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Study of technical support of operations research theory for rational calculation of logistics transportation costs in practice

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ABSTRACT

The scientific calculation of logistics transportation costs can lay a solid foundation for the developing road of logistics enterprises, so as to enhance the brand competitiveness of logistics enterprises. In this study, first of all is the modeling of logistics transportation process with operations research theory, and then is the specific analysis of the model. In this process firstly give an effectively introduction of logistics enterprise transportation process to further clarify the specific transport process of logistics enterprise. Secondly give an effective introduction of the entities and attributes of logistics transportation system to further show the constituent elements of attributes between entities. Finally is the corresponding discussion of the main structure of logistics transportation process model construction, and to specifically study the construction elements by the establishment of the target model and the cost calculation of outsourcing and insourcing transportation process in the model. The next part is the effective establishment of the transportation costs calculation model, to have a scientific exploration of the outsourcing transportation cost calculation process and insourcing transportation costs calculation model for effective control of transportation cost. Finally, there is a concrete analysis of transportation cost optimization, but also a specific optimization program of transportation cost calculation for the traditional logistics enterprises. This is the main idea of this study, from which can clearly see that the main objectives and contents of the study.

KEYWORDS

Operations research theory; Logistics transportation costs; Calculation model; optimization model.

INTRODUCTION

From the perspective of operations research theory, how the logistics enterprises can find the best cost control calculation method is of great significance. In this study, mainly discusses three parts namely analysis of logistics transportation process modeling, transportation cost calculation model and analysis of transportation cost optimization, so that the paper can be more scientific and reasonable, at the same time have a positive impact on the realization of scientific development of logistics enterprises.

ANALYSIS OF LOGISTICS TRANSPORTATION PROCESS MODELING

Before modeling the logistics transportation cost, the basic process of logistics transportation should be fully and effectively understood, and then based on the corresponding transportation process to effectively write the simulation program[1]. In the research and exploration of this paper, there is an introduction of the basic process of model construction by diagrams, in order to have corresponding analysis of specific elements of the logistics transportation cost modeling.

Analysis of logistics enterprise transport process

In the study of logistics enterprises transportation cost modeling, firstly is an effective summary of the whole transportation process of the logistics enterprises, to list the main steps in transportation process, from which show the cost of each step elements involved, and the concretes are shown in Figure 1.
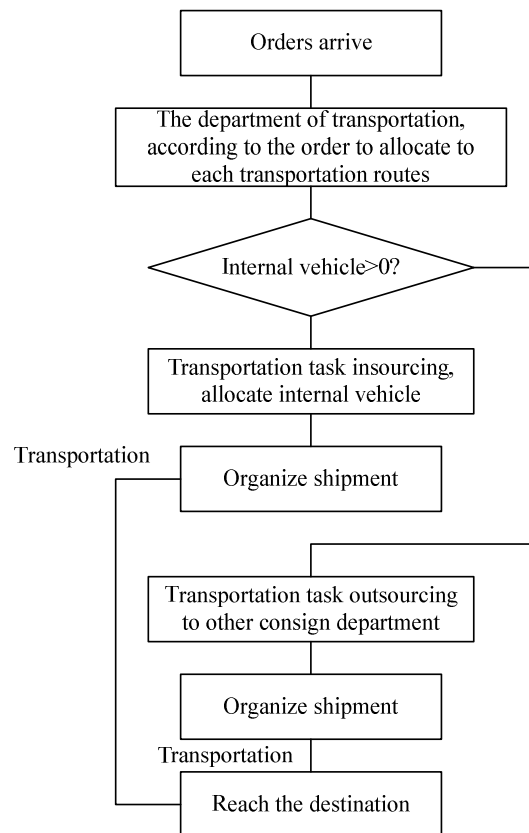

