

EMERGENCY LOGISTICS SYSTEMS SYNNERGETICS RESEARCH

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Abstract: Emergency logistics is to provide surprises natural disasters, burst waiting for public health event of unexpected incidents the required emergency supplies for the purpose to seek to maximize efficiency of the time and disaster losses into the goal of a special kind of logistics. Logistics system in the running in the process of co-operation benefits system in the effectiveness of the exigencies of the key contents. Study and explore their emergency supplies of logistics system, and improve the logistics system within the various elements of effective co-ordination between capacity and improving the logistics system of overall management, for national, regional and processing enterprises and other public events to be acute emergency a very important practical value. The emergency supplies of logistics system based on its own characteristics of logistics system, emergency operations with uncertainty and instability, and any other requirements of the system together in effective control, and crystallized form, and the system needs to be a major difference, how is emergency logistics system to ensure effective control, the timeliness and economical situation and better coordination in this way for discussions.

1 INTRODUCTION

Despite technological advances in today's world, the forecasting of natural disasters has been developed to a very high level, but local, regional, regional, national or even global scale natural disasters, public health emergencies is still time have occurred, but to human beings is a devastating blow to cause significant even for human survival and social development constitutes a major threat. 1923 Kanto earthquake, 1976 earthquake in Tangshan, China in 2001, the United States "9 • 11" incident, but beginning in China in 2003 affected the whole world "SARS" outbreak, the end of 2004 Indian Ocean tsunami, the United States in early 2005 New Orleans hurricane and so frequent outbreaks of public emergencies, as well as China's Wenchuan earthquake in 2008, gave mankind over a bitter experience.

Therefore, emergency logistics and related research projects in the field of emergency management is an important research direction in the outbreak of major emergencies on how to use various means of transport as soon as a specific number and type of delivery of emergency supplies to the designated disaster or events in the logistics

activities, its goal is to minimize the material delivery time. Because in this environment disaster, emergency logistics best reflect the "time is life" meaning. Virtually every level of a major emergency supply of emergency supplies will run into a lot of problems, such as the Indian Ocean tsunami, the United States, "Katrina" hurricane or other disaster requires the disposal of large quantities of emergency supplies, but also in the process also appears No disaster supplies in place in time leaving the issue of enlargement.

With earthquakes, mining accidents, bird flu and other kinds of "natural disasters", "man-made," the frequent, certainly requires a lot of emergency supplies to solve or deal with the dead buried, the injured relief, health and epidemic prevention, post-disaster reconstruction to restore production and to restore order and so on, to reduce the disaster area, personnel losses and prevent further expansion of the disaster, which created an enormous demand for emergency logistics. China all kinds of emergency supplies emergency management system to build a sound basis for an important material and accelerate the establishment of emergency material storage system, and continuously enrich the variety of emergency supplies reserves to improve our

emergency management system is a necessary requirement, but also related to emergency management the smooth conduct of the important factors.

Emergencies not only caused great loss of life and property, but also affect social stability, or even threaten national security, economic and social development have a significant impact. Level coordination of emergency logistics system effectiveness will be directly related to a variety of unexpected events on the effective response to the first time, the implementation of effective control measures to avoid the disaster spread, unexpected events will minimize the losses. Therefore, coordination of emergency logistics system, the level of research, effective system of collaborative research methods, emergency logistics system is an important issue facing the building.

2 METHODOLOGY

In 20th century, 70 years, Harken the "synergy" concept to be clarified and established a new discipline-"Synergetics." His study found that the laser system, the system there is a general evolution theory, that in any system, the subsystems are relying on a regulation, a purpose of "self-organizing" process, so vastly different subsystems synergy, and a new stable and orderly structure. Haken found that both balanced and non-equilibrium phase transition phase transition phase transition system in a state of disorder before the reason is due to a large number of sub-components of the system does not form a partnership, their own ways, disorganized and could not produce a whole new quality; and once the system reached or at a critical state, this time some kind of coincidental factors, can lead to critical fluctuations, which will produce one or several parameters critical slowing down, there was no damping critical phenomenon, which dominates the change other subsystems quickly established a cooperative relationship, very organized way to concerted action, which leads to the system macroscopic properties of the mutation. Therefore, the Harken the "synergy" is defined as: the system of mutual cooperation between the various parts so that the whole system formed by the micro individual level there is no new structure and quality characteristics.

Project to adhere to qualitative analysis in the study and quantitative analysis, and strive to start Dingxing aspects of the definition of emergency logistics system, elements, structure, function and

characteristics to explain, then the quantitative aspects of logistics coordination on emergency ordering, order parameters and the order parameter on the degree of order to analyze the impact, while making this analysis can be applied in practice, used to guide practice.

2.1 Method Design

From the actual existence of the complex process of coordination of emergency logistics system, ignore the surface, the secondary part of the development of things to seize the essence of things, from a variety of phenomena generalize the general law. And it's from the abstract to the concrete, with the general rules and principles guiding the specific coordination of emergency logistics system analysis and management practices. The course of the project several times in his discussion of induction and deduction used in the analysis.

