Academic Journal of Science and Technology
ISSN: 2771-3032 | Vol. 12, No. 1, 2024

Optimisation of Urban Logistics Distribution Routing with Time Window

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Abstract: Reasonable optimization of the path can not only reduce unnecessary logistics cost expenditure; efficient circulation speed can also enhance the economic development of the city. In the process of the transformation of the model, it will be directly affected by the change of the importance of logistics enterprises to logistics distribution work. Based on the background of urban logistics, the optimization process of multi-logistics distribution path with time window is comprehensively studied. The relevant theoretical knowledge involved in the distribution link is reviewed, and through the analysis of the existing problems of urban logistics and the vehicle path optimization problem, the heuristic algorithm is used to establish the path optimization model of urban logistics center with time window, which reduces the vehicle transportation cost, thus reducing the total cost of logistics, and at the same time, improves the efficiency of the internal circulation of urban logistics and accelerates the economic development.

Keywords: Time Window; Mileage Saving Method; Urban Logistics; Distribution Center; Path Optimization.

1. Introduction

In the actual logistics distribution or service scheduling, distribution vehicles or service personnel need to complete the task on time within a specific time window. For example, express delivery needs to deliver the package to the destination within a specified period of time, and service personnel need to arrive at the customer site to provide services according to the appointment time. This is an important challenge for logistics enterprises, because the violation of time windows will cause inconvenience, affect customer satisfaction, and may lead to additional costs and waste of resources.

At present, there are many researches on distribution route optimization, but with the refinement of business, the increase of functions and the strict requirements of distribution links, it is difficult to meet the current service needs of users only by studying the route optimization of a single distribution center. In order to better meet the distribution needs of urban logistics and ensure the efficiency of logistics services, distribution centers should actively take linkage distribution measures. However, domestic scholars for the logistics center distribution path optimization research is not much, scholars spent a lot of time and energy in this area, to solve the real life of the existence of distribution and path optimization problem provides a theoretical reference and reference value.

At present, with the continuous progress of modern science and technology and the increasing level of living demand, one of the important reasons for the high cost of logistics is the increasing cost of logistics transportation. In order to better increase customer stickiness and improve the logistics service level, the distribution link is the end of the logistics system, which meets the logistics needs of the end retailers for goods and reasonably reduces the logistics cost. Through the observation and analysis of the existing distribution operation process, this paper aims at the layout of the existing urban planning and the prediction of the future urban development trend. Designing a reasonable and efficient distribution plan, such as arranging the transportation route and time of vehicles, can not only greatly shorten the overall distribution time, reduce distribution costs, improve the operational efficiency of enterprises, but also better improve customer service satisfaction, so as to establish a good corporate image. The problem of distribution path optimization is a problem that every distribution center needs to face before and after the establishment, how to make the vehicle transport more efficiently, how to better reduce the cost of distribution, and ultimately meet the need to complete customer service at the lowest cost.

2. Research Status at Home and Abroad

Domestic and foreign scholars in the vehicle routing problem in the research process, most will focus on the following two aspects: one is the vehicle routing problem with time windows, such as: VRP, VRPTW; the other is the multi-distribution center vehicle routing problem with time windows, such as: MDVRP, MDVRPTW.

2.1. Research Status Abroad

Due to the late start of domestic logistics, the research on vehicle routing optimization abroad is more abundant and mature than that in China. It is these fruitful research results that provide theoretical support for such research in China in the later period.

Ramse, Dantzig and others first put forward the concept of "VRP" in 1959, and focused on the related contents of closed VRP. Based on the description of a series of problems occurring in the process of gasoline distribution in gas stations, this paper not only proposes a mathematical programming model for the first time, but also clarifies its solution algorithm. Based on a large number of related studies, Wrigh and Clark proposed an improved algorithm in 1964, which we can call "Clark-Wright parsimonious algorithm".