Figure 1 : Transportation process

It can be intuitively seen from Figure 1, general process of logistics enterprise transportation is that the business department received orders then immediately forwarded to the department of transportation, after that, according to the specific needs of the order, the department of transportation will make appropriate arrangement for transport vehicles to meet the practical needs of the order. However, if the vehicles of logistics enterprises are insufficient, the department of transportation will contract the order to other consign department to complete the logistics transportation. After the safe arrival of the consignment, the transportation task of the order is completed. In this process, logistics transportation enterprise do not take a full consideration for how to make reasonable arrangement, how to use their own internal vehicles, and for establishing a more convenient transportation route, so that within the logistics enterprise the cost of transportation has been increasing[2]. The following part is discussion mainly on model of logistics enterprises transportation costs, and also a further analysis of the results of the calculation model, so that the logistics enterprise transportation process may have a

corresponding optimization, at the same time may have a positive effect on effective control of logistics enterprises transportation cost.

Entities and attributes in logistics system

For some relevant entities involved in the logistics enterprise transportation process, the attributes of the entities determines the logistics transportation costs, and the specific entity attributes are as follows:

Attribute of the goods

This entity attribute mainly covers the specific weight in the process of picking up goods every time, and the number of the weight is a concrete stochastic index of probability distribution function.

Attribute of outsourcing transportation

This entity attribute mainly contains the needed cost in transportation outsourcing of each time, and the cost is another stochastic index of probability distribution function.

Attribute of the vehicles

The entity attributes mainly include (1) every time, in the process of goods transportation, the attributes of the situation, the cost and the specific value of the road toll are stochastic index of probability distribution function. (2) The vehicle insurance, vehicle maintenance, and the corresponding specific cost and so on should be calculated. (3) Specific efficiency of the vehicle. These costs are stochastic index of probability distribution function.

Attribute of the driver

This entity attribute mainly reflects in the driver's salary of the year.

Proposal of the model

In this study, through the further calculation of the logistics enterprise transportation cost, at the same time a corresponding simulation model of logistics transportation process should be established. In this model, the basic process of logistics transportation can be adequately expressed from the pick up of the goods from logistics enterprises, transport the goods to the destination and return in a time the entire process. In this process, the transportation cost produced by logistics enterprises need an effective calculation, including specific cost of goods loading, minimum consumption cost in the process of transportation, etc. And for internal transportation of logistics enterprises, first of all, should have a corresponding calculation of the total number of vehicles and the efficiency of vehicles within the enterprise, at the same time concluded the loading fee produced in the process of goods transportation within logistics enterprise and specific values of transportation consumption costs. On this basis, through the differences existing between using efficiency of different vehicles to calculate the specific cost required for vehicle maintenance, use tax required for the using process of vehicles, insurance, and the drivers' specific salary, etc, these are the components of internal transportation costs of logistics enterprises, after which the different cost between different vehicles can be fully reflected, and the optimal solution of internal transportation cost can be clear shown[3].

Target of the model

The simulation model construction process of logistics transportation cost calculation model and its basic idea are clearly shown in Figure 2. In the basic construction process of simulation model, the main target is that on the basis of arrival of orders into the enterprises transportation process and the corresponding completion, to scientifically and effectively analyze the operation situation of internal vehicles in enterprise and effectively analyze the corresponding change. In this process, the model application will have an effective calculation for transportation costs of internal logistics enterprise, and according to which to have further establishment of the most efficiency vehicles. At the same time, the specific costs as well as related fees in outsourcing transportation task of logistics enterprise will also be able to get a more accurate calculation in the model program, so that the cost of outsourcing transportation task can be further reflected.
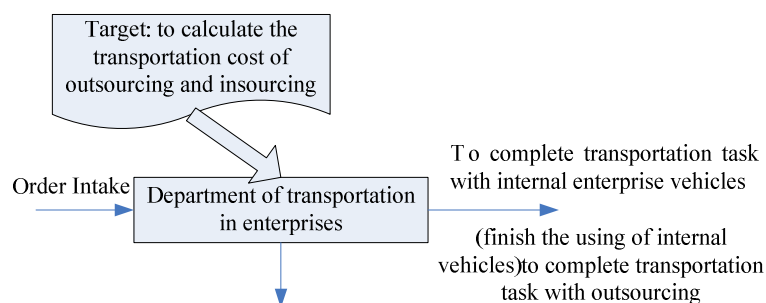

