An analytical study of convenience store transportation optimization

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Abstract

With the development of urban economy, China's chain convenience stores have experienced rapid growth in retail sales. However, there are still many problems in China's chain convenience store enterprises. Among them, the huge increase in logistics costs has made the cost of China's chain convenience store enterprises remain high. Solving the problems in logistics, reducing costs, improving market competitiveness, and enhancing profitability are urgent issues for chain convenience store enterprises to address. Efficient logistics distribution is crucial to ensure that convenience stores meet customers' needs for convenience and effectively reduce logistics costs. Optimizing logistics distribution can achieve zero or low inventory, optimize inventory structure, and facilitate negotiations between enterprises and suppliers. Through analyzing the major issues in logistics transportation of convenience stores in China, we found the high logistics costs and the factors affecting them. We also identified problems in three major modules of convenience store transportation, including distribution planning, distribution route planning, and distribution information system. In addition, we analyzed various factors. Finally, we proposed targeted solutions to arrange and select transportation vehicles for convenience stores, plan distribution processes, and improve the distribution information system, making the transportation of convenience stores more reasonable and achieving the goal of reducing logistics costs.

Keywords

Chain convenience store; distribution planning; distribution route planning; distribution information system.

1. Introduction

With the development of urban economy, many different forms of chain retail formats have emerged in China's retail industry, among which chain convenience stores are one of the fastest growing formats in China's retail industry. China's chain convenience store enterprises have developed rapidly, but there are still some problems such as rapid increase in operating costs, imperfect franchise mechanism, and weak membership system. The biggest problem is that with the increase in the number of chain convenience store outlets, the cost of logistics and distribution has risen rapidly, and the huge increase in logistics costs has made the cost of China's chain convenience store enterprises remain high.

At the same time, foreign chain brands have also increased their investment in the domestic market. Foreign convenience store giants such as 7-11 and Lawson have rushed to China. They have more mature experience and sound supply chain management in convenience store

operation, location selection, marketing, etc. than domestic chain convenience store enterprises, which will inevitably have an impact on domestic local chain convenience store enterprises.

At the same time, drivers and logistics personnel responsible for distribution in convenience stores usually choose routes based on experience, and often deliver goods to several convenience stores along the same route or using the proximity principle, resulting in overlapping and duplication of delivery routes. At the same time, the number of convenience stores in Chengdu has been increasing, and the problems caused by this distribution method are becoming more and more obvious. At the same time, this also leads to delays or early arrival of delivery vehicles for most convenience stores, especially for those located far from the distribution center. This further increases the penalty cost of delivery.

As the "third profit source", logistics and distribution are not only an important process for convenience store operations, but also a key area for enterprises to strive to improve and enhance their market competitiveness. Efficient and fast logistics and distribution rely on the support of information systems, through a series of processes such as sorting, packaging, loading, and transportation, to deliver goods to stores in a timely manner according to orders, meet consumers' purchasing needs in a timely manner, improve the service quality of stores, and also improve the overall operational efficiency of chain enterprises, effectively controlling logistics costs.

The cost of logistics includes many aspects, among which the distribution cost accounts for a large part of the total logistics cost, and the efficiency of distribution directly affects the sales of convenience stores. Nowadays, the competition among various brands of chain convenience stores has evolved from competition in front of the store to competition in the distribution system. The logistics and distribution solutions are diverse, and how to choose a logistics and distribution model that suits the enterprise, continuously optimize the logistics and distribution management to better match the business operation, and generate synergies, so as to improve the market competitiveness and profitability of the enterprise, is an urgent problem for chain convenience store enterprises to solve.

2. Review of relevant literature

From the perspective of the overall development of convenience stores and the distribution models of convenience stores, there are many problems in the current convenience store distribution. Many scholars have also proposed corresponding solutions and distribution optimization plans for convenience store distribution.

