Research on Optimization of Distribution Route

Lin He

School of Economics and Management, Chongqing University of Posts and Telecommunications, Chongqing 400065, China.

Abstract

With the development of The Times, small batch, multi-batch distribution method makes the cost of enterprise distribution more and more high. In order to reduce the cost of enterprises, many logistics enterprises have begun to optimize the distribution routes, so as to achieve reasonable transportation, improve the utilization rate of vehicles, destocking, to achieve the purpose of reducing the cost of enterprises, and ultimately the benefits of enterprises can also be improved accordingly. Now consumers’ requirements for commodities are not limited to the goods themselves, and their additional experience requirements are also getting higher and higher with the changes of The Times. This paper takes the distribution of Gome Electric Appliances as an example. Through field investigation and data collection, the data are processed and analyzed with the mileage saving algorithm, and the optimized distribution route is obtained. As a result, the daily distribution cost is reduced by 16.5%, and the optimization effect is very significant. Therefore, using the mileage saving algorithm to optimize the route in the distribution process can achieve the purpose of reducing the cost and improving the enterprise benefit.

Keywords

Distribution; Rout Optimization; Mileage Saving Algorithm.

1. Introduction

In recent years, China's e-commerce has been booming. The transformation of the distribution mode from the initial purchase of large quantities to small batches and multiple batches has given many opportunities to the emerging logistics enterprises. But this series of changes also make the logistics cost increases year by year. In 2015, the total sales volume of China’s social logistics was 220.2 trillion yuan, which increased by 5.8% compared with 2014 based on comparable prices, and the growth rate fell by 2.3 percentage points. The fourth quarter showed 49.5 trillion yuan in the first quarter, up 5.5 percent from last year, or 3 percentage points lower.104.7 trillion yuan in the first two quarters, up 5.8% or down 3.0 percentage points; The sales volume in the first three quarters was 162.8 trillion yuan, up 5.8 percent or down 2.6 percentage points. In 2015, China’s total social logistics showed a steady development trend. As one of the most important functional elements in distribution activities, the cost of distribution and transportation can be reduced by reasonable transportation. As mentioned above, if an economical distribution route can be selected, and the route can be optimized by scientific algorithm to reduce the mileage, the cost can be reduced and the profit of the enterprise can be greatly improved. In this paper, Guangyuan City Gome electrical distribution, the use of mileage saving algorithm. Optimize the route, so that the number of vehicles used, delivery mileage, enterprise cost to reach a lower value.

In 2003, after an in-depth study on vehicle routing problem, Baker [1] improved the Genetic Algorithm previously used to solve such problems and made a considerable breakthrough. More and more researchers have begun to pay attention to the use of Genetic Algorithm to solve
the vehicle routing problem. It is believed that Genetic Algorithm will get a broader development before too long.

In 2004, Lius. C and Linc. C [2] used heuristic algorithm to solve the inventory combination optimization problem and positioning route problem, which also includes multi-ant colony algorithm, simulated annealing algorithm and neural network. Moreover, heuristic algorithm is found to be more convenient to solve the combination of positioning routes and inventory control, and it can reduce the cost.

Over the past 30 years of reform and opening up, the French economy of China has maintained a strong growth, industrialization and urbanization have accelerated, and China has gradually become a global manufacturing and consumer power. Like the development of developed countries, China's economy is also facing the problem of soaring costs while growing rapidly. Apart from the factors of rising raw materials and labor costs, the main reason is the rising cost of logistics and distribution. In this context, the government needs to build an efficient, convenient, low-cost, three-dimensional logistics system to lay a solid foundation for the national supply and distribution system, to maintain the competitiveness of the manufacturing industry in the global market, to meet the growing needs of the people's logistics and distribution, and to narrow the gap between the urban and rural areas in the region.

During this period, Geng Jiwu et al. [3] studied the mile-saving method in 2003. They thought that even though this method was simple and convenient to implement, its shortcoming was obvious -- that is, the mile-saving method was not flexible enough. Chen Xiaowei [4] analyzed the deficiencies of his algorithm in his book, and some other optimization methods were also reflected in the corresponding articles. After the efforts of this generation of experts, the mileage saving method has become more and more perfect.

From the perspective of the development level of national logistics distribution industry, the modern logistics industry in Beijing, Jiangsu, Shandong, Hubei and other provinces (cities) develops rapidly, and their experience in promoting the development of logistics industry is worth learning.

2. Research technique

The optimization of logistics distribution routes is mainly manifested in the following three aspects: firstly, it can reduce the required distribution kilometers and time in the distribution process, so as to make the distribution more efficient, reduce the empty load rate of vehicles, and then achieve the purpose of greatly reducing the distribution cost. Then, the efficiency of the whole logistics activity will be improved because of the optimization of the logistics route, which is like the domino effect, the optimization of a link is often related to the whole body. Therefore, the goods will be delivered to customers more accurately, quickly and efficiently, so as to achieve the purpose of improving customer satisfaction. Finally, the arrangement of distribution operations will be more appropriate, so as to improve the production efficiency of the enterprise, and at the same time to create higher profits, so that more time and energy will be spent on continuing to study route optimization, to achieve a virtuous cycle effect. In this paper, mileage saving method is used to optimize the distribution route.