Figure 2 : Basic idea of simulation model

The simulation model can also be called the calculation model of logistics transportation cost, and on the basis of this model, by effective comparison between different transport routes and comparison between logistics enterprise internal transportation cost and external contract, the transportation routes of internal logistics enterprise can be more effectively established. In logistics transportation process, first of all is specific study on advantage route on the basis of the meeting of requirement for internal transportation of transportation enterprise, then calculated for costs of different transportation routes, to sum up the gap between costs, so that the selection between transportation routes of internal logistics enterprise will be more clear, and the arrangement of the vehicles will also be able to meet the reasonable requirements[4]. In order to achieve this purpose, in the usage process of the model the interface of internal logistics enterprise vehicles need to be reserved in advance and the interface of usage efficiency need to be effectively reserved. In this process, the two interfaces are set to an initial variable, during the entry process, manual entry or automatic entry are both allowed, and the initial data entry into the model can also be rewritten accordingly.

Calculation of transportation costs in outsourcing and insourcing model

From the previous research and discussion, the calculation model of logistics enterprises transportation cost can be preliminarily established, after the effective calculation of the cost there will get an effective solution to the logistics enterprise transportation. This model involves calculation of outsourcing transportation cost and calculation of internal logistics enterprise transportation cost, the former calculation process is shown in Figure 3, while the latter one is shown in Figure 4.

Figure 3 : Transportation costs produced by outsourcing transportation

According to the above figure it is easy to see that in the process of transportation contracting by enterprises, the costs mainly concentrated in several aspects. First of all, is the loading fee, the second is the transportation fee of vehicle in the process of transportation[5]. In these two fees contained specific transportation prices of vehicles and insurance of goods itself. The insurance is be in charged by undertaking outsourcing company.

