Design of Decision-Making System of Emergency Logistics Information System Based on Data Mining

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ABSTRACT: *Emergency logistics system is mainly composed of emergency command center, emergency logistics center, and emergency logistics information system. Among them, emergency logistics information system is a very important part of the emergency logistics throughout the whole emergency logistics rescue process, which is consisted of early-warning, reserve and distribution, monitoring, decision-making and evaluation six subsystems. This paper discussed the data mining technology applied to the construction process of emergency logistics information system, used data mining to find valuable potential information and provided it to each subsystem of emergency logistics information system, in order to support emergency decision-making.*

1. Introduction

With the accelerated development of economic globalization, the constantly deepen of national industrialization, urbanization, occasionally occurrence of major natural disasters, major accident disasters, major public health and social security events, endlessly emerge of new situations, new problems. On the one hand, these suddenly happened public events may cause great casualties and property losses. It needs a lot of emergency material to reduce all kinds of public emergency personnel and property losses, to prevent the damage degree of further deterioration, to speed up the reconstruction and restoration of the order and production, etc. On the other hand, although the development of science and technology improved people's prediction ability to disasters, most of the natural disasters, major accidents, public health, social security events are difficult to predict or interval between forecast time and occurrence time is very short. High requirements are put forward to emergency logistics system of providing material support. Hence, research on emergency logistics system has very important practical significance.

Emergency logistics system is a special case of general logistics system, which is an organic integrity, composed of various logistics factors, logistics entity, logistics links, with the purpose of satisfying the unconventional emergency logistics demand. Each component of system interacts, interrelates, and inter coordinates [1]. Because all kinds of emergency events occur frequently, construction demand is becoming higher and higher for emergency logistics system, but from current circumstances, emergency logistics system construction aspects still have many shortcomings.

2. Functional Requirement of Emergency Logistics Decision - Making System

Emergency logistics is a process of plan, organization, management and control through dynamic judgment of sudden logistics demand level and quickly identifying to reasonably and effectively deploy logistics resources and personnel allocation, etc in the situation of emergency logistics demand caused by emergency event. And in this process the requirements of time efficiency, logistics operation cost principle and emergency logistics demand are met. Unconventional, sudden, uncertainty and weak economy are the four significant characteristics of emergency logistics. Besides, according to the conclusion and summarize from related scholars on different emergency logistics types, "*fast*" and "*accurate*" are the common features of emergency logistics.

Based on analysis of connotation and characteristics on emergency logistics, a scientific designed, well-functioning emergency logistics decision-making system should have the function of emergency logistics project intelligence generation and all real-time monitoring for emergency logistics. In order to achieve and meet the functional requirements of emergency logistics decision-making system, we must improve the efficiency, real-time and accuracy of logistics data information. This paper selects data mining techniques for the design of the emergency logistics decision-making system, trying to provide emergency logistics decision-making intelligence, visualization and comprehensive support.

3. The composition of emergency logistics information system

After unconventional emergency event happened, it needed to immediately start the emergency logistics system. The system is mainly composed of emergency command center, emergency logistics center and emergency logistics information system (Figure 1). Emergency logistics information system is mainly composed of early-warning, reserve, distribution, monitoring, decision-making and evaluation six subsystems [2]. Early-warning subsystem is mainly to deal with unconventional emergency alarm, make a confirmation and disposition on time, publish information through various media after it is confirmed true; Reserve subsystem mainly stores relevant data and information of emergency material, call needed emergency material from reserve subsystem according to the confirmed information from early-warning system after unconventional emergency events happened; distribution subsystem is to distribute emergency material reasonably after command center confirms the preliminary requirements of the emergency material [3]; monitoring subsystem is responsible for monitoring the entire emergency rescue activities, until to the aftermath disposal stage of emergency logistics, and updating the database, ensuring the real-time information[4]; decision-making subsystem should start the corresponding contingency plan according to the early-warning subsystem confirmed information, rescue timely and adjust real-time decisions according to the situation progress; evaluation subsystem is mainly for emergency decision-making summary and

evaluation, find out the deficiencies and defects during the implementation of emergency logistics, summary accumulated experience, and constantly enrich case base, provide a reference for future decisions.

