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Research on Logistics Network System among Cities: A Literature Review

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Abstract: Logistics Network System among cities has attracted considerable research attention in the recent past. Despite the growing body of literature on this topic, precious little effort has been devoted to synthesizing the overall state of research on this issue. In this study, an attempt is made to review the status of literature on the logistics network system among cities issue. We classified the related issue into five contents and reviewed, respectively; there are the connotation research, planning theories and methods research, facility location research, spatial structure research and urban distribution route optimal research. Based on these reviews, suggestions for future research are likewise provided.

Key words: Logistics network system among cities, literature review, future research direction

INTRODUCTION

In the recent past, Logistics Network System among Cities (LNSAC) has received considerable attention from logistics scholars, resulting in a plethora of research and writing in this field. The interest of researches in LNSAC should continue as several recent studies suggest that a steadily increasing research interesting in this field (Patier and Browne, 2010; Gonzalez-Feliu *et al.*, 2013). Despite the growing body of literature on this topic, efforts to synthesize the overall state of art of research on this issue have so far been rather limited. The LNSAC concept comes from city logistics and Japan Institute of Logistics is one of the first provided the LNSAC concept, they classified city logistics into three contents: there are LNSAC, inter-city logistics of cities and ending city logistics, respectively. Later, more and more research papers are further researched in this issue, but till now, they isn't any paper synthesize these topic.

As an attempt to fill this drawback, this study presents a review of the major literature and key finds in logistics network system among cities. We classified the related issue into five contents and reviewed, respectively; there are the connotation research, planning theories and methods research, facility location research, spatial structure research and urban distribution route optimal research. Based on these reviews, suggestions for future research are likewise provided at the end of this study. Each of these contents is reviewed in a section and the organization of this study can be seen as follows.

DEFINITION AND CONNOTATION RESEARCH OF LNSAC

One of the challenges in trying to evaluate the growing body of literature on logistics network system among cities is the lack of concept definition. Indeed, little definitions and interpretations can be found in previous literature (Taniguchi *et al.*, 1999). To trace the definition of this issue, we could start from city logistics system which is thought to be the foundation of LNSAC.

The main research findings can be reviewed as follows: The Japanese scholar Eiichi Taniguchi *et al* was one of the first who proposed the definition of city logistics in the 1st conference of city logistics, he (Taniguchi, 2001) thought city logistics is an optimal process of enterprise logistics and transportation activities within urban system which considering the traffic environment, traffic congestion, energy waste and some other related factors. Professor Cui (2003) thought that city logistics is a kind of regional logistics to meet the demand and characterizes of city's economic development under certain administrative planning conditions. Extend the definition of this concept he proposed in 1999 and 2001, they Taniguchi and Thompson (2002) also thought city logistics is also affected by inner production (include the productivity), production flow and the exchange between inside and outside. Later (2004) Taniguchi *et al.* extend this concept again from city transportation optimization angle; they (Taniguchi and Thompson, 2004) thought that the goal of city logistics is to improving the core completion of cities by advanced information

technology, it not only optimize the logistics and transport activities, but also strive to reduce the city traffic congestion, traffic environment pollution and other negative impact of our cities. Russo and Comi (2006) thought that city logistics can be divided into three different modes considering the economic influence factor, the industrial structure influence factor and the city logistics infrastructure factor which are outputting model, consumption model and comprehensive logistics model. Chinese scholar Shu-Fang LI also holds this view (Li, 2007).

As we described above, Japan Institute of Logistics is one of the first provided city logistics concept, they classified city logistics into three contents: There are LNSAC, inner logistics of cities and ending logistics of cities, respectively. HUA Fang-Ling proposed his opinion in his book named logistics structure, he thought that the city logistics demand objectives' demand characteristics can be summarized as follows (1) For city distribution, the growth radiation range of cities and the rapid development of business format improved the demand of city distribution logistics, (2) For regional logistics in metropolitan areas, the formation of metropolitan area or city group is a major trend in the process of civilization, the logistics activities develop from inter-city to among the cities comes to an important part of city logistics, (3) for province and inter-city logistics, modern cities has incorporated into multi-level economic zone, so as to this, province and inter-city logistics plays an important role in promoting the exchange of cities in different regions and (4) For international logistics, the internationalization of city economic promotes the development of international logistics (Hua, 2001).

As we can see from previous results, review the scholars can't make an agreement in city logistics concept and there isn't any valuable study proposed the ULSAC concept. The current definition of city logistics concept is mainly from the view of function point and the research on city logistics function are mostly focused in the following point (1) To meet the demand of city live and economic development, (2) To solve specific city logistics problem, such as traffic congestion, air pollution and energy consumption, etc. and (3) To meet the important role of city's economic development and competitiveness improving.

According to the review above, we can see that, to propose a valuable and accurate concept of ULSAC seems especially important.

PLANNING THEORIES AND METHODS RESEARCH OF LNSAC

In planning theories and methods research field, there are many related research papers and the scholars have achieved fruitful findings.