Figure 4 : Transportation costs produced by insourcing transportation

TRANSPORT COST CALCULATION MODEL

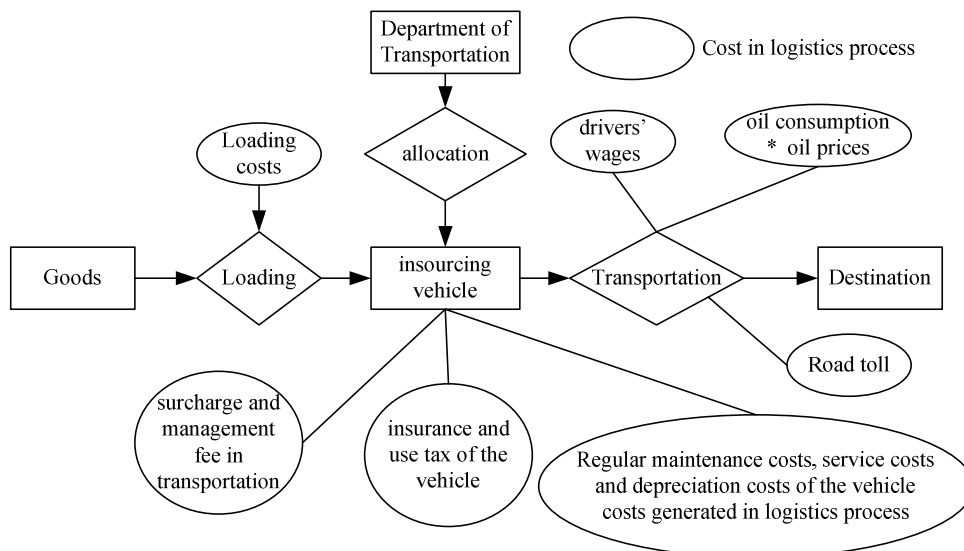The figure below is the specific flow chart model of transportation cost model, in the process of building this model mainly uses the frame structure to specifically express the whole transportation process of logistics enterprise. In the overall process of model construction, the main structure is shown in Figure 5.
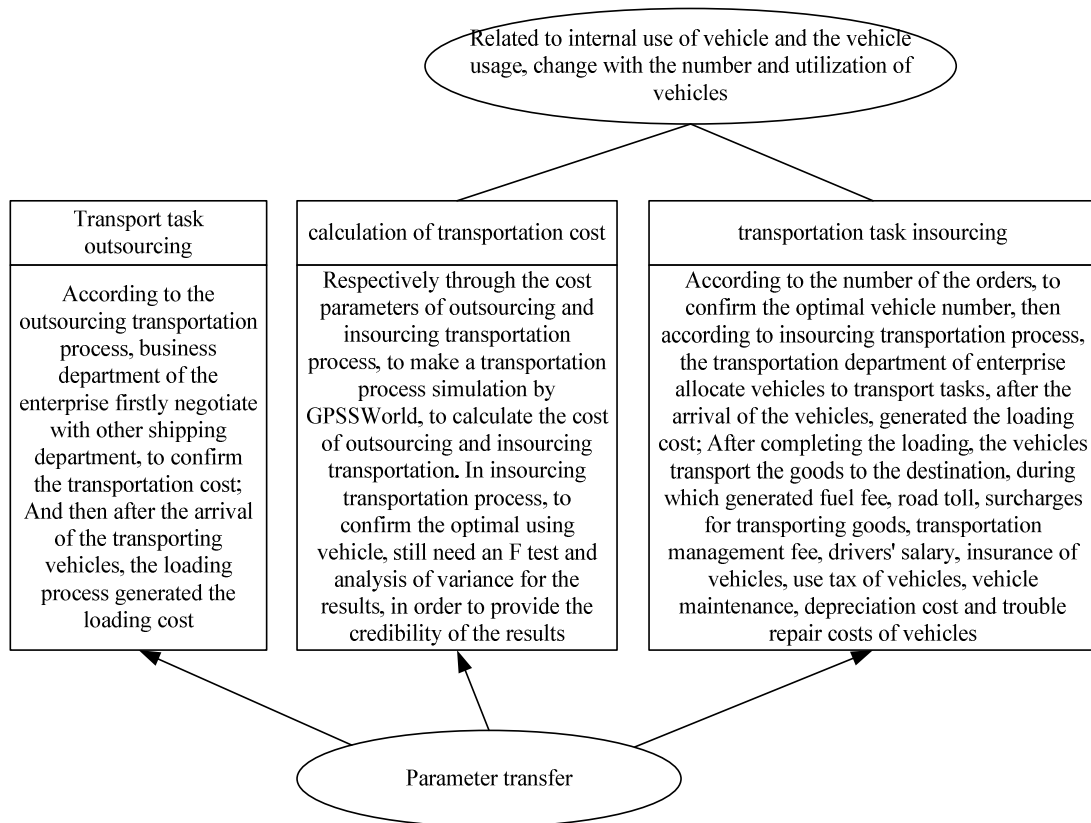
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        ┌──────────────────────────────────────┐
        │ Related to internal use of vehicle    │
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        │ the number and utilization of vehicles │
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Transport task outsourcing	calculation of transportation cost	transportation task insourcing
According to the outsourcing transportation process, business department of the enterprise firstly negotiate with other shipping department, to confirm the transportation cost; And then after the arrival of the transporting vehicles, the loading process generated the loading cost	Respectively through the cost parameters of outsourcing and insourcing transportation process, to make a transportation process simulation by GPSSWorld, to calculate the cost of outsourcing and insourcing transportation. In insourcing transportation process, to confirm the optimal using vehicle, still need an F test and analysis of variance for the results, in order to provide the credibility of the results	According to the number of the orders, to confirm the optimal vehicle number, then according to insourcing transportation process, the transportation department of enterprise allocate vehicles to transport tasks, after the arrival of the vehicles, generated the loading cost; After completing the loading, the vehicles transport the goods to the destination, during which generated fuel fee, road toll, surcharges for transporting goods, transportation management fee, drivers' salary, insurance of vehicles, use tax of vehicles, vehicle maintenance, depreciation cost and trouble repair costs of vehicles

Parameter transfer

Figure 5 : Overall structure of transport cost calculation model

From Figure 5 it can be seen the main structure of logistics cost calculation model construction, but by Figure 1 the overall process of logistics enterprise transportation above can be concluded that in the process of effective complication of logistics enterprises transportation tasks, the method can be internal enterprise transportation, at the same time can also contract the goods transportation to other institutions of consignment. Below is corresponding introduction of main process for the cost calculation of the two methods of transportation by logistics cost calculation model.