2.2 Synnergetics Application Consider

Elements of emergency logistics system, structure, function and properties were studied. Elements is the main element, object elements and elements of facilities and equipment; structure constituted by the main number and different and the main two types of different sizes; by function in the role of emergency logistics system will be divided into two basic functions of logistics functions and auxiliary functions, Basic functions include transportation, warehousing and distribution. Auxiliary functions are including packaging, handling, logistics, information processing and distribution processing. Emergency Logistics System features include: time of the primary logistics, security, sensitivity, system cost, information diversity, technical complexity, space and poor conditions of dispersion.

2.3 Sensitivity Analysis

On the basis of the integrated use of systems, logistics management theory, the collaborative learning and other subjects to study the theories and methods of emergency logistics is coordinated to the problems.

Emergency logistics system is composed of different levels and different types of multi-element composition of the organic compound system. Application of systems theory, put forward the theoretical framework of emergency logistics system, the system is decomposed into elements, structure and function analysis.

The theory of supply chain and logistics applications, the definition of emergency logistics system, elements, structure, function and characteristics of the specific content analysis may all use in our research.

Application of synergetic theory of emergency logistics system synergy content, objectives and principles, collaborative content, since the degree of organization, order parameter, order parameter on the self-organization degree of impact analysis, from a deeper grasp and reveal the system operation rules.

Coordination of emergency logistics system analysis of the content, and collaborative content and process were analyzed. Coordination can be divided into the main coordination, object collaboration, coordination and information facilities and equipment co. Collaborative process under the management of the scope and extent is divided into strategic, tactical and operational level the three levels of analysis. This article uses regression based on information entropy theory and the theory of modeling and algorithm for emergency logistics system order parameter is solved. Application of sensitivity analysis methods to define the order parameter changes in upper and lower bounds.

2.3.1 Model and Solution

Natural disasters or emergencies occur, the affected areas the demand for emergency supplies often diverse. In most cases, they usually take into account the Distribution for a variety of materials, and thus research on the emergency transporting various goods more. Have practical significance and application value. As no transport capacity constraints of the more simple, here we only have capacity constraints of the multi-model building for Transportation and solution.

2.3.2 Model Suppose

1. Make A_1, A_2, \dots, A_n n-a state of emergency to mobilize emergency supplies supply point, B point for the needs of emergency supplies.
2. In the state of emergency, the demand point B requires a total $m(m > 1)$ species of emergency supplies, set $X = (X_1, X_2, \dots, X_m)$. Emergency supplies that demand vector, where X_j to the first kind of material that needs, of which $j = 1, 2, \dots, m$;
3. Within the time limit set A , the first. J kinds of materials the maximum transport capacity of

$X_{ij}, i = 1, 2, \dots, n; j = 1, 2, \dots, m$. And meet the

$$\text{million } \sum_{n=1}^n X_{ij} \geq X_j, \text{ and for any } A_i, X_{ij} \geq 0,$$

and not all 0;

4. Assume that the transport capacity of a variety of materials known J and unrelated;

5. Set from A_i , the maximum delivery volume of transporting X_{ij} to the time required for the B $t(t > 0)$, $i = 1, 2, \dots, n$; $T(T > 0)$ is Emergency provisions for the time limit for emergency dispatching period.

Without loss of generality, we assume $t_1 \leq t_2 \leq \dots \leq t_n \leq T$, if it reaches a point of emergency supplies should be needed.

Demand is greater than the time limit point of T , then the material supply point is not involved in emergency dispatching. Are now required to give a solution involved in transporting emergency supplies to determine the material supply point and the point of supply, so as to meet the time limit in Article Conditions, so that the emergency dispatching the shortest time.

2.3.3 A Single Target Model

In most cases, different factors have different dimensions and sometimes there is a significant difference in orders of magnitude among different properties, so we need normalize the data of original matrix and make each indicator value unified in a common range.

$$X_i^* = \begin{cases} 0, & X_i \leq X_{\min i}, \\ \frac{X_i - X_{\min i}}{X_{\max i} - X_{\min i}}, & X_{\min i} < X_i < X_{\max i}, \\ 1, & X_i \geq X_{\max i}. \end{cases}$$

Here,

$$X_{\max i} = \max\{X_1, X_2, \dots, X_m\}, X_{\min i} = \min\{X_1, X_2, \dots, X_m\}$$

, X_i^* represents a dimensionless value of indicator i , X_i represents a real value of indicator i , $X_{\max i}$ and $X_{\min i}$ represents the maximum and minimum values of original target respectively.