2.1. The concept of distribution

The meaning of logistics distribution process is that the first step is to select, process, divide, package and arrange the goods according to the specific requirements of the customer and the different urgency of the time, and deliver the goods to the agreed place within the agreed time. Generally, the distribution is generally based on the location of the customer is different, in the logistics distribution points for classification, processing, and final distribution. The process of finally delivering the packaged goods to the consignee within a specified time. It is a step in the
logistics process. In the same way, the distribution process also includes the business flow as well as several different functions in the logistics activities.

Throughout the development process of distribution in China, we intercepted a one-sided logistics distribution under the background of e-commerce spawned by the Internet. There were three huge changes: the first logistics delivery was a very simple door-to-door delivery, known as the "last mile problem", due to equipment and technology defects. However, such distribution is very inefficient, so many manufacturers then reduce the price slightly and send the goods directly to the buyer, using the change to improve their operations and customer satisfaction. The second change is arguably a from the inside out thoroughly remould oneself change, with the age of electronic commerce in our country was born, also to the requirement of logistics distribution and immediately started from quantitative change to qualitative change, this kind of change has had a huge impact on the logistics distribution itself, also about the influence of each section of the supply chain is immeasurable, including top suppliers and end customers; The third change of distribution logistics is mainly at the technical level, that is, the information age forces the comprehensive informatization of distribution service, that is, the changes brought about by the wide application of network technology of physical distribution, which greatly improves the speed and range of logistics distribution.

2.2. Comparison of several algorithms in distribution theory

The advantage of tabu search algorithm is that it can break through the local optimality without losing the global optimality. The disadvantage is that the dependence on the initial solution is too strong.

The advantage of the simulated annealing algorithm is that it is easy to realize the global optimal serial structure, but the disadvantage is that it takes a long time for large-scale problems.

The advantage of genetic algorithm is that it is good for global optimization and easy to realize parallel optimization, but the disadvantage is that it is difficult to select parameters, so it can only make specific analysis for specific problems.

The mileage saving algorithm has the advantage of being simple and easy to operate, shortening the transportation distance, and reflecting the advantages of logistics distribution network. The disadvantage is that it responds slowly to the change of customer demand. However, this algorithm is relatively simple and easy to master compared to the above algorithms.

3. Optimization of distribution line

3.1. A brief introduction to the mileage saving method

The core idea of Saving Algorithm is to merge the two loops in the distribution problem into one loop successively, and reduce the combined total distance to the maximum extent each time until the vehicle reaches the full load or the driving limit, and then optimize the next vehicle. The optimization process is parallel mode and serial mode respectively.

This algorithm is used to solve the VRP problem with the uncertain number of transport vehicles. It belongs to a method with the same name as the class and has no return value type, that is, the construction algorithm. The basic concept of this algorithm is that the sum of two sides of a triangle in geometry must be greater than the length of the other side. In recent years, the small batch and multi-batch distribution methods develop rapidly, making the saving algorithm has become the main method to choose distribution routes. When the distribution route is determined, the two points required to connect can realize the maximum mileage saving successively, so the maximum mileage saving can be obtained by successively arranging round-trip delivery. If the load of the distribution vehicle does not exceed, and the mileage of
the vehicle does not exceed the upper limit, new customer distribution points can be added into
the route again, so as to work out the optimal distribution route in line with the reality.

3.2. Steps of mileage saving algorithm are introduced
As one of the main distribution route selection algorithms, the steps are as follows:

3.2.1. Clarify the number and demand of customers and the shortest distance of each
customer distribution point
The specific locations of distribution centers and distribution points are determined and
numbered, and the shortest distance between each two distribution points is measured.

3.2.2. Calculate the degree of saving and arrange the calculated results in descending
order
The saving degree refers to the mileage saved by the two-point combined delivery. The greater
the saving degree is, the maximum mileage saved by the two-point combined delivery point.
The calculated saving degree is the largest, which means that the two distribution points can
save the largest mileage by combining distribution, so they are arranged in order from the
largest to the smallest.

3.2.3. Merge loop
Combine the loops from the two points with the greatest savings. First, verify whether the goods
delivered by the two distribution points exceed the single vehicle carrying capacity. If not, that
is, proceed to the next step. Secondly, it is verified whether the maximum mileage of the vehicle
will be exceeded after the merger. If the total mileage of the loop does not exceed the 300
proposed by the company, the two points can be combined, and the first merger is completed.
For the second merge, select the next one with greater savings for the merge calculation (and
so on). If one of the two points involves the first combined item, the total of the three points is
considered in the test carrying capacity and mileage. If not exceeded, the three points can be
combined; If exceeded, the first time items are combined as a route.
When a complete distribution route is planned, the following merging process will directly
avoid the planned distribution points and choose the unplanned distribution points. The
merging operation will start from the largest one and continue until all distribution points are
merged.

4. Summary
For most enterprises, reducing the distribution cost can greatly reduce the cost of enterprises,
and optimizing the distribution route is the most economical and effective way to achieve this
goal. In this paper, through the mileage saving method, optimize the distribution routes of
guangyuan city gome home appliances, enhance the competitiveness of gome enterprises.
Observing the final calculation result, not only saves the delivery time, but also reduces the
delivery cost of the vehicle. As mentioned above, many enterprises ignore the choice of logistics
distribution route and have great randomness, which makes the distribution cost remain high.
Therefore, the viewpoints put forward in this paper may help enterprises to make some
thinking.
To sum up, although the mileage saving method can reduce the cost for enterprises, it cannot
be simply used in the actual distribution process, and many actual situations may need to
change the optimal distribution path calculated by the algorithm.

References
2004.
