

Constructing Xi'an International Freight Hub of Silk Road Economic Belt

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Abstract. The Xi'an freight hub node and operation status are sorted out. With the purpose of breaking through the existing limitations and adapt to the development needs of the Silk Road Economic Belt, the paper proposes a Xi'an international freight transportation hub with "one center + two carriers + four channels". It elaborates on four aspects: freight demand analysis, freight hub composition, layout and supporting system. It is helpful to provide useful suggestions for improving the international strategic position of Xi'an freight hub.

Introduction

Xi'an is an important node and hub city in the economic zone of the Silk Road. It has a core strategic position and carries the important mission of opening and large circulation of Xi'an to the west. It highlights the irreplaceable position of freight transportation hub and lays its foundation in both geographical location and development strategy. It is necessary to make full use of the new economic growth pole cultivated by the economic zone of the Silk Road Economic Belt and the opportunity of the construction of the Shaanxi Free Trade Zone to expand Xi'an's comparative advantage in the Silk Road Economic Belt and become an international trade logistics and financial center for Central Asia. Meanwhile, it is good for integrating the high-quality resources of the international transportation network. Forming a sound international logistics channel and building a platform for industrial development and factor agglomeration have important practical significance.

Literature Review

The hub location problem study originated from O'Kelly (1986, 1987) [1-2], and it was defined as a secondary heuristic based location model and classified as an NP-hard problem. Subsequent scholars have carried out research in the perspective of site selection model formulation and solution algorithms. To extend the heuristic algorithm, Klincewicz (1991) [3] used local neighborhood search to study the cluster node location model solution. For the first time, Campbell (1994) [4] used the "P-hub median" to describe such problems and assigned new definitions to variables by means of linear programming. Ernst and Krishnamoorthy [5] used a mixed integer programming model for analysis. Rafay Ishfaq and Charles R.Sox (2010) [6-7] constructed a multimodal transport hub location model considering three modes of road, rail and air transportation, and solved the problem with the tabu search algorithm. Rodriguezav et al. (2007) [8] constructed a central and branch network freight hub location model; Racunica, I. [9] established an optimization model to increase the multimodal rail freight volume in the spoke-type freight network. The review of Farahani, RZ et al. [10] summarized the variables of the hub location, including network type,

continuity and discrete type, and summarized the mathematical model, the algorithm, the main norms and practical applications with detailed length.

At present, domestic research on freight hubs mainly focuses on the following four aspects: hub size forecasting method, station layout method, hub layout model and cargo hub site selection problem research. Yao Zhigang [11] selected the passenger and freight volume of 221 prefecture-level and above cities in mainland China in 1998-2004 to explore the geographical distribution and scale agglomeration characteristics of their cargo hubs. Zhao Peng and Zhang Jianpeng (2013) [11] analyzed the layout of the freight hub in Xi'an, studied the comprehensive traffic planning of the Xi'an freight hub, and proposed the formation of the main skeleton of the "three rings and two links". Li Yuan and Zhang Jiefei (2015) [12] analyzed the current situation and problems of Xi'an freight hub based on the strategic background of "One Belt, One Road" and put forward the development countermeasures for the construction of an integrated three-dimensional transportation hub in Xi'an. Zhang Xinsheng, et al. (2015)[13] analyzed the necessity and feasibility of the International Transit function of Xi'an inland port Hub from the perspective of expanding the hub and port area of the hub and attracting sources of supply, it proposes a path analysis and countermeasures for reference in the inland areas.

In summary, domestic and foreign research on freight hubs is not uncommon. More developed, commonly used methods are elastic coefficient method, time series method, linear regression method, etc.. However, from the perspective of the economic strategy of the Silk Road Economic Belt and the requirements for the construction of the Free Trade Zone, the concentration and scope of freight traffic will inevitably change accordingly. The Xi'an freight transportation hub is in the new opportunity. The strategic position of Xi'an International Logistics has not been fully considered, and there is still a lot of work to be carried out.

Status and Development Goals of Xi'an Freight Hub

Status of Xi'an Freight Hub

At present, the road, rail and air transportation in Xi'an is a national hub level, but they have not formed an effective linkage. The overall efficiency of the entire freight system is not high, and it does not have the proper forward-looking and guidance for economic growth and urban development. This can be showed by the following table with the freight volume of various modes of transportation in Xi'an for the past five years:

Table 1 List of Freight Volume of Various Modes of Transport in Xi'an

Item Year	Total Cargo Transportation(10000 tons)	Road[10000 tons]	Rail[10000 tons]	Rail[10000 tons]
2013	50118.82	49243.00	857.93	17.89
2014	42038.55	41120.03	899.87	18.64
2015	46269.72	45401.00	847.56	21.16
2016	23888.03	23011.00	853.66	23.38
2017	25496.62	24477.00	993.63	25.99

(Data Source: Xi'an Municipal Bureau of Statistics)

According to the literature [11], the cargo hub of Xi'an can be divided into three categories from the aspects of the function of the cargo hub and the cargo handling capacity.