Yue Li considered that the traditional self-operated distribution model under the new retail model would lead to the idleness and waste of distribution resources. He proposed a new retail store distribution system that guarantees the quality and efficiency of distribution[1]. Ming Ni et al. constructed a mixed integer model for the logistics distribution between physical stores and customers to achieve convergence to global optimality[2]. Hossein Fotouhi et al. proposed a two-stage plan considering delivery time and customer satisfaction, using an example to prove that the model can achieve retail delivery within the promised delivery time[3]. Ma Yiwen studied the logistics distribution of the new integrated development model combining chain convenience stores and community group buying, believing that the new business model and optimized distribution system are inevitable trends[4]. Li Danlian and Cao Qian considered the optimization model of the distribution path of convenience stores with time window constraints, and used genetic algorithms to solve the model of single-depot and multi-vehicle types for convenience store distribution, providing an optimization plan for the distribution path planning of convenience stores[5]. Wei Ziqiu and Xiong Yingxiang, similarly, considered the issue of distribution path planning for chain convenience stores under time windows, providing

economic and reasonable optimization references for the distribution path of the convenience stores of this enterprise[6].

Some scholars have also subdivided the research on convenience store distribution into the optimization of fresh food distribution. Chaug-Ing Hsu considered the characteristics of urban fresh food distribution and aimed to maximize profits, and conducted model planning for fresh food distribution delivery[7]. Lei Wang et al. considered the characteristics of fresh food transportation and based on the impact of big data and informatization, achieved the goal of minimizing the total logistics cost[8]. He Yue mainly analyzed the current situation and problems of fresh agricultural product distribution in chain supermarkets, and believed that the establishment of a standardized distribution system should consider the characteristics of the distribution items[9]. Geng Sujuan and Zhang Li analyzed the problems existing in the distribution of a certain fresh food supermarket, proposed optimization measures for its logistics distribution, and believed that it could increase the competitiveness of fresh food supermarkets and improve logistics efficiency and level[10]. Wang Xizhuang and Chen Yulan considered the characteristics of agricultural products and urban traffic conditions, analyzed the problems of a certain convenience store, and optimized the distribution route of the convenience store considering time window factors, achieving the dual goals of shortening the distribution distance and reducing costs[11].

3. A description of the issue affecting the convenience

At present, the commodities sold in convenience stores tend to be homogenized, and it is difficult for various chain convenience store operators to make significant breakthroughs in terms of product differentiation. Therefore, an instant and effective distribution system has become the key to core competitiveness. Therefore, the core competitiveness of chain convenience stores is efficient and low-cost distribution services.

3.1. The delivery plan is not reasonable

(1) The delivery vehicle models are complex

At present, chain convenience stores have established a competitive logistics system, which is based on their own fleet of vehicles, flexibly utilizing outsourced vehicles, and equipped with a variety of refrigerated trucks and normal temperature trucks. Each temperature zone only undertakes the task of transporting goods. Multi-vehicle models not only increase the difficulty of vehicle management, but also bring great difficulties to the operation of the enterprise, and also bring a great burden to the logistics enterprise. In addition, the cost of refrigerated trucks is high and the initial investment is also large. Therefore, for chain supermarkets that are still in the expansion period, if they want to further expand their business scale, they still need to establish their own logistics system. Therefore, the investment in logistics vehicles will be a considerable expense.

The temperature for delivery is uniform

Chain convenience stores have different requirements for low-temperature products in different temperature layers, which belong to short-distance and multi-variety cold chain distribution. However, most convenience stores' refrigerated and frozen foods can only use refrigerated trucks that match them. When a store sends a distribution request containing items in different temperature layers to the headquarters, it must be distributed separately, with dedicated vehicles for specific purposes and a single distribution temperature, which cannot simultaneously meet the requirements of various convenience stores for small batches and diverse products. This will not only lead to the consumption of human resources, but also greatly reduce the efficiency of vehicle distribution.

3.2.   Lack of scientific basis for distribution route planning

(1) Arrangement of distribution routes is manual

Generally speaking, there is a strong subjectivity in the planning of distribution routes. Logistics supervisors will arrange distribution routes based on past experience and the number of stores that have requested delivery on the current day, which results in unscientific distribution routes and affects the timeliness of delivery.

(2) The delivery route is affected by the driver's experience

During the delivery process, the driver will deliver to all stores along the entire route based on past delivery experience. If new stores are added, it may disrupt the driver's delivery plan and cause them to forget about the new stores, resulting in a backflow of routes and an extension of delivery time. Moreover, the dedicated delivery model for each vehicle type only allows for the delivery of a single temperature layer of goods, while convenience stores have a small but diverse range of product requirements. This results in each vehicle being responsible for delivering to a larger number of stores, which requires more stops and unloading during delivery, making it difficult to control.

