Ray Tahir,Mehboob Asad,Xiaohu Chen,Rehman Mudassar.Applications of additive manufacturing (AM) in sustainable energy generation and battle against COVID-19 pandemic: The knowledge evolution of 3D printing[J].Journal of Manufacturing Systems,2021,60.
2. Yu Wuyang.Pre-disaster location and storage model for emergency commodities considering both randomness and uncertainty[J].Safety Science,2021,141.
3. Wu Xiaoyuan,Wu Fengping,Li Mengke,Ji Yingwen.Optimal Model of Emergency Medical Supplies Stowage under Traffic Control during the Initial Period of the Epidemic Based on Characteristics Analysis of COVID-19 Epidemic[J].Mathematical Problems in Engineering,2021.
4. Hou Yan,Yu Haisheng.Dual-Source Procurement Strategies of Emergency Materials Considering Risk Attitudes[J].Discrete Dynamics in Nature and Society,2022.
5. Wang Yanyan.An Optimization Method for Distributing Emergency Materials Which Balances Multiple Decision Criteria[J].Processes,2022,10(11).
6. Arias Juan C.,Cubillas Juan J.,Ramos Maria I..Optimising Health Emergency Resource Management from Multi-Model Databases[J].Electronics,2022,11(21).
7. Jin Yinzi,Chen Hui,Ge Hongxia,Li Siwen,Zhang Jinjun,Ma Qingbian.Urban–suburb disparities in pre-hospital emergency medical resources and response time among patients with out-of-hospital cardiac arrest: A mixed-method cross-sectional study#13;[J].Frontiers in Public Health,2023,11.
8. Ren Xiangyang,Chen Shuai,Ren Liyuan.Optimization of regional emergency supplies distribution vehicle route with dynamic real-time demand.[J].Mathematical biosciences and engineering : MBE,2023,20(4).
9. Li Xia,Xiao Yuewen,Li Jiaxuan,Wang Haipeng,Chuo Eryong,Bai Haili.Special Emergency Resources Preallocation Concerning Demand Time for Tunnel Collapse[J].International Journal of Disaster Risk Science,2023,14(1).