



MODELING AND ANALYSIS OF MATERIAL SUPPLY NETWORK BASED ON BIG DATA PACKED WITH TRAFFIC

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ABSTRACT:

Big data is an important tool for intelligent supply, which can effectively improve the efficiency of the existing installed security. This paper uses complex network analysis and modeling method, establish the whole supply network model is put forward in the future is based on business data, some optimization targets on the basis of this, to provide a reference for further improving our army is security efficiency.

I. INTRODUCTION

Is business is the foundation of professional logistics service, is directly related to the officers and soldiers in battlefield protection and survivability, affect the battle effectiveness, cohesion increased, in relation to the prestige and the army [1]. Supply network is an important foundation to put security, because is materials from the manufacturer to the rear warehouse, and then distributed to soldiers in the hands of, generally go through long distance transportation, material supply network topology is the rear munitions warehouse sorting ability and in the transportation service planning and so on factors have important influence on the security is [2]. In order to further improve the protection ability of

our army is to enhance the precision and control level, rational design, evaluation and optimization is real time supply network, in order to integrate cyber source, so that the entire

supply network and efficient operation.

At present, in accordance with the general requirements of logistics informatization construction and related technical standards, relying on the military and national information infrastructure, comprehensive use of perception, instant message center and material cataloging, data mining and other advanced technology, our army has been built, the army is integrated business information system under

development, integration, interoperability of military and civil.

Through the development of a series of special equipment network, to achieve the "factory network" and "storage network", from the source to solve the problem is data acquisition [3]; PLA password management system construction of civil military integration, secure and reliable data exchange channel and is based on data center, to create a single flow operation mechanism and operation mode of data centralization that is, the business data real-time, integrity and sharing, to provide research material supply is based on big data networks The data support.

II. RESEARCH STATUS

A. Introduction to Network Science

Many systems in the real world, such as traffic system, power system, economic system, Internet system, ecological system, super large scale integrated circuit system, etc., are not only large in scale, complex in structure, but also showing complex spatial and temporal dynamic characteristics. When people study them, it is difficult to describe the inherent law of the whole system by individual individuals in the research system [4]. Because these systems are not simply integrated by a single individual, but have a

close interaction relationship, these close interactions are necessary conditions for the realization of each function of the whole system. If these individuals are regarded as nodes in the network, and the connections among individuals are regarded as edges in the network, then these complex systems form a complex network (Complex Network). Network Science (Network Science) is a complex network modeling and analysis based on the data in the graph theory, statistics, game theory, power system and other research methods, using the idea of data mining that network structure complexity, node complexity, node structure and the interaction between the network and the interaction between[5]. Complex network discipline provides a powerful tool for the study of complex systems, and the analysis and modeling methods based on complex networks are widely used in power and transportation networks, express networks, social networks, economic and financial networks, the Internet and other research fields.

This paper is using the method of network science, is to analyze the supply network topology and is dynamic loaded by material circulation business data, and put on material supply network topology flow comprehensive understanding, find the relevant characteristics

and potential problems and optimization improvements. On the basis of a comprehensive understanding of the supply network, the network modeling method is used to describe the process of material transportation [6].

B. Research on Complex Network Analysis and Modeling Based on Data

Internet network, mobile communication network, electric power and transportation network, economic and financial networks, social networks are complex networks, they mostly use the method of data analysis and modeling of complex networks are studied based on the existing problems. The research of complex network based on data includes complex network topology analysis, traffic flow analysis and complex network modeling. The complex network topology analysis mainly includes the analysis of the node degree, path length, node centrality, community structure and other aspects of the network, which is mainly based on the theory of single sleeve, discover network characteristics from the aspects of network topology.

Traffic flow analysis of complex network based on data mainly analyzes the distribution characteristics of traffic flow, spatial and temporal dynamic characteristics, traffic congestion

and so on. The modeling of complex networks is mainly to study the complex network using the classical network model, probability theory, random process, network communication and network control method. These operations are based on actual data as a starting point, the use of data analysis, network modeling to solve existing problems in the network, is a general method for the study of complex networks [7]. Based on these general methods, this paper uses a set of business data based analysis methods to describe the characteristics of the material flow in the supply network.

III. MATERIAL SUPPLY NETWORK MODELING BASED ON BIG DATA PACKED WITH TRAFFIC

This section mainly carries on the processing, the conformity, records the connection topology between the node and the node, so as to establish the entire supply network topology. The reconstruction of topology helps to better analyze the topological characteristics of the network, and to study the influence of the corresponding topological characteristics on the process of the supply. First, the data of single hop link data are scanned. When the amount of goods directly between the two units and the receiving unit is greater than a certain threshold, there is an edge

between the two nodes, and the weight of the edge depends on the size of the material. Because the material transportation between nodes is generally bidirectional, that is, the node A to the node B is loaded by material circulation, then the node B to the node A will also often exist material circulation.