3.3.   The distribution information system is not sound

(1) Single information communication channel

In the distribution management of most chain convenience store enterprises, especially small convenience store enterprises, there is no common communication information channel and sharing platform among convenience stores, distribution centers, fleets, and third-party logistics companies.

(2) The visual management system is not perfect

Although convenience store distribution uses a specialized platform monitoring system and GPS tracking system to provide monitoring, temperature data curves, and in-transit data, this only provides in-transit tracking and query services, with limited functionality and limited use of the visualization system. It cannot achieve the goal of timely response at each node, resulting in poor delivery timeliness and failing to achieve the company's visual management effect.

4.   Conclusions and recommendations

4.1.   Selection of Delivery Vehicle Models

In view of the problems of multiple and small demands and variety in the current distribution of convenience stores, based on the analysis of their distribution characteristics and the insulation needs of convenience store products, it is recommended that convenience stores adopt a multi-temperature sharing distribution model in response to the differences in multi-temperature shared vehicles.

The multi-temperature co-distribution technology can transport refrigerated goods such as fruits, yogurt, frozen foods, and zero-temperature goods on the same ordinary distribution vehicle, achieving the goal of delivering convenience store goods in one delivery and ensuring the integrity of the goods, greatly reducing the number of loading and unloading operations.

At the same time, using a multi-temperature co-distribution model can reduce delivery time, improve vehicle loading capacity and loading and unloading efficiency. At the same time, it can save energy, reduce fuel consumption, delivery costs, order processing costs, inventory storage costs, and cargo loss costs. Using a cold storage and insulation box to load multi-temperature layer goods and then transporting them by ordinary vehicles can not only ensure the quality of cold chain goods delivery, but also make full use of the delivery capacity of ordinary vehicles to reduce costs during the delivery process. Compared with cold chain vehicle transportation, cold

storage and insulation box transportation has advantages in flexibility, environmental protection, economy, safety, and controllability.

4.2. Reconstruction of distribution process

In response to the unreasonable distribution plan of chain convenience stores, after improving the vehicle model, the delivery mode has been changed from dedicated vehicle delivery to multi-temperature co-distribution mode. The distribution is divided into two cases: centralized distribution and additional replenishment. The distribution management has changed, requiring the reconstruction of some distribution processes, which can also assist in solving the problem of poor information communication.

Convenience stores submit delivery requests based on their inventory and sales. Each distribution center picks and prepares goods in their respective warehouses based on the list of requests, awaiting unified delivery either in the evening or the following morning. A vehicle scheduling plan is established: Once the vehicle scheduling plan is established, the distribution center and fleet are notified to make a loading plan. When there are insufficient vehicles, the fleet can directly borrow vehicles from third-party logistics companies. The distribution center sorts and loads the goods that have been pre-picked according to the loading plan, and reminds the fleet to start the delivery on time.

4.3. Improvement of distribution information system

In the context of information technology, information systems have played an increasingly important role in the management of enterprises. In order to improve the logistics information system of convenience store enterprises, improve the information exchange between enterprises, and solve the problem of insufficiently developed visual management platforms, it is necessary to establish an integrated and visual distribution information system.

The main function is to collect data information from various end-of-line intelligent information platforms and in-transit distribution visualization management systems, perform calculations and analysis, and then make decisions based on the results and provide feedback to the terminal interfaces of each node. As a distribution business interaction platform between the fleet, convenience store, supply chain strategy department, and distribution center, it provides dynamic visualization monitoring of the distribution process. The system can monitor data information from the insulation boxes in each distribution vehicle.

The establishment of the system aims to allow real-time information connection between various distribution nodes such as chain convenience stores, logistics centers, and vehicle fleets, as well as dynamic tracking and visual management of the entire distribution process, thereby improving the timeliness of distribution.

In general, at this stage, China's chain convenience store enterprises are facing the huge challenges of direct competition with foreign chain convenience store enterprises and high logistics and transportation costs. Faced with this challenge, the key for China's chain convenience store enterprises to maintain their victory in this competition is to improve their core competitiveness through the improvement of the transportation process and transportation system.

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