Calculation process of outsourcing transportation cost

The first step is definition process of the initialization for outsourcing transportation cost, in this process mainly contains the amount of goods transportation, the probability distribution between specific costs of goods transportation and the distribution of corresponding total probability of the loading. After that is the effective calculation on the probability of occurrence between the two things, and concluded the specific relationship between the loading transportation and costs calculation. Subsequently, the total number of the orders should be as the fundamental, to confirm the actual number of loading as well as the total number of transportation, and to have specific calculation on the actual loading cost of the year and the corresponding transportation cost[6]. However, in the calculation process, the total cost of the two fees can be obtained by related operation of custom function, and the custom function is obtained by the summary of probability distribution of the two data above. The whole calculation process of outsourcing transportation cost is clearly shown in Figure 6.

Calculation process of insourcing transportation cost

The first step is to reserve the using efficiency of vehicles in the process of logistics enterprise internal transportation and the corresponding number structure, and set the output data of interface to initial variables. And the variables can correspondingly change the initial variables by manual entry or automatic entry. The second step is to effectively define and set up the initial variables, in the setup process mainly contains several aspects, the first is the probability distribution of the total transportation and the total fuel consumption in transportation process of the internal goods of logistics enterprise within a year, as well as the probability distribution of the actual oil prices, etc. After that,

establish loading transportation and cost calculation process for common existence between the two things. The second step is that, take total number of the orders in the year as fundamental, to confirm the actual amount of loading as well as the total time of transportation, to have specific calculation of these two fees by the actual price of loading in this year and the corresponding transportation price. To calculate according to the probability distribution of actual oil consumption, the specific oil price and the total fuel cost of logistics enterprise transportation, and to effectively calculate road toll cost combined with the actual road toll for transportation in this year. And to calculate vehicle maintenance and vehicle service according to the total number of vehicles and the use efficiency in internal logistics enterprises for clearly reflection of the cost[7]. To calculate corresponding cost needed by vehicles according to the specific cost of vehicles using and vehicle insurance in transportation. The custom function is obtained by the summary of probability distribution of the two data above.
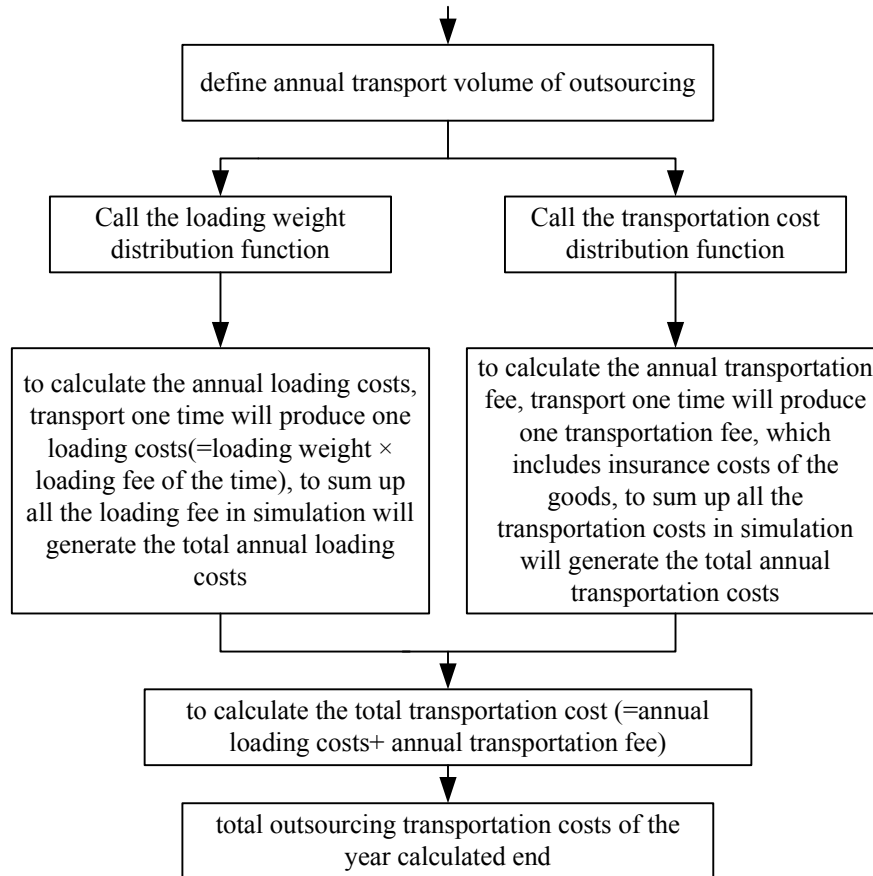