It is the supply network can be viewed as a weighted undirected weighted network, or two-way network, the node set and edge set in the (expressed as $G = (V, E)$), each edge has a pair of nodes and the corresponding E . We select the simulation data set, put the supply network G through the method by drawing software Gephi generated as shown in Figure 1, the graph nodes for the production of enterprises, and in part by the rear warehouse for the unit, the actual edge is the circulation of goods.

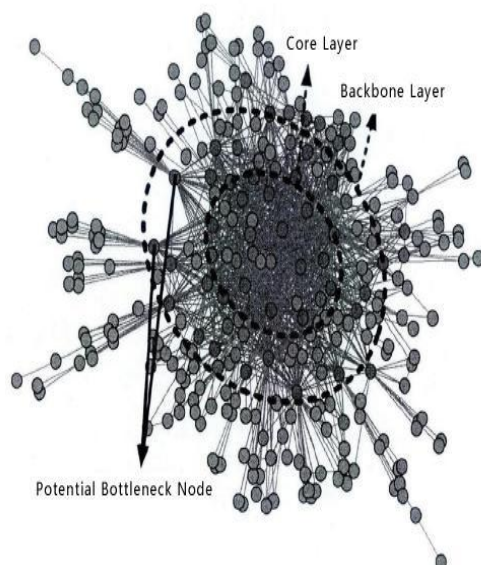


Figure 1. Supply network topology.

The nodes in the core layer are almost completely connected, generally the rear warehouse, which is the core to ensure network connectivity. In the joint between the core layer and the backbone layer is partially connected, these nodes are mostly production enterprises and has the function of generation for installed units, and their core nodes together constitute the entire network of strong regional connectivity, become the backbone of the supply network framework is, the rest of the outer nodes need to rely on strong connections with other regional connectivity node set. At the same time, it can be found that some nodes only depend on one node to connect with the outside world, and the dependent node is likely to become the potential bottleneck node in the network.

If you add the actual geographic location information of the node, the express network topology is shown in Figure 2. It can be seen that the built in supply network based on the simulation data covers most of the country, and the link between nodes is very complex.



Figure 2. Supply network topology based on geographic location information.

Thus, the relevant characterization is the supply network based on the above modeling method can accurately, can provide a means of support for the subsequent optimization analysis.

IV. THE OPTIMIZATION GOAL OF MATERIAL SUPPLY NETWORK BUSINESS BASED ON BIG DATA

A. Optimization of Location of Loaded Material Storage by Large Business Data

The business is big data in different regions of the consumption preference difference, size variety etc. Were demand information are collected, according to historical records and practical supply standard is to predict the future demand in different regions. On the basis of selecting the appropriate position of the rear military warehouse, set a reasonable amount of storage for varieties, to meet the different needs of different regions in the army, will most likely be placed on the material distribution location from the target unit recently, reduced due to improper location of the budget line is too long to increase transportation cost problem.

B. Big Data Packed Business Big Data Warehouse Inventory Optimization

Have strong cyclical varieties were most of supply, as the supply cycle curve goes on, the demand will change accordingly, supply will fluctuate, the current supply is often based on subordinates reporting budget and plan provided to determine the inventory of the corresponding materials, but this prediction is not only time-consuming. It is not accurate enough to lag, is not conducive to efficient operation is guaranteed. In big data support, can release the data mining of association rules is constructed, variety and the dimension of time, then according to a certain probability will be related to the deployment of goods in advance, to achieve "active delivery" business process, is beneficial to improve the efficiency is the guarantee.

C. Optimization of Warehouse System Efficiency by Big Data

Reasonable storage zoning and appropriate positions are essential for the rational utilization of the rear munitions warehouse, the reduction of warehousing costs and the reduction of the number of loading and unloading. For the security work, the law of the delivery of munitions warehouse will not be changed for a period of time, which means that some materials varieties in a certain

period of time often into and out of the library [8]. Relatively speaking, some goods and materials in a certain period of time only to maintain the level of storage and the frequency of access to the library is low. In this case, it is possible to place the goods that are often in and out of the warehouse in the nearest place of the freight car, and the goods with low frequency are placed in a region far away from the exit. But this rule is not immutable and frozen goods, but as for troop movements, areas affected by seasonal changes, supply standard changes and other factors effect at any time change [9]. Therefore, the history of information storage, external factors and other data were analyzed using a big data technology, the use of artificial neural network, decision tree, clustering analysis of data mining, prediction of the trend of the type and quantity of goods to the future, to help the rear warehouse storage location, timely adjust the partition distribution. To maximize the efficiency of logistics to provide information support.

D. Optimization of Allocation Path Planning Based on Big Data

The annual allocation of logistics path planning is also often rely on personal assistant is business experience, each variety from the production enterprise to allocate the path of the receiving point determined by the assistant is manual, because the process is

complex, involving many factors, the actual workload is huge, in urgent need of scientific and reasonable planning of intelligent path support[10].Is business in support of big data, can use the warehouse voucher reporting and inventory data, provide the data necessary for the allocation of path planning, regional, considering the variety, type, time conditions, intelligent matching to generate the initial optimization path of each batch. In addition, in the actual supply process, according to the supply demand and logistics information provided by the military department, part of the material allocation adjustment.