Based on the theories and algorithms proposed by these early scholars, more accurate and more complex algorithms are derived, which provide more theoretical support for the study of path optimization. In Tailllard, the vehicle routing problem of distribution centers is decomposed into two sub-problems, that is, the location selection problem of multiple distribution centers and the vehicle scheduling problem of a single distribution center. Based on the consideration of the time factor of vehicle distribution, Sulomon and Desrosiers first introduced the concept of time window constraints in the distribution vehicle routing problem, and began to carry out related research. In the research process of VRP with time windows for different types of vehicles, Ceschia and others have studied the application process of tabu search algorithm in solving such problems. Taniguchi and Teo focus on the relevant case of Osaka urban logistics distribution, and propose a new vehicle routing optimization model on this basis, which fully combines the existing routing optimization model on the basis of the characteristics of urban logistics distribution.

2.2. Domestic Research Status

After entering the 21st century, with the development of various aspects and changing customer needs, in order to provide better distribution services and improve distribution efficiency, many domestic scholars began to study the vehicle routing problem of logistics center distribution. Based on the analysis of the known defects of traditional optimization methods (① long search time; ② difficulty in finding the optimal path, etc.), Wu Jieming proposed an algorithm suitable for vehicle routing optimization of logistics distribution, which we call "ant colony algorithm", and based on this, the corresponding mathematical model is effectively solved. In the application research of vehicle routing optimization, domestic scholars have also made some achievements. Yan Li and Hao Ruiqing found a multi-objective dynamic service logistics vehicle routing model based on time window in the research process, and comprehensively analyzed various characteristics of this vehicle routing problem. The results show that the model is effective in solving the vehicle dynamic routing problem. Ge Xianlong and others focused on the analysis of the comprehensive use cost and loading rate of different models, and on this basis, formulated the principle of model-customer allocation, and combined with the improved quantum genetic algorithm to improve the computational efficiency of the solution. Tai Xiaohong added the time window restriction to the customer's delivery time, and proposed an improved C-W saving algorithm. Qu Qianqian added the traffic conditions of the distribution process to the influence conditions of path optimization, and then proposed a vehicle scheduling optimization model with traffic conditions, using hybrid genetic algorithm combined with crossover and mutation probability to build an improved model. Liu Sha and He Zhenggang proposed a vehicle routing optimization model with time windows (VRPTW). The overall optimization objective is to minimize the total recovery time and reduce the transportation cost on this basis.

3. Analysis of Path Optimization with Time Windows based on Saving Mileage Method

3.1. VRP with Time Window Constraint

There are two kinds of time constraint problems, one is the "soft time window" problem of "allowing delay", the other is the "hard time window" problem of "not allowing delay". The problem of "soft time window" means that the customer's time requirement for delivery is flexible, and the customer can bear the failure to deliver on time due to various reasons, but he has to claim the loss caused by it. The problem of "hard time window" means that customers have strict requirements for the longest delivery time, that is to say, within the time requirements of customers, the distribution center must deliver the goods in place, otherwise the delivery does not meet the time requirements of customers, which directly leads to obstacles and bottlenecks in logistics circulation.

Due to the constraint of "hard time window", it often leads to a sharp increase in cost. Therefore, in comparison, "soft time window" is more flexible in management. We can improve the frequency of punctual service by formulating a penalty mechanism, such as setting a penalty cost. When establishing the penalty cost model, we set the acceptable time window [Ma, Na] for store a and the required time window [ma, na] for store A. According to the time when the delivery vehicle arrives at the store, it can be divided into three situations: First, the delivery vehicle arrives before the time required by the store. At this time, it can be divided into two situations, one is that the vehicle arrives at the acceptable time of the store, that is, within [Ma, ma], the vehicle can be delivered after arrival, but because the delivery is not within the time required by the store, it needs to pay a certain penalty cost, then the function is $P(Xa) = (ma-Xa)\cdot \alpha$; the second is that the arrival time of the vehicle is before the acceptable time of the store, that is, before Ma, when the customer cannot receive the goods, the penalty cost is infinite, $P(Xa) = \infty$. Second, the delivery vehicle arrives within the time required by the store, that is, within [Ma, Na], at this time, there is no penalty cost, $P(Xa) = 0$. Third, the delivery vehicle arrives after the time required by the store. At this time, it can also be divided into two situations, one is that the vehicle arrives at the acceptable time of the store, that is, within (Na, Na], the vehicle can be delivered after arrival, but at this time it needs to bear a certain penalty cost, then the function can be expressed as $P(Xa) = (Xa-na) \cdot \beta$; The second is that the arrival time of the vehicle is after the acceptable time of the store, that is, after Na, when the customer cannot receive the goods, the penalty cost is infinite, $P(Xa) = \infty$.