In planning theories research field, O'Connor *et al.* (2010) constructed the city logistics theory structure by considering the relationship between supply chain management, industrial cluster and the space of new city industrials. Taniguchi *et al.* (2003) thought that city logistics planning should be consistent with city planning, it should be demand-oriented and the logistics resources should be integration and form a complementary advantage. Köhler U *et al.* conducted an further research on Taniguchi E's, they deeply analyzed the process of city logistics planning, they thought that different logistics supply subject plays different role in city logistics (1) For signal logistics service provider, it provides single but professional logistics service for its customers, (2) For integrated logistics service provider, it integrates varieties of logistics service to meet varieties forms of service require, not just one single kind of professional service and (3) For large-scaled logistics service provider, the service ability and level increase with the increases of logistics service providers' integration level (Kohler and Groke, 2003). Later, Crainic (2008) explored the city logistics developing issue by analyzing the relationship between city logistics developing and regional economics and he also analyzed the developing process of city logistics by system dynamics. To city logistics developing issue, Tong (2002) thought the evaluation index system of regional logistics development mainly reflected by the following 4 aspects: Modern logistics demand indicators, modern logistics supply indicators, modern logistics environment developing indicators and modern logistics performance indicators.

In methods research field, Rogers and Tibben-Lembke (1999) analyzed the network and management system of reverse logistics. Taniguchi and Nemoto (2001) proposed a green logistics strategy to optimize city traffic by developing intelligent transportation and E-commerce. Awasthi and Proth (2006) discussed the city logistics decision model by system dynamics by analyzing the comprehensive goods movement, vehicle allocation, transportation environment and other factors. Crainic *et al.* (2009) emphasized the relationship of urban distribution system and the urban economic development; they introduced a two-track distribution structure to evaluate and plan the city distribution system and this method provide a new version to research on LNSAC planning.

As we described above, the research on this field has achieved fruitful findings, but as we can see, these research papers are mainly focus on city logistics developing strategy, there isn't any valuable study researching on the planning theories and methods of different type of cities or among cities.

FACILITY LOCATION RESEARCH OF LNSAC

Facility location research of LNSAC can be specific into distribution center, logistics Park, supply hub and other specific logistics facilities. The previous research on logistics facility location were mainly by the method of Analytic Hierarch Process (AHP), genetic algorithm, integer programming, grey correlation analysis, the improved analytic hierarchy process and fuzzy evaluation method. In addition to these traditional methods, many scholars have improved these methods and innovated new methods.

Davis (2011) researched the logistics facility location issue by web GIS method; he introduced the storage cost, processing cost, construction cost of facilities to construct the location model. To this issue, Chinese scholar Ji *et al.* (2009) also made an in-depth research, he introduced some additional variables to calculate the model; there are the rent, slop, inventory and some other factors, respectively. Later on this, Kaundinya *et al.* (2013) further studied this issue; he proposed the structure of city logistics system based on GIS and the optimization model of distribution layout and then he put forward an alternate location method to solve this model which provides a new way to improve city logistics system planning. Zapfel and Wasner (2002) made a research on facilities layout planning, transportation routing by constructing the city logistics model, transportation system, supply and demand model and impacting model, he also evaluated various options and proposed the city logistics resources integration concept to maximize the value of city logistics. Melo *et al.* (2009) introduced 9 basic facilities location model, such as linear programming, integer programming, dynamic programming and some others, the goal of these models are to minimize the total location cost and the difference between these models are mainly the object function. Awasthi *et al.* (2011) discussed the logistics distribution center location network concept, he constructed the coordination analysis model of logistics distribution center network scale and economic development and he also proposed a method to calculate the coordination coefficient. The research by Awasthi *et al.* was based on Fisher (2002) classification of distribution center which are production distribution center, consumptions distribution center and transportation distribution center. Considering the particularity of Chinese distribution center location, professor Cui (2003) thought that distribution center location in China should not only consider the basic factors, such as logistics scale, customer demand, transportation, logistics, capitals or marketing, but also should consider the regulation of government.

By reviewing these research literatures, it is concluded that, although many scholars of domestic and abroad researched on the logistics facility location issue of inter-city logistics and they have achieved fruitful findings, but as we can see, little effort has been devoted to research the logistics network construction among cities. It left over a large exploration space of multi-level and multi-node facility location problem of logistics network system among cities.

SPATIAL STRUCTURE RESEARCH OF LNSAC

Scholars have explored the spatial structure from city planning, geography angles and they have already put forward many innovative algorithm, these researches can be extend to spatial structure of LNSAC research. So, review these literature has a significance to LNSAC spatial structure.

