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Logistics Network Model Based on Matter Element Node

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Abstract

In this paper, we study the construction of the heterogeneous-nodes logistics network model based on the extension theory and complex system theory. A logistics network model logically based on matter element node, relational element node and event element node is presented. The model is useful for describing the heterogeneity of node, the multi-dimension and the dynamic properties of nodes in the logistics networks. Under the framework of this model, the extension theory can be further used to study the evolution and controlling of the logistics network.

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Keywords: logistics network; Heterogeneous nodes; Extension theory; logistics network Model; Network Basic-Element

1. INTRODUCTION

Theory of complex network research has made great breakthroughs in the 21st century[1]. With the development of science and technology, the network formed in the practical problems increasingly requires the use of complex network theory and technology to research and explore its development rule, to realize the optimization control more effectively.*

The complexity of network node diversity is an important performance or call the heterogeneity, complex networks of nodes can represent anything. Logistics activities can abstract for the node and node chain between the formation of the network, namely the logistics network. Said another way, the logistics network is the combination of network system formed by transportation network and logistics center network, a combination of two elements-- logistics line and logistics node. and in accordance with the difference of configuration, structure, composition, contact information between line and node , form the different logistics networks. Logistics network system refers to a collection of interconnected organizations and facilities in the process of the logistics activity. In common understanding, the logistics network is made up of logistics organization

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network (*O*), logistics infrastructure network *(F*), logistics information network(*I*) , is generic terms of the logistics service network system [2] formed by the organic combination of all three, this is a multiple logistics network system composed of multiple points and lines, including not only the body of the logistics activity (organizational elements), the object of logistics activity (infrastructure elements), also includes exchange of information, capital flow and personnel flow, etc (the information),associated with logistics business. Between each network is not independent of each other, but interrelated and interdependent, combination together to form the logistics network system. Logistics network is the necessity of logistics information, is one of the main characteristics of the logistics activity in e-commerce environment, the inevitable outcome of especially in the large-scale development of Internet + logistics mode currently.

The study of behavior of complex systems should start from how to depict the complex network, or in other words it should start from the description of the network structure and its properties, namely, to establish a complex network structure model, on the basis, to research the network development and evolution, to research on the dynamic behavior and process on specific network structure[3].

Although there are a lot of research both at home and abroad on complex network modeling problem , Xi Yunjiang[4] and other people built standard division. Sheffiy[5] come up with the concept of super-net, and put particular emphasis on the problem about heterogeneous net's interaction and influence. But for characteristics and mechanism of the evolution of heterogeneous nodes complex networks structure needs to further study[6]. Such as how to describe the he terogeneity and internal structure of the node? The internal structure of heterogeneous nodes has what effect on the network structure change? The interaction between heterogeneous nodes are realized through what? Previous studies about network change description mainly focus on the change of the network structure caused by external environment, network structure change of nodes' behavior how to embed the behavior rule of the entire network is little researched, the basic starting point to solve these problems is the heterogeneity and the internal structure description of the node.

Extenics discusses the possibility of matters' extension and rules and methods of innovation with formalized models, which are used to solve contradictory problems[7-9]. According to the theory and method of extenics, express heterogeneous nodes information and relation information. Complex system model based on extenics theory provide well quantitative analysis support to analyze the status of heterogeneous nodes in the network, the structure of interactions relationship between nodes, and the overall network structure characteristics in logistics network. Reshape the logical framework for heterogeneous nodes logistics network with this new view, this will help to explore a new way on the research about logistics network. Offer the possibility to build a comprehensive, objective compositive model, and it can give a deep description about heterogeneous node logistics net. In brief, this paper apply the extenics in the reaserch about heterogeneous node logistics net model.

2. THE REPRESENTATION of LOGISTICS NETWORK NODE

The logic cell of Extension theory is basic-element[10] ,which include matter-element[11], affair-element[12] and relation-element[13].

The array composed of matter O_m n-names of characteristic of, $c_{m1}, c_{m2}, \cdots, c_{mn}$ and the corresponding measure $v_{mi}\ \ i=1,2,\cdots,n$ of O_m about $c_{mi}\ \ i=1,2,\cdots,n$

$$M=\begin{bmatrix} O_m & c_{m1} & v_{m1} \\ & c_{m2} & v_{m2} \\ & \vdots & \vdots \\ & c_{mn} & v_{mn} \end{bmatrix}= O_m, c_m, v_m$$

is referred to as n-dimensional matter-element， wherein