3.2. VRP Problem Description and Assumptions

3.2.1. Problem Description

Logistics center distribution vehicle routing problem, in fact, is a complex problem based on the optimization of vehicle routing combination and further expanded. The research direction of this paper is the path optimization of distribution center with time window in urban logistics. It can be described as: in order to improve transportation efficiency and service quality, enterprises establish distribution centers, which are allocated with vehicles to provide services for customers in their respective areas. Vehicles only exist in the process of service delivery. No matter the customer sends the project or loads, the initial distribution center after the service delivery vehicle returns. For the service of the distribution system, the assembly personnel of the distribution center need to require reasonable vehicle loading according to the regional distribution of customers, the demand of different customers for goods and the time window. The problem is to study the maximum vehicle loading rate under the condition, and how to plan the time window under the requirement of our customers for more central distribution vehicles with multiple routes, so as to minimize the total cost of distribution.

3.2.2. Model Assumptions

Based on the problem description, the following basic assumptions need to be made:

Both the specific location of the distribution center and the actual location and needs of customers within the distribution area are known.

The supply of goods in the distribution center is sufficient, and there will be no shortage, shortage and so on.

As a goods delivery vehicle, the goods must be unloaded within the first time of arrival at the customer's point, taking into account the unloading time.

The delivery vehicles are all of the same type, that is, the vehicle type, fuel consumption, load, average speed and other such conditions are the same.

The distribution distance does not take into account the special objective conditions such as traffic congestion and weather influence.

Given the time window required by the customer, if it arrives at the customer point within the earliest time required by the customer, it should wait for the arrival of the earliest service time and provide the corresponding service in time.

Each vehicle only serves one transport route.

The quantity demanded by each customer is known.

Each customer point can only be served by one vehicle once.

The total load of goods on each distribution line shall not exceed the maximum load that can be carried by the vehicle itself.

The total distance of the vehicle distribution route shall not exceed the maximum mileage of the vehicle.

After starting from the current distribution center, the vehicle shall return to the original distribution center to complete the distribution task.

3.3. Case Data Analysis based on Mileage Saving Method

3.3.1. Basic Data

Two of the distribution routes within the distribution range radiated by the warehouse of Company A as the center are optimized, and a single point is represented by the letters A-J.

The distribution center has five vehicles of the same type, each with an average speed of 40 km/H and a maximum speed of 70 km/H. The cost of individual vehicle mobilization is 83.3 yuan/time, the unit distance transportation cost is 20 yuan/100km (less than 10 km is calculated as 10 km), the driver's single transportation cost is 200 yuan/time, the penalty cost for exceeding the specified time is 100 yuan/unit, and the maximum carrying capacity of a single vehicle is 1 t. Table 1 below is the basic data table.

Table 1. Basic Data Table

Category	Data
Average vehicle speed	40km/h
Maximum vehicle speed	70km/h
Separate vehicle mobilization cost	CNY 83.3/time
Cost per unit distance	CNY 20/10km
Single transportation cost of driver	CNY 200/time
Penalty cost	CNY 100/unit
Maximum carrying capacity of vehicles	1t
Average uninstallation time for a single community	10min

(1) Table 2 shows the distance between the camp O and the head of each subordinate community.