4. The Application of Data Mining in the Emergency Logistics Information System

4.1 Theory analysis
The emergency logistics information system should be a whole day operation. In peacetime, according to the national policies and regulations, organize emergency material suppliers and transporters to implement information release and organization management work; connect the national emergency material reserve base together through the network easy to master the real-time dynamic information of emergency material; manage and analyze stored historical data in data base, summarize various emergency events and corresponding emergency material and the contact in the emergency disaster relief activities. In case of emergency event, to effectively predict the intensity, the extent of damage and so on; updated development dynamic of emergency event, make emergency command center can effectively control and coordinate various departments' work as well as make each emergency services grasp the allocation situation of emergency material and dynamic changes in the disaster district at any time [5, 6].

Data mining refers to find data and knowledge valuable but not yet been recognized from a large number of complex data [7, 8]. These data and knowledge can meet the needs of information demanders and provide them decision support.

4.2 Application Steps of Data Mining in the Emergency Logistics Information System
The emergency logistics information system wants to achieve the above goals; it needs to be strong and flexible database support. All kinds of data produced in the emergency rescue process are stored in the database after extraction, purification and selection, and then according to the emergency department's specific needs use different analysis tools to obtain the required information, express analysis result through the different knowledge and modes, finally is used for auxiliary decision-making. Database is the foundation of the emergency logistics information system, supporting the each subsystem of emergency logistics information system [9ÿ10]. Data mining technology can find valuable knowledge and information from the database of emergency logistics information system presented visually. Application steps of data mining technique in the emergency logistics information system as shown in Figure 2:

4.2.1 Data Preparation Stage
Emergency logistics data source includes emergency material data source, emergency department data source, emergency material production enterprise data source,

various ways data source and so forth, which are the data preparation in the early data mining. Remove the noise data in the massive data source through data integration, extraction, and purification and selection means, complete incomplete data in data source, extract the useful data in the data source, and integrate the data, store it in a database.

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┌─────────────────────────────────────────┐
│      Unconventional Emergency Event       │
└─────────────────────────────────────────┘

┌─────────────────────────────────────────┐
│     Emergency Logistics Command Center    │
└─────────────────────────────────────────┘