Figure 6 : Calculation process of outsourcing transportation cost

ANALYSIS OF TRANSPORTATION COST OPTIMIZATION

First step

In the transportation of internal enterprise vehicles, first should meet the first advantage line, and then should meet the second advantage line by analogy, after allocating the internal vehicle then to adopt the outsourcing strategy. In this way, enterprises can make more reasonable use of its own resources to reduce the transport cost. It broke the traditional methods that in allocation of vehicles in logistics enterprises internal transportation, regardless of transportation lines, but to arrange transportation vehicles according to the arrival of business department logistics transportation task, with the principle "to arrange transportation vehicles for first come transportation task, after allocating the internal transportation vehicles adopt the outsourcing strategy", which lead to enterprise unreasonable using its own resources, make the logistics transportation costs rise.

Second step

On the premise of obeying the principle that "Internal vehicles are always priority to meet the transport task big with advantage transportation routes", input determined optimal utilization of vehicles in transportation cost calculating model, according to the internal vehicle usage number of different transportation routes, calculate and compare between the total transportation cost and profit to find a transportation program with the lowest total cost. To see at this time whether the profit are the maximum, so as to finally determine the amount of vehicle usage number and vehicle utilization of all the internal transportation routes for optimizing the transportation costs.

CONCLUSION

Above all is the study of technical support of operations research theory for rational calculation of logistics transportation costs in practice, among which mainly focus on the analysis of logistics transportation process modeling and calculation model of transportation cost. This makes the idea of this study can maintain rigorous, at the same time provides a strong model basis for the further study of calculation of logistics enterprise transportation cost.

REFERENCES

[1]   Zhou Xiaorong; Curriculum reform of "logistics transportation planning and smart scheduling", Education and Vocation, **(2)**, 137-138 **(2014)**.

[2]   Wu Jiaqin; Selection of shortest logistics transportation path based on dijkstra model, Logistics Technology, **32(11)**, 193-195 **(2013)**.

[3]   Sun Jiangyan; Design of cloud computation architecture in logistics transportation, Logistics Technology, **32(9)**, 429-431 **(2013)**.

[4]   Zheng Guang; Optimal operation model of logistics and transport based on POS particle filter, Bulletin of Science and Technology, **29(4)**, 109-111 **(2013)**.

[5]   Gao Xiaowei; Research on logistics vehicle routing problem based on improved QPSO algorithm, Computer Simulation, **30(8)**, 169-172 **(2013)**.

[6]   Jia Ziruo; Study on effective restraining mechanism for overloading of freight vehicles of transportation enterprises, Logistics Technology, **32(3)**, 292-294 **(2013)**.

[7]   Li Changfu, Wang Yong, Zhang Zhanfeng; Outsourcing decision of fourth party transportation and inventory considering the competing third party logistics, Chinese Journal of Management Science, **(6)**, 71-81 **(2010)**.