Table 2. Distance from the Camp to the Head of the Subordinate Community

Serial number	A	B	C	D	E	F	G	H	I	J
Distance (km)	3.8	1.7	1.3	8.6	9.8	6.4	5.7	9.8	7.3	2.7

(2) Company A is responsible for the distribution of daily necessities. A single order has many varieties and small batches, and the distribution frequency of a single receiving point is once a day. The fluctuation of the daily demand is not large. Taking the average value of the monthly distribution volume, the average monthly demand of each community is as follows:

Table 3. Daily Demand Scale of Each Community

Serial number	A	B	C	D	E	F	G	H	I	J
Demand (t/time)	0.12	0.22	0.10	0.24	0.21	0.17	0.20	0.21	0.15	0.13

(3) The delivery time window of Company A is that the delivery time of a single line is not more than 2 hours, and the receiving time of the subordinate team leader is from 8:00 to 18:00. Vehicles are required not to arrive late, which will result in a penalty cost of 100 yuan per unit.

3.3.2. Table of the Shortest Transportation Distance

Table 4. Table of Transportation Distance between the Camp and the Head of the Subordinate Community (km)

	O	A	B	C	D	E	F	G	H	I	J
O		5.8	1.7	1.3	8.6	9.8	6.4	5.7	9.8	7.3	2.7
A			5.4	4.6	9.5	6.8	7.7	7.1	10.6	5.6	8.4
B				1.4	8.3	10.9	6.2	5.0	9.7	0.6	0.4
C					4.3	10.6	5.7	4.4	8.5	1.0	1.2
D						2.5	4.7	4.5	3.6	7.8	8.2
E							7.7	13	9.5	10.6	14.3
F								5.8	4.6	4.4	7.0
G									4.3	4.6	5.8
H										6.0	6.6
I											0.6
J											

A company's main user groups are community residents, and its brand positioning is to combine the retail industry with e-commerce, so as to create a "new retail" model. According to this characteristic, the radiation range of the planned warehouse in the early stage is limited to a certain extent. Therefore, the distribution range is about 10km, which can effectively control the timeliness of distribution and ensure the freshness. Based on the analysis of the distance between the leaders of the subordinate communities in Yingcangyu, the preparation of the table of the shortest transportation distance can be successfully completed. For details, please refer to Table 4.

3.3.3. Table of Saved Mileage

According to the table of the shortest transportation distance, the saved mileage table between the regimental commanders is calculated by the formula, as shown in Table 5. $\triangle S=a+b-x$

Table 5. Table of saved mileage

	A	B	C	D	E	F	G	H	I	J
A		2.1	0.3	3.3	2	0	7.4	1.2	4.7	0
B			1.6	4.3	3.3	0	0	0	0	0
C				5.6	4.3	0	0	0	0	0
D					15.9	4.8	0	0	0	0
E						8.5	0	1.3	0	0.8
F							0	5.6	0	5.1
G								5.2	8.7	0
H									11.1	5.9
I										0
J										

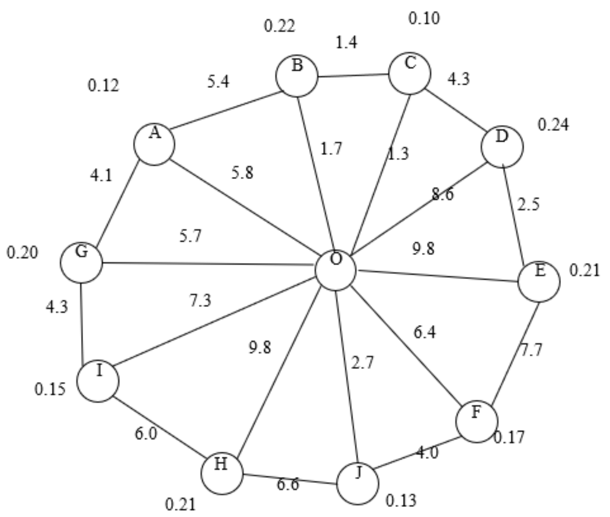

Figure 1. Distance map of company A's delivery route

3.3.4. Sorting Table of Saved Mileage

The saved mileage table is sorted from large to small. On this basis, the saved mileage sorting table can be obtained smoothly. For details, please refer to Table 6 below:

Table 6. Sorting table of saved mileage

Connection Point	Save mileage	Connection Point	Save mileage
D-E	15.9	B-D	4.6
H-I	11.1	C-E	4.3
G-I	8.7	B-E	3.3
E-F	8.5	A-D	2.9
A-G	7.4	A-B	2.1
H-J	5.9	A-E	2
F-H	5.8	B-C	1.6
C-D	5.6	E-H	1.3
G-H	5.2	A-H	1.2
F-J	5.1	E-J	0.8
D-F	4.8	A-C	0.3
A-I	4.7		

3.3.5. Route Optimization Diagram

According to the upper limit of the load of a single vehicle and the order of the saving mileage sorting table, the route optimization is carried out, and the distribution points covered by a single route and the distribution order are planned to meet the use efficiency of the vehicle to the greatest extent. The optimization process is as follows:

Route 1: The distribution route obtained is O-D-E-H-I-O according to the monthly average cargo demand weight of a single receiving point and the maximum load of the transport vehicle without overtaking 1 t. The route map is as follows:

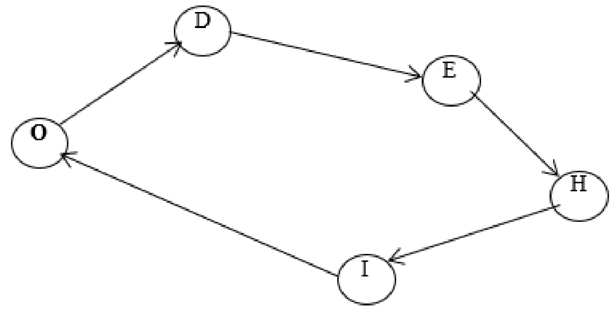

Figure 2. Route 1 Distribution Route Map

The distribution cost of line 1 can be calculated according to the individual transfer cost of the vehicle is 83.3 yuan, the single trip cost of the driver is 200 yuan, and the distance cost per 10 km is 20 yuan.

Transportation distance: 8.6 + 2.5 + 9.5 + 6 + 7.3 = 33.9 (km)

Transport weight: 0.24 + 0.21 + 0.21 + 0.15 = 0.81 (t)

Use cost F1: 200 + + 83.3 = 283.3 (RMB)

Distribution cost F2: 20 × 4 = 80 (RMB)

Transportation cost of Line 1: 283.3 + 80 = 363.3 (RMB)

Route 2: Exclude the acceptance points involved in Route 1, and re-plan the remaining points according to the saved mileage table to obtain the route map O-A-G-F-J-B-C-O of Route 2, as shown in Figure 3.

The relevant data of the second line is calculated:

Transportation distance: 5.8 + 7.1 + 5.8 + 7 + 0.4 + 1.4 + 1.3 = 28.8 (km)

Transport weight: 0.12 + 0.2 + 0.17 + 0.13 + 0.22 + 0.1 = 0.94 (t)

Use cost F1: 200 + 83.3 = 283.3 (RMB)

Distribution cost F2: 20 × 3 = 60 (RMB)

Transportation cost of Line 2: 283.3 + 60 = 343.3 (RMB)

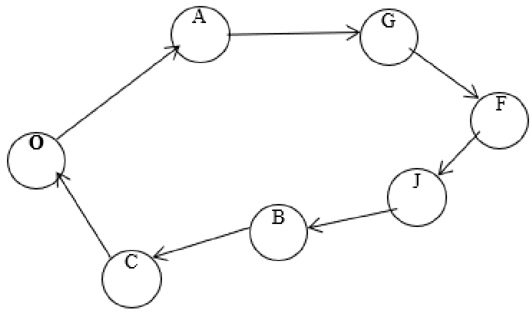

Figure 3. Route 2 Distribution Route

The two lines are re-planned to obtain a new distribution route map, which makes the distribution route shortest while meeting the use efficiency of vehicles to the greatest extent. The two lines are integrated to obtain a complete optimized distribution route map, as shown in Figure 4.