┌──────────────────────┐   ┌──────────────────────────┐
│ Emergency Logistics  │ ← │  Emergency Logistics       │
│       Center         │   │  Information System        │
└──────────────────────┘   └──────────────────────────┘
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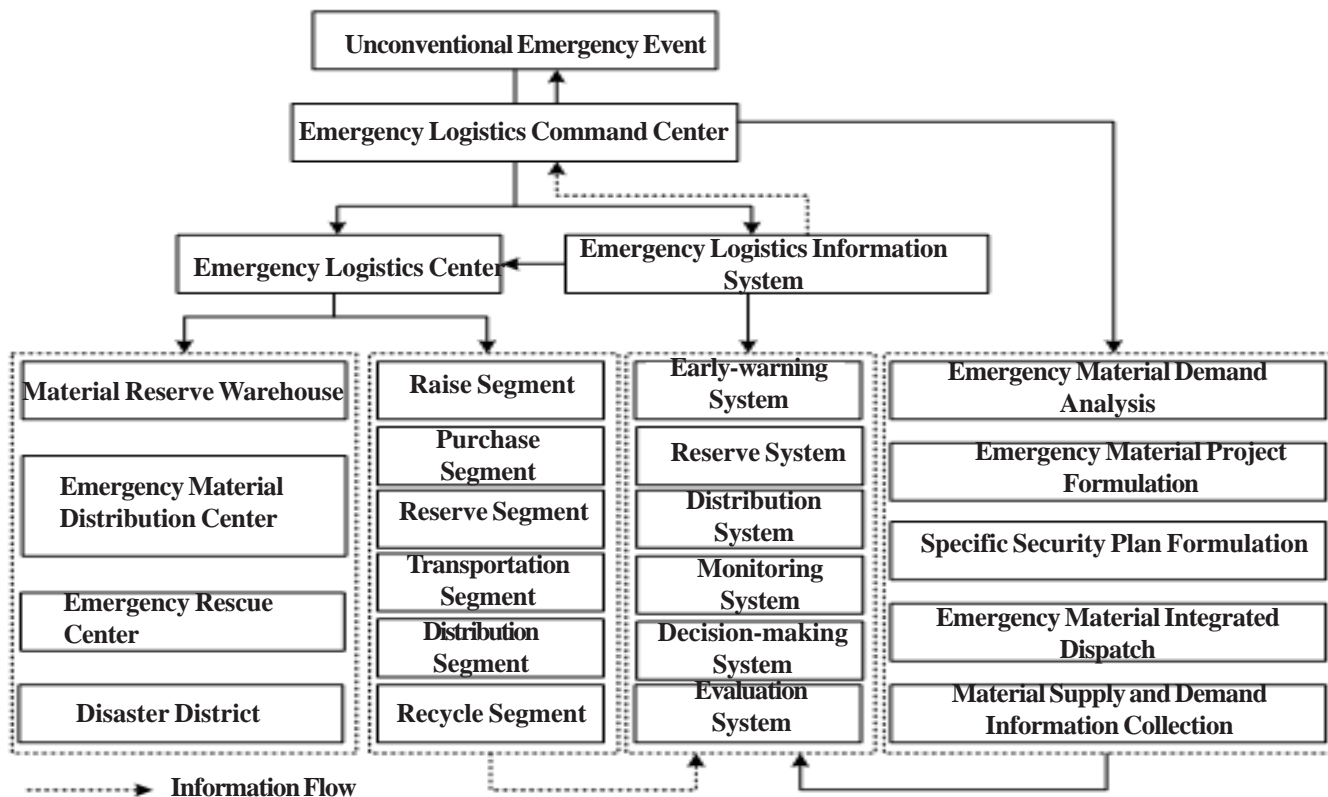| Material Reserve Warehouse	Raise Segment	Early-warning System	Emergency Material Demand Analysis
Emergency Material Distribution Center	Purchase Segment	Reserve System	Emergency Material Project Formulation
	Reserve Segment	Distribution System	Specific Security Plan Formulation
Emergency Rescue Center	Transportation Segment	Monitoring System	Emergency Material Integrated Dispatch
	Distribution Segment	Decision-making System	
Disaster District	Recycle Segment	Evaluation System	Material Supply and Demand Information Collection