Calculating the weight of each attribute value

$$\bar{A}_j = \frac{1}{n} \sum_{i=1}^n X_{ij}^*, \bar{V}_j = \left[\frac{1}{n} \sum_{i=1}^n (X_{ij}^* - \bar{A}_j)^2 \right]^{\frac{1}{2}}.$$

So the weight of each attribute value is:

$$\omega_j = V_j \left[\sum_{j=1}^m V_j \right]^{-1}, j = 1, 2, \dots, m$$

Euclidean distance algorithm

Euclidean distance formula is as follows:

$$d_n = \left[\sum_{j=1}^m \omega_j (X_{ij}^* - T_j)^2 \right]^{\frac{1}{2}}.$$

Where T_j represents the i th attribute value of target case, d_n represents the Euclidean distance between the new target case T and the i th case in source case base; d_n the smaller, the more similar.

After the attribute value is normalized, we use the following formula to calculate the similarity and identify the most similar case.

$$d_n = \left[\sum_{j=1}^m \omega_j (X_{ij}^* - T_j)^2 \right]^{\frac{1}{2}}.$$

3 DATA RESULTS

Assuming the land of cotton affected demand for 15,000 tents, requiring delivery within 24 hours. According to GPS software, the repository can be simulated disasters point to the path and the distance (in ten single-bit rounded.) This case we can achieve door to door transportation of road transport, for example, the average speed of transport at 50km / h basis, calculated for each repository to the A point of dispatching schedule (time rounded) as follows:

Table 1: Central repository of all disasters point to the distance and dispatching schedule.

Reserve Library-Disaster land	Distance (km)	Time (hour)
Tianjin-Tangshan	140	3
Shenyang-Tangshan	550	11
Haerbin-Tangshan	1100	22
Hefei-Tangshan	1150	23
Zhengzhou-Tangshan	850	17
Wuhan-Tangshan	1350	27
Changsha-Tangshan	1650	33
Nanning-Tangshan	2500	50
Chengdu-Tangshan	2100	42
Xian-Tangshan	1300	26

The best dispatching scheme: 7050 in Tianjin, Shenyang, 7950, the program shows the above analysis, in the absence of transport capacity constraints, by the time 11 hours. Distribution for goods only by the material supply point to point transportation needs time to decide, and in a single mode of transport, the transport time is uniquely determined by the transport distance. The problem is changing to meet the traffic requirements in the case, find the shortest distance transport problems.

If the storage point follows the affected areas of the transport time constant, considering the capacity constraints and assuming that the capacity of the reserve is the reserve bank of such table.

Table 2: Central repository of all cotton tent reserves and capacity restrictions table.

Repository	Number	Reserve	Capacity
Tianjin	1	7050	6000
Shenyang	2	12200	4000
Haerbin	3	5000	4000
Hefei	4	1000	3000
Zhengzhou	5	22200	8000
Wuhan	6	9500	5000
Changsha	7	800	3000
Nanning	8	0	2000
Chengdu	9	2000	2000
Xian	10	6000	4000

Assuming the demand for disaster areas are still 15,000 cotton tents, requires delivery within 24 hours, find the point and the point of transporting transported volume.

The best dispatching scheme: 7050 in Tianjin, Shenyang, 4000, Zhengzhou, 3950, when used 17 hours.

From this we can see that, when the material constant demand and time constraints, capacity constraints of transport capacity than the non-complicated cases. When there is limited transport capacity, transported again due to the need to consider, even in a single mode of transport, the transport time and distance only, but also by the transport capacity constraints.

4 CONCLUSIONS

Although the Chinese government and relevant organizations to disaster reduction and prevention plans, but logistics costs incurred are enormous, in the unexpected natural disasters and man-made disasters caused huge casualties and property losses, due to the loss of about emergency logistics total loss of 15% to 20%, such as SARS losses totaling 17.6 billion, of which the loss of emergency logistics, about 30 billion U.S. dollars.

With earthquakes, mining accidents, bird flu and other kinds of "natural disasters", "man-made," the frequent, certainly requires a lot of emergency supplies to solve or deal with the dead buried, the injured relief, health and epidemic prevention, post-disaster reconstruction to restore production and to restore order and so on, to reduce the disaster area, personnel losses and prevent further expansion of

the disaster, which created an enormous demand for emergency logistics. China all kinds of emergency supplies emergency management system to build a sound basis for an important material and accelerate the establishment of emergency material storage system, and continuously enrich the variety of emergency supplies reserves to improve our emergency management system is a necessary requirement, but also related to emergency management the smooth conduct of the important factors.

Unexpected events such time and place can not be predicted, but also the pre-disaster levels can not be predicted, and this led to a sudden demand for emergency supplies, uncertainty, urgency and diversity. From the logistics point of view, the disaster occurred, the short time requires a lot of material, from disaster relief equipment, medical equipment, supplies communications equipment to the life of everything, which the procurement of emergency supplies, inventory, made more high demands to the various emergency supplies of common plans in peacetime, the storage, and effective inventory management in order to prepare for contingencies. Time is important to raise urgent, but also compact and simple procurement procedures, but also pay attention to the quality of the procurement target. At the same time, some unexpected events, often accompanied by deterioration of the transport system, such as roads due to floods or landslides blocked, to timely delivery of these items on the emergency logistics system is a severe test.

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