The total data of the two lines are as follows:

Total transportation distance: 33. + 28.8 = 62.7 (km)

Total transport weight: 0.81 + 0.94 = 1.75 (t)

Total allocation cost: 363.3 + 343.3 = 706.6 (RMB)

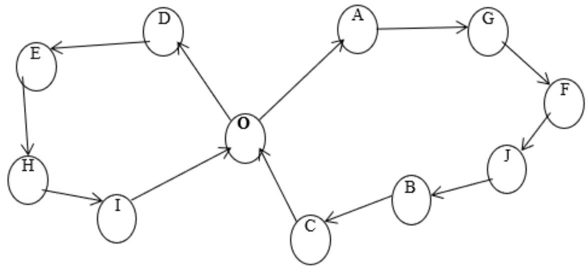

Figure 4. Route optimization diagram

3.4. Path Optimization under Time Window Constraints

According to the relevant regulations of Company A, the acceptable time for the head of the subordinate community is from 8:00 to 18:00, and the delivery time of a single line is not more than 2 hours. If the delivery time is exceeded, a penalty cost of 100 yuan/unit will be incurred. The transportation speed is calculated based on the average speed of the vehicle of 40 km/H, and the two routes are constrained by the time window. The results are as follows:

(1) Line 1:

Table 7. Time window distribution along the line

Line 1: O-D-E-H-I-O					
Distribution point	D	E	H	I	O
Transit time	8: 00	8: 23	8: 37	9: 02	9: 21
Demand (t)	0.24	0.21	0.21	0.15	
Unloading time (min)	10	10	10	10	
Transportation distance (km)	8.6	2.5	9.5	6	7.3
Time of arrival	8:13	8:27	8:52	9:11	9:31
Penalty cost F3	0	0	0	0	0

(2) Line 2:

Table 8. Distribution of Line 2 with Time Window

Line 2: O-A-G-F-J-B-C-O							
Distribution point	A	G	F	J	B	C	O
Transit time	8:00	8:19	8:40	8:59	9:21	9:32	9:45
Demand (t)	0.12	0.2	0.17	0.13	0.22	0.1	
Unloading time (min)	10	10	10	10	10	10	
Transportation distance (km)	5.8	7.1	5.8	7	0.4	1.4	1.3
Time of arrival	8:09	8:30	8:49	9:10	9:22	9:35	9:47
Penalty cost F3	0	0	0	0	0	0	0

It can be seen from Table 9 and Table 10 that the total delivery time of the two routes is within two hours, which meets the requirements of the delivery time window, that is, no penalty cost will be generated when the goods of the two routes are delivered, which reduces the unnecessary cost expenditure in the delivery process.

3.5. Optimization Results

According to the constructed model, the total minimum distribution cost can be calculated according to the above calculation results: $\min F = F_1 + F_2 + F_3$

Line 1: minF '= 363.3 + 0 = 363.3 (RMB)

Line 2: minF " = 434.3 + 0 = 343.3 (RMB)

3.5.1. Comparison of Optimization Results

In this case study, only the vehicle path is optimized, and other conditions remain unchanged. The results before and after optimization are compared and analyzed, as shown in Table 9.

Table 9. Comparison before and after optimization of single-day transportation cost

	Before optimization	After optimization
Delivery distance (km)	84.5	62.7
Use cost (yuan)	283.3	283.3
Distribution cost (yuan)	180	140
Transportation cost (yuan)	746.6	706.6

Through the above two charts, it can be seen that this optimization only aims at two distribution routes, which can directly save 40 yuan in transportation costs. The rational use of vehicles and the rational planning of routes have been greatly improved. A company's distribution mode, the goods need to be delivered every day, the line use frequency is higher, so we can calculate azz to save 1200 yuan per month transportation costs, saving 14400 yuan per year. The optimization effect is remarkable.

3.6. Optimized Implementation and Planning

After the optimization of the original distribution scheme, it is necessary to change and optimize the matching system in order to achieve more efficient optimization.