Table 2 Existing Freight Center in Xi'an

Item Level	Level Standardization(In term of throughput capacity)	Hub Function	Hub Name
The first	Railway \geq 10 million tons ; Highway \geq 3 million tons; Airport \geq 1 million tons.	Serving the international and national area;	Rail: Xinzhu Logistics Center;
			Road: Jinghe Logistics Center, Xi'an Highway Port, Liucunbao Logistics Center, Dongying Logistics Center, Best Freight Market, Huaqing Road Freight Hub, Majiagou Logistics Center, Hechizhai Logistics Center, Chang'an Freight Hub;
			Air: Xian Yang International Port
The second	Highway \geq 1 million tons	Serving the regional area;	Road: Sanqiao Freight Hub; Asia-Europe Freight Market;Jutong Logistics Center;Shuangsheng Logistics Center;Changlong Freight Market;;Sanli Logistics Center
The third		Serving the city's internal freight services and areas	Rail: Xianyang North Comprehensive Freight Yard;Xi'an South Comprehensive Freight Yard;
			Road: Gudu Logistics Center;Puhua Logistics Center;Huada Freight Market;Zhongsen Shuiye Freight Market

Xi'an Freight Hub Development Goals

The freight transportation and related activities of various hubs are disconnected from each other due to transportation organization functions. The freight quotas of various transportation modes are not reasonable, and there is no institutional mechanism for coordinated operation. The transportation and distribution functions of the goods are inefficient and the radiation range needs to be further improved. The Xi'an freight hub needs to be upgraded in the following aspects:

Taking full location advantages of existing hubs

Most cargo hubs do not interact with the regional economy, making their location advantages fully used. For example, the textile city truck hub station is close to the Xi'an National Civil Aerospace Industry Base, but it has failed to drive the industrial development of the region because the planning and construction of the hub station is not in place. This means causing waste of resources and more likely to cause resistance to industrial development.

Enhancing the Radiation Capacity of Existing Hubs

All of the three major transportation modes don't have an enough radiation range, which is one of the reasons for the weak cross-regional relationship and the less open economy of Xi'an. Taking air transportation as an example, the Chengdu Shuangliu Airport in the northwest region has a cargo

throughput of 611,600 tons in 2016. Chengdu International Airport has opened 104 routes and maintained a leading position in the central and western regions. In contrast, in the context of the “Silk Road Economic Belt”, Xi’an’s international routes are so less that they have not been able to connect with the countries along the “Silk Road Economic Belt”, so the aviation core hub functions are not available.

Strengthening the interconnection and linkage of various modes of transportation

It can be seen from Table 2 that although Xi'an already has the status of national freight hub, there is a lack of connection between various modes of transportation. The distribution of freight hubs is scattered, and the railway container business can be handled in Xinzhu, Xi'an west, Xi'an East and other stations. The transportation capacity and organization of the overall freight system have not adapted to the development strategy of the Silk Road Economic Belt. Therefore, a freight expressway between the stations should be established to make all kinds of ways to connect as soon as possible and achieve smooth flow of goods and rapid distribution.

Improving the linkage Mechanism As soon as Possible

From the perspective of organization and management, we should actively introduce a series of industrial support policies in order to promote the freight hub to get rid of the development dilemma as soon as possible and cultivate the industrial development of the Silk Road Economic Belt. It can start with improving the modernization level of the freight hub operation, and open up the upstream and downstream logistics services of the industrial chain. The linkage mechanism and system between the major modes of transportation eliminate barriers and improve the overall capacity of the freight system.

Enhancing the international status of the cargo hub

The blueprint depicted in the National Strategy of the Silk Road Economic Belt is to open up the Eurasian continent. Therefore, whether it is Xi'an international inland port or the airport, it must take on the heavy responsibility of communicating with Asia and Europe. And the new Eurasian Continental Bridge and the airport economy industry should be truly utilized so as to promote regional economic development, enhance foreign trade strength and enhance the status of Xi'an freight hub as an international transit hub.