E. Optimization of Supply Time Window Management with Large Business Data

The current distribution process, the concept of not introducing the time window release time management, warehouse and distribution is often dependent on the donor unit dynamic relationship in the distribution process, easy to cause the donor unit please collar supplies waiting for a long time, reduce the efficiency of payment problems [11]. In business is big data support, for the unit of analysis time please show statistical information on various materials from the supply area, the supply unit provides delivery time window for each difference.

V. CONSTRUCTION OF MATERIAL SUPPLY NETWORK CHAIN BASED ON BIG DATA

Based on the construction of the material supply network chain, the construction of the information system is the core. Although our army has been equipped with information technology for a large scale, especially after many upgrading and upgrading, the business information system of clothing business is relatively perfect, widely applied and running relatively stable. However, due to the fact that the information standard of the installed information is not standardized, and the operation of the existing system is not enough, there still exist "fog of demand" and "resource fog". It is necessary to build a more powerful information system for the material supply network on the basis of existing. The core of the informatization construction of the material supply network is to solve the real-time demand, real-time visualization and real-time control of the demand for the clothing supply, and the main construction tasks include four aspects.

One is to build the information data center of the installed strength. The data center contains information about the strength of all units and officers and soldiers related to the supply and supply. At present, we can first rely on the data channel of the military

security card, and establish the 5 level data nodes according to the guarantee link, and store the information of the strength and the capacity of the units provided by the units respectively.

The army to carry out logistic supply strength of monorail system operation, unified maintenance is strength of basic information from all levels of the military security card management office is responsible for the update and transfer to the business sector is only business departments at all levels to manage the human dimensions of information, information and other professional dress size information, together with the clothing distribution records are regularly to the superior strength of data transfer is center. After completing all the construction and operation of the military security card system, the installed strength information data center can be built into a first level data center and synchronized with the data center of the military security card system. In addition to personnel information completely relying on the strength of military security card system upload, body size information, information and other professional information is dress size, can also rely on the military security setting network query terminal card system, according to the person authorized by the officers and men, and fill in the maintenance of self

automatically uploaded to the data center is strength.

The two is to build the information data center of the support resources. It mainly includes the information of potential loading resources, the information of the installed resources and the dynamic change information of the guarantee process. According to the characteristics of the current supply, the information and data center of the installed support resources can be set up at the headquarters, the large units and the three ranks of the army. The collection and maintenance of potential clothing safeguard resources information is done jointly by headquarters and manufacturers. The headquarters is mainly responsible for the maintenance of the related information of the loaded vendor database and the production task assignment, and the manufacturer is responsible for maintaining the production schedule information of the production. Both were security resource information by the warehouse and Quartermaster corps and divisions (brigades) and regimental units responsible for the acquisition.

The dynamic information of the guarantee process is generated automatically by the integrated business information system, which is based on the relationship between the requirements, the

reserve, the production and the guarantee ring nodes. In the near future, the goal of the construction of the information resource support center is to establish a mechanism of timing collection, updating and ensuring resources and information, so as to realize the timely passive maintenance of the information resources of the installed support resources through the demand of the clothing demand. In the long run, the goal of the construction of the data center of the installed support resources is to establish a real-time acquisition and update mechanism for ensuring the resources and information, so as to realize the real-time intelligent maintenance of resources information, and further achieve the dynamic visualization and controllable of the supporting resources of the clothing. The three is to build a universal information data center. General information data is the basic data for security is the core is loaded, the general information data center to provide standardized basic information for the standard is a comprehensive business information system, including basic information supply army unit information, packed material name information, information security is the supply standard is required. The information collection is carried out by the headquarters and is automatically distributed from top to bottom to the subordinate departments at all

levels below the headquarters. The four is to build the integrated service information platform. The integrated service information platform is an important link to connect the three data centers, and is the carrier of the operation of the supply chain information system. Based on the existing business information system, upgrading and upgrading, expanding functions, improving data interface, expanding network functions and developing new subsystems are mainly carried out.

The army is the business information systems research and development of new science and technology as the backbone of organic integration of networking, big data and other elements of the new, the upgrading of existing products and settlement management system was put into production management system, including security, assessment, command and control is loaded security information service and production management is guarantee and quality inspection is a comprehensive business information platform system in one of the four points, the formation of financial readiness plan, financing, production, quality inspection, transportation, storage, distribution and service in one of the old, is the supply chain, and its corresponding information system. Through the supply chain network construction is put in business data based on

Optimization of armed forces is the functions of the Department, the integration of the army is loaded security resources, is the integration of various types of business software, improve the supporting facilities and equipment installed, strive for the next few years, basically reached a "security demand is known, is the distribution of dynamic real-time visual, accurate and controllable, security process at any time on the goal of benefit.

VI. CONCLUSION

With the arrival of the era of big data, how to make use of big data technology to enhance the precision guarantee, fine management and precise service ability has become a hot research topic in the future [12]. In this paper, the complex network analysis and modeling method is used to establish the whole network model of the installed supply based on the business data. Based on this, some optimization objectives are put forward, which can provide reference for further improving the efficiency of our army.

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