3.6.1. Considerations for Implementation Planning after Optimization

The optimization scheme needs to be combined with the actual situation for reasonable planning in order to maximize the optimization effect. Under the combination of theory and practice, we can solve the problem pertinently, suit the remedy to the case and hit the nail on the head. A company in this paper as a case company is to consider the specific status of the actual, its route data collection, optimization of the content of the analysis. The practice is the best way to verify the theory, and the theory provides the basis for practice. They complement each other in a program. However, it is worth noting that we should also take into account the following factors in the specific implementation process:

1. Reasonably plan the distribution time according to the time window

A company mainly aims at community distribution, the main characteristics of community distribution are short distance, high density and wide range, so when distributing goods, it chooses reasonable distribution time within the time window, and tries to avoid traffic congestion caused by morning and evening rush hours, which leads to the penalty cost caused by exceeding the time required by a single route.

2. Selection of experienced staff

Compared with urban main roads, the road conditions of community distribution roads are more complex. The radiation range of the warehouse where Shuangliu of Company A is located is within 10km, but the surrounding traffic conditions are relatively complex, so experienced drivers can be selected as far as possible to ensure that they are not affected by human driving factors;

3. Ensure the accuracy of order sorting

As a retail e-commerce platform for daily life, it has the characteristics of small batch and multi-variety, so the goods that need to be distributed should be carefully examined before loading to avoid mismatching and missing. According to the duty requirements of the staff of Company A, there will be corresponding fines for the phenomenon of missing or mismatching of goods, which will also improve the service level of customers.

4. Reasonable loading according to the distribution route and product nature

After reasonable planning of the distribution route, the order of arrival at each community group is relatively fixed, and attention should be paid to the order of loading and unloading to ensure faster and more accurate loading and unloading.

A company's retail products are mainly fruits and vegetables, meat, poultry, eggs, milk, rice, flour, grain and oil, daily necessities sales and distribution, so the packaging and loading order of goods should be reasonable and standardized to prevent the impact of external factors on the implementation of the results.

3.6.2. Improvement of Operation Efficiency after Optimization

1. Improve operation equipment and establish "accident protection" measures

At present, the distribution vehicles selected by Company A are new energy electric vehicles, which have great restrictions on the amount of goods loaded, transportation distance and speed. In the process of distribution, vehicles with larger capacity can be properly selected to meet the unexpected situation of distribution, such as sudden increase of orders.

Reasonable planning of the use of transportation tools can reduce the occupancy rate of distribution resources and maximize the utilization rate of transportation tools. The use of cost-effective transportation tools and scientific and rational planning of existing transportation tools can greatly reduce the cost of distribution and improve the level of service.

2. Reasonable arrangement of orders

Due to the numerous positions of the downstream community leaders of Company A, in order to meet the requirements of time window and timeliness, the orders are reasonably distributed to the drivers and distribution supervisors responsible for distribution, so as to avoid the distribution situation beyond the time window caused by unreasonable distribution. In the case of not exceeding the maximum load of vehicles, the distribution orders should be divided reasonably, which not only ensures the maximum utilization rate of vehicles, but also makes the distribution orders of vehicles have extensibility, that is, it can meet the special situation of sudden increase of orders.

3. Effective use of crowdsourcing

A company's community leaders are mostly express collection points or convenience stores around, and their activity time is more flexible. Community leaders can encourage neighborhood cooperation, and in this way, the actual storage cost of products and the energy consumption during the waiting process can be effectively reduced. Strengthen the integration of social idle transport capacity resources, and use it to match the orders of Company A, so as to achieve the purpose of saving transportation costs.

4. Personnel training

As a company in the retail service industry, the distribution personnel have direct contact with users, so the distribution personnel need to have high professional ethics and etiquette. For the staff in the distribution link, they need to have adequate pre-job training before taking up their posts, improve the professional level of the staff, and ensure the comprehensive quality and professional quality of the operation team, so as to prevent unexpected situations from reducing the operation efficiency.

