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Optimal route selection of container multimodal transport between Asia and Europe

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ABSTRACT. *In the route planning of international multimodal transport, it is impossible to design the optimal route simply by taking the minimum freight as the standard. Under the assumption of "rational economic man", considering the increasingly high depreciation rate, high yield rate and high capital occupation rate of goods, the relationship between the value of goods and transportation time is increasingly close. Therefore, the time value function model of goods is constructed and the empirical analysis of Tokyo Duisburg route is carried out.*

KEYWORDS: *Multimodal transport, Time value of goods, China Europe train*

1. Introduction

The significance of international multimodal transport is to realize the optimal overall benefit of cargo transportation. I Therefore, applying the theory of time value of goods to international container multimodal transport is a necessary supplement to the existing research.

These time values are not unimportant to both sides of Asia Europe trade, especially to Japan Europe trade. The goods in bilateral trade are characterized by high yield, high insurance rate and high depreciation rate. Therefore, in order to save freight and avoid the depreciation of goods, capital occupation and extra costs caused by the long transportation time, the Asia Europe Container Multimodal Transport Route Based on the China Europe train has attracted extensive attention of Japanese and Korean enterprises, and European enterprises have gradually considered "China Europe train shipping" as the first choice for carrying out cargo transportation with Japan and South Korea.

Cui Mingyang classified the goods with different value characteristics and analyzed the time value function, established the optimization model algorithm and model of multi container intermodal transportation and solved the model [1]. Yang

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Xiaoqiang combines the traditional VRP model to establish the multimodal transport optimization model for the combination of transportation route and mode, and seeks the optimal combination through hybrid algorithm [2]. Based on the mode of transportation, Zhao Yiran constructed the generalized transportation cost including transportation, inventory cost, opportunity cost and depreciation cost [3].

2. On the theory of time value of goods

Under the assumption of "rational economic man", the ultimate goal of decision-making subject is to maximize their own interests. In the decision-making of transportation route, both shippers, customers and third-party logistics providers will choose or provide the scheme which can make the transportation cost the lowest, the time shortest and the profit maximum.

In the past, it was generally believed that the lowest cost means the largest profit. However, with the individuation of transportation demand, the diversification of goods and the influence of various factors from the macro environment, such as market competition between supply and demand, technological upgrading and so on, the value of any goods in the process of transportation is always fluctuating, not unchangeable, and usually shows depreciation; warehousing, insurance, etc. during transportation. It will also consume and occupy certain funds. In addition, the long transit time will also affect the expected income and capital flow of both parties. The above expenses or loss of value due to time belong to the time value of goods

3. Current situation of Japan Europe Container Multimodal Transport Based on China Europe train

Since the successful operation of the first China Europe train in 2011, by the end of October 2019, the total number of China Europe trains has exceeded 20000.Even in the first quarter of this year, a total of 1941 trains and 174000 TEUs were operated by China Europe trains, with a year-on-year increase of 15% and 18% respectively, and the comprehensive heavy container rate reached 98.1%.China's "iron and steel camel team" is becoming more and more mature and moving towards competition and cooperation. It has become an important carrier connecting economic and trade exchanges between Asia and Europe and undertaking material transportation.

At present, there are 71 domestic cities operating the China Europe train, connecting 67 cities in 19 countries through three transportation channels and the first and Second Eurasian Continental bridges, with 69 lines running.

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4. Case analysis

4.1 Case introduction

According to a news release provided by Japan express, a large Japanese logistics enterprise, the transportation cycle from Tokyo port to Duisburg will be shortened from 40 days to 28 days under the condition of international container multimodal transport based on China Europe train.

This paper selects Tokyo port as the starting point and Duisburg as the terminal point, finds the shortest path through genetic algorithm, and substitutes it into the model to solve the time value of goods.

4.2 Results and analysis

Through MATLAB software, genetic algorithm is used to solve the problem. The population size is 200, the maximum iteration number is 100, and the crossover probability and mutation probability are 0.8 and 0.3, respectively. The shortest transportation route is Tokyo - Ningbo - Wuhan - Duisburg, in which road transportation is adopted except for Japan - China shipping and Sino - European trains. The whole journey time is about 21 days; it takes 3 days to transfer three times; and because the liner transportation and China Europe train can’t follow the same way as road transportation, so after calculation, this route also has a constraint time window of at most 2 days. In summary, the whole journey time is about 26 days.

The time-saving value of goods calculated by the model is about 816100 yuan.

5. Conclusion

Based on the background one is taking more active one in the "one belt, one road" construction, the article analyzes the value of time of goods and the value of cargo time from three aspects, and takes the shortest time value model of freight transportation time. Taking the Tokyo Duisburg line in Japan Europe container multimodal transport as an example, the shortest path is obtained by genetic algorithm, and the time value of goods is calculated by the model, which shows the influence of time value of goods in practice, so as to provide reference for the route planning of multimodal transport between Asia and Europe.

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