Wu (1999) analyzed the researches, theories and findings of city spatial organization since the middle of 20 century and he also made some attempt the fill the research blank on the evolution research from city group to metropolis. Adams (2012) pointed out that social attribute is an important aspect of city spatial structure and topology is a very effective method to analyze its structure, in topology theory, we can calculate the quantification relationships between city morphology and social activities by conversing the structure between these groups, it has an important significance in exploring the complexity and self-organized feature of cities though this structure is static and graphic. Later, Anand *et al.* (2012) pointed out that city logistics is a professional aiming at solving the city freight traffic problem in its sustainable development, one of the most important characteristic is the heterogeneity among stakeholders, city logistics concerned more about public managing and public interest, so in order to achieve the optimal balance between private interest and public interest, it is necessary to predict the behavior of different groups of city logistics network layout decision. To this issue, Professor Xu and Ju (2008) pointed out that city economic development has a strong relationship with city logistics and the development of city logistics need the support of logistics network system, he also thought that construct the city logistics network system is the inevitable requirement of city industry and commerce developing, is the inevitable requirement of city competitiveness, is the inevitable requirement to integrate logistics resources and is the inevitable requirement to realize the logistics industry intensive developing, he also pointed out that constructing city logistics network system, reasonable logistics facilities planning and spatial structure is very

important, it can promote the coordinated operation, orderly competition, strengthen the construction of logistics information network system and the organization. To construct the spatial structure, some scholar established a very special model named city underground tree logistics network layout model by simulating the plant growth, this model can get the optimal spatial structure by simulating the growth process of artificial plant, at the end of his study, they compared the solving results with genetic algorithm method and annealing algorithm method by calculating the STEINLIB laboratory data (Li *et al.*, 2012).

There are many other valuable papers on this issue, the above literatures are some representative studies, but as we described before, these literatures are not explicitly toward LNSAC spatial structure, but it can be extend to the spatial structure of LNSAC research.

URBAN DISTRIBUTION ROUTE OPTIMIZATION RESEARCH OF LNSAC

Logistics scholars have achieved fruitful research results of inter-city logistics and between-cities logistics optimization, although the gist of this study is not research on the route optimization, but these researches are of great significance to LNSAC, especially the methods in these papers. So, we carried out a literature review on this issue, hoping that it can help studying logistics network system among cities.

Button and Pearman (1981) first put forward the economic factors which affect the city transportation. Later, Noortman (1984) started to research the distribution problem. He and Crainic (1999) proposed the basic principles to solve city traffic congestion problem. Taniguchi *et al.* (2003) proposed a view to construct the logistics system of sustainable developing cities. Stephen *et al.* (2005) deepen this view and his study focus on the discussion between city freight transportation and city economic vitality maintain. Eiichi Taniguchi *et al.* (1999) proposed a method to simulate the dynamic traffic of city logistics, this method can evaluation accurately of the total transportation costs and carbon dioxide emissions by analyzing the route, time and total freight volume. Hu and Sheu (2003) optimal the city distribution route by classifying the customers with fuzzy cluster analysis method. Later, Sheu (2006) made a further research on this issue; he designed a dynamic logistics resources allocation method based on fuzzy cluster and fuzzy ranking of customers, this method is based on 5 process of city logistics which including demand attribute description, customer groups, customer groups ranking, container allocation and

vehicle allocation, the final simulation results showed that the total operation cost and average turnaround time is reduced by 27.4 and 8.7%, respectively. Jesu's Munfiuzuri *et al.* (2005) proposed a relation between city communities based solutions, they have proved the efficiency of this model by simulation. Gentile and Vigo, (2006) first proposed the city freight distribution demand model and later in 2009, they extended this research, they proposed a movement generation models and trip distribution models based on category index models and gravity models, this model can realize the optimization path between different cities, it have been proved by applying to solve the city distribution route optimization problem between Emilia and Rome Nirvana (Gentile and Vigo, 2007).

CONCLUSION AND RESEARCH IMPLICATIONS

By the above literature review, it can be concluded that:

- There is no unified academic definition of city logistics, nor the connotation of LNSAC, current researches on this issue are mainly focus on city logistics from economics, ecology, transportation, economic geography and regional economics aspect, these researches on city logistics and city logistics system laid a solid foundation for LNSAC researching, further research should concentrate more on related theories
- Current research on city logistics mainly focus on logistics facility location and distribution network planning by static programming, dynamic programming, system engineering method and there are a certain amount of papers discussed the form of distribution network and its route optimization. However, city logistics is a large and complex system; signal facility layout and terminal distribution network construction only belong to local system optimization. Therefore, further research should concentrate more on the whole system and the spatial structure researches await deep studies
- Previous literature considered the relationship between city and economic, city logistics and regional economics. These researched studied the effect of single city economic on logistics, studied the connection issue between city logistics planning and surrounding regions as well as the effect of city logistics planning on surrounding regions. These issues are the external effects factor and constraint condition of city logistics network construction and which provide research ideas to LNSAC. However, as

we can see from previous literature review, there is no literature that clearly and comprehensively exposed the construction elements of city logistics network and its hierarchical framework, it left over a large exploration space on this issue

- Previous literatures studied the city logistics developing planning issue from strategic and conceptual level and the scholars put forward the sustainable development and green planning concept which is of some reference significance to LNSAC. However, the concept planning of city logistics network should be refining and turned to quantization gradually. Further research should be continued along this way

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