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Retraction

Retracted: Research on Optimal Design of Short-Life Cycle Product Logistics Supply Chain Based on Multicriteria Decision Model

Security and Communication Networks

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This article has been retracted by Hindawi, as publisher, following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of systematic manipulation of the publication and peer-review process. We cannot, therefore, vouch for the reliability or integrity of this article.

Please note that this notice is intended solely to alert readers that the peer-review process of this article has been compromised.

Wiley and Hindawi regret that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

References

[1] C. Wang, "Research on Optimal Design of Short-Life Cycle Product Logistics Supply Chain Based on Multicriteria Decision Model," *Security and Communication Networks*, vol. 2021, Article ID 5564831, 12 pages, 2021.

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Research Article

Research on Optimal Design of Short-Life Cycle Product Logistics Supply Chain Based on Multicriteria Decision Model

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In order to study the special production, distribution, transportation, and sales of short-lived and short-lived multimedia products, this paper studies the cost and benefit optimization of a three-level supply chain network consisting of a supplier-producer-distribution center. Simultaneously, to effectively describe the actual inventory level of the retailer's multimedia products, this paper introduces a new nonlinear function to define the real-time inventory of multimedia products to establish a biobjective nonlinear mixed-integer programming model to estimate the inventory. The research results show that the model established in this paper can not only provide the overall cost and optimal decision-making plan for the short-lived dairy supply chain but also the design method is better than the standard constraint method. Relevant research results have important potential guiding significance for research and design of supply chain network structure, measurement of multimedia product inventory levels, and improvement of customer satisfaction. The optimized design of the logistics supply chain of multimedia products with short life cycle under the background of new retail is beneficial.

1. Introduction

The concept of "new retail" was put forward by Jack Ma, chairman of Alibaba Group. He pointed out that new retail is a new sales model formed by the combination of online and offline logistics. The so-called "new retail" is the application of the advanced ideas and technologies of the Internet, the improvement and innovation of traditional retail methods, and the use of the latest ideas and thinking as a guide to sell goods and services to all activities of the final consumer [1, 2]. It is not just a simple integration of O2O and logistics but also incorporates innovative technologies such as cloud computing and big data. It includes omnichannel, but beyond omnichannel, breaking all the past boundaries so that consumers enter a new field of consumption. Therefore, "new retail" allows consumers to buy the goods they need in the shortest time. The key to supporting the "new retail" activities is the idea of the open Internet and advanced science and technology in the new era. The arrival of new retail has subverted the pattern of the traditional retail industry. The technology has accumulated for many years, and the business breaks the border and gradually merges. The multimedia products, services, and management also have spill-over effects [3–5]. By integrating big data of consumers, we continually improve marketing and payment experience, optimize product procurement and pricing, and activate online and offline trading. In the environment of new retail, the supply chain has also begun to be smart.

With the improvement of people's living standards and dietary structure, dairy products have become an essential nutritional food in people's daily life. Its consumption in the domestic market is also expanding, especially for short-lived dairy products (such as yogurt, fresh agricultural products, and pure milk), showing a rapid growth trend [6]. This not only brings new development opportunities to logistics companies but also brings challenges. Because short-lived dairy products have many varieties and are easy to deteriorate and their production, processing, distribution, and transportation in the entire supply chain need to be carried out under strict temperature and sanitation environment, the cost of their supply chain is relatively much higher than ordinary products [7]. However, each node member in the supply chain hopes to satisfy the customer's product demand at the lowest cost and the best condition. Therefore, it is of great theoretical significance and practical application value to study how to reasonably arrange the short-life cycle dairy product ordering, production, and distribution schemes to optimize the cost and benefit of the supply chain under the condition of satisfying customers' specific product demand.

In this paper, we will analyze the cost and benefit of short life product logistics supply chain network under the new retail background, establish a unified mathematical model of related problems, and give the solution. Firstly, we analyze the particularity of short life-cycle products in production and transportation and their special requirements for distribution networks. Secondly, on the premise of meeting the demand of retailers in the logistics supply chain network of short-lived products under the new retail background, we establish a mathematical model that can optimize the cost and benefit of the whole supply chain network, which is a two-objective mixed-integer programming model. Finally, through empirical analysis, we find that the model can provide the optimal decision scheme for the production and transportation of products in the supply chain. Relevant research results have essential potential guiding significance for further research