Xi'an International Freight Hub Construction Plan

The planning is based on the layout and operation status of Xi'an freight hub node and the need to make up the short board and combine with the construction of the Silk Road Economic Belt. The basic theory of hub planning is used, with the comprehensive consideration of domestic and international freight demand, industrial layout, sustainable development and opening up. The study on the layout planning of Xi'an International Freight Hub should mainly include the following aspects.

Analysis of International Freight Demand in Xi'an City

The instructions for the demand analysis include the “One Belt and One Road” strategy, the national “13th Five-Year Plan”, the “13th Five-Year Plan” of Shaanxi Province, the “the Overall Urban Planning of Xi’an” and the “Study on the Overall Planning of Xi’an Comprehensive Transportation Hub”. The basic conditions and development environment for setting up Xi’an International Freight Hub need to be discussed from the perspective of the economic and social development status and transportation status respectively. On the other hand, freight station adaptability and logistics demand need to be considered as well. The influencing factors of Xi'an international freight demand changes under the new situation and policy orientation should be focused on by comparing the limitations of traditional freight network layout and traditional

logistics mode, the gray forecasting method can be used to predict the freight volume of modern logistics system and international freight hub.

Research on the Composition of Xi'an International Freight Transportation Hub

On the basis of the forecast of the previous freight volume, the functional composition of Xi'an International Freight Transportation Hub can be further studied. The Xi'an International Freight Transportation Hub will be planned as a "one center + two carriers + four channels" mode among which the international freight forwarding center acting as the center, and the two carriers are inland ports and airports. The four passages are rail transport lanes, road transport lanes and air transport lanes, as well as information channels.

①The international freight forwarding center not only needs to provide the cargo platform of materials in Xi'an, but also realizes the effective connection between the cargo and transportation resources within and outside the province. The center will make full use of the strategic position of Xi'an internationalized metropolis and build an important channel for interconnection between inland areas, inland and coastal areas. Freight sources is expected to be effectively expanded, the freight network will be significantly revitalized to achieve effective synergy in multiple markets.

②Inland port and airport are important gathering places and outputs for international cargo transportation in Xi'an, and have played a vital role in the international freight transportation hub of Shaanxi. How to make them a bridge connecting inland areas with coastal ports and border crossing ports, a window for foreign trade, and an engine for export-oriented economic development needs to be thoroughly explored and analyzed.

③The construction of rail, road and air physical transport corridors provides the most basic and important transportation resources for international freight transportation hubs. Therefore, it is significant to explore how to make full use of the advantages of modern container transportation, practice green transportation concepts, and vigorously develop intelligent transportation and Cold chain transportation. Finally, the efficiency of various modes of transportation is enhanced and seamless links to each other can be achieved.

④Information channel is the core of Xi'an international freight transportation hub. The application of "Internet + Logistics", information, mobile internet, big data and other technologies can promote the construction of international logistics channels, expand logistics needs, and promote the construction of resource-concentration and platform-based projects.

Research on the Layout of Xi'an International Freight Transportation Hub

The layout plan is further studied in details based on the constituent modules of Xi'an International Freight Transportation Hub. The layout model is used to obtain the layout plan, so that the distribution function of the freight yard can be fully utilized, the service field can be expanded, and the efficiency of cargo transportation can be improved. The focus is how to re-examine the positioning of logistics nodes under new requirements and constraints. Formulating the layout principle and layout plan of Xi'an international freight transportation hub before the practical construction. Next, the function and scale of logistics nodes are determined. Lastly, according to the number of functional areas, the cost per unit distance, the flow of goods between functional areas, the degree of association between functional areas, the area of the application model is laid out.

Xi'an International Freight Transportation Hub Support System Research

Not only the scientific planning and rational layout are important for the normal operation of the freight transportation hub, but also support system. First of all, all aspects should meet the normative understanding of the freight hub; secondly, specific support conditions for the support project need to be created, the system limits are to be reduced. Also, the organization are to strengthen the pre-project guidance and management, having more attention on service standards and operational supervision.

Conclusions

The economic development demand of the Silk Road Economic Belt is accompanied by the increasing cargo volume and the increasing demand for multimodal transport. It also exposes the drawbacks and limitations of the original freight hub. Starting from the international freight demand, the composition and layout of the Xi'an international freight transportation hub under the model of "one center + two carriers + four channels" was discussed, and the safeguard measures and conditions were briefly pointed out. It is hoped that the Xi'an international freight transportation hub will be built as soon as possible. It is clear that the current study is not enough. So, further analysis is needed on how to form a more efficient and orderly intermodal freight network and to smoothly upgrade the freight hub to meet the freight demand.

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