- - - - - - → **Information Flow**

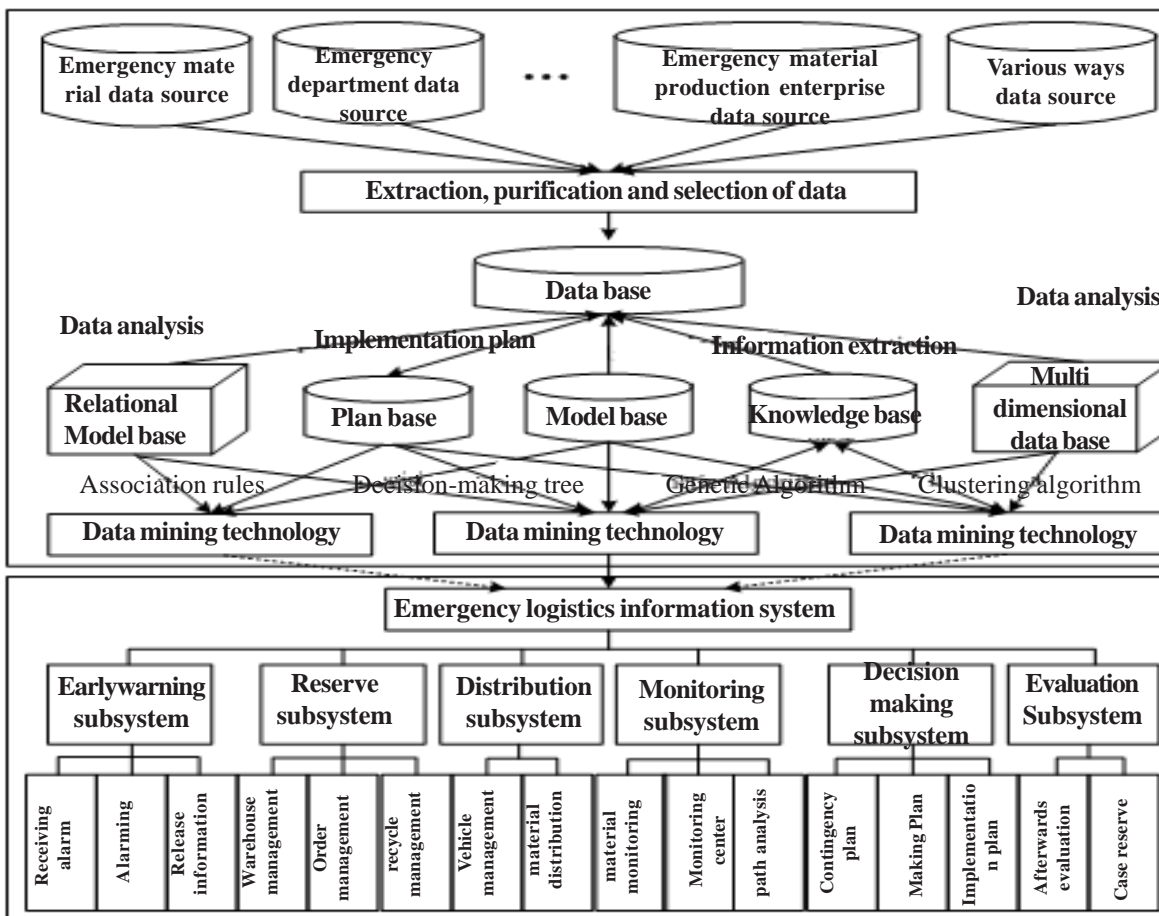Figure 1. The composition of emergency logistics system

Figure 2. Application steps of data mining technique in the emergency logistics information system

4.2.2 Data mining stage

This stage is the core part of the whole system. Emergency logistics have multiple model bases. Relational model base and multidimensional database conduct depth data analysis mainly through the relationship between data, and then classify data according to the rules; plan base is mainly used for reserving various contingency plans and implementation plan so that after the emergency event happened to have an effective solution to deal with, to reduce disorderly phenomena in the beginning of emergency event; model base mainly build all kinds of models, decision makers can choose suitable for the current model to analyze the present situation according to the specific situation of emergency logistics, to ensure the accuracy of emergency decisions; knowledge base mainly store some knowledge experience, for example, summarize from the past successful experience in the process of emergency logistics, the knowledge and experience can provide reference for the implementation of emergency rescue[11,12]. Database is also responsible for data storage for these model bases, which makes data large and complex. Data mining mainly find potential and useful information and data for decision-making from the database, and also obtain information and data directly from these five model bases.

4.2.3 Results analysis statement and mining applications stage

In the late of data mining, digging useful information is intuitive showed through the visualization method and is convenient for decision makers to understand and use; obtain the useful part of mining results by screening and evaluation means, and delivery to the emergency logistics information system through the information flow, thus to provide useful information for its 6 subsystem[13].

5. Conclusion

Data mining is applied to the construction of emergency logistics information system, which can improve the efficiency of emergency management. Data mining can find potential, unknown but useful knowledge and information from mass complex data. These knowledge and information can constantly enrich and update the emergency logistics information system, provide the information they need for the emergency command decision makers and related departments, so as to assist decision makers to make emergency decisions.

Acknowledgement

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