4. Conclusion

With the development of China's economy and service industry, great changes have taken place in the operation mode and development mode of logistics enterprises in China under the support of social needs and science and technology. The changing economic structure requires enterprises to have the comprehensive ability to cope with the challenges and opportunities brought by these development trends. In the process of improving the comprehensive ability of enterprises, not only the time of commodity transaction will be shortened, but also the transaction cost will be greatly reduced. It is not difficult to see that the time and cost of commodity circulation will be largely affected by the operational efficiency of the logistics distribution service system. Because of the short distance of urban logistics distribution, it may directly face the daily circulation of consumers. For this reason, we should strengthen the development of urban logistics industry, actively encourage the majority of professional logistics enterprises to devote themselves to the development of urban distribution services, so as to effectively improve the service level of urban logistics system, and solve a series of operational problems of logistics distribution vehicles, such as difficulties in entering the city, loading and unloading, and parking.

In fact, urban logistics distribution is actually a relatively new "concept". It is a modern service industry with the change of retail industry, e-commerce and people's shopping habits from physical to online. It focuses on optimizing the urban logistics system to ensure that urban logistics activities can fully meet the daily production and living needs of consumers.

References

[1] Lucas R. On the Mechanics of Economic Development [J] Journal of Monetary Economics,1988(22):3-42.

[2] Perroux F. Economic Space: Theory and Applications[J]. Quarterly Joual of Economics,1950 64(01):89-104.

[3] Qin Lu. Research on Spatial Structure Characteristics and Evolution Theory of Urban Logistics [D]. Beijing: Beijing Jiaotong University, 2012.

[4] Hu Han, Meng yuan. Analysis of Logistics Operation in 2020 [R]. China: China Federation of Logistics and Purchasing, 2020.

[5] Paolo Toth, Daniele Vigo. THE VEHICLE ROUTING PROBLEM[M]. Society for Industrial and Applied Mathematics philadephia.2002.

[6] Clarke G, Wright J W. Scheduling of vehicle les from a central depot to a number of delivery points[J]. Operations research, 1964, 12(4): 568-581.

[7] Taillard E. Parallel interative search method for vehicle routing problem [J].Operations Research Society,1 994, 45(10): 115-116.

[8] Desrosiers J, Solomon M. A new optimization algorithm for the vehicle routing problem with time windows[J]. Operations research,1992,40(2): 342-354.

[9] CESCHIA S, GASPERO L D, SCHAERF A. Tabu Search Techniques for the Heterogeneous Vehicle Routing Problem with Time Windows and Carrier-Dependent Costs[J]. Journal of Scheduling,2011,14(6):601-615.

[10] Teo Taniguchi.Evaluation of Urban Distribution Center Using Multiagent Model with Geographic Information Systems[A]. Transportation Research Board 94th Annual Meeting[C].2015.

[11] Wu Jieming. Simulation Research on Vehicle Routing Problem in Logistics Distribution [J]. Computer Simulation, 2011, (7): 25-27.

[12] Hao Ruiqing, Yan Li. Research on Vehicle Routing Problem of Military Distribution Logistics [J]. Journal of Xi'an University of Technology, 2015. (1): 5-7.

[13] Ge Xianlong, Xu Maozeng, Wang Weixin. Research on Quantum Genetic Algorithm for Multi-type Vehicle Routing Problem [J]. China Management, 2013 (1): 125-133.

[14] Tai Xiaohong, Li Lu. Optimization of Logistics Distribution Path Based on Improved Saving Method [J]. Journal of Liaoning Technical University (Natural Science Edition), 2016,35 (6): 667-672.

[15] Qu Qianqian, Qu Shiru, Wen Kaige. Hybrid Genetic Algorithm for Solving Distribution Vehicle Scheduling Problem [J]. Computer Engineering and Application, 2008,44 (15): 205-207.

[16] He Zhenggang, Liu Sha. Study on Path Optimization of Urban Medical Waste Recycling-Taking Jinniu District of Chengdu as an Example [J]. Logistics Technology, 2015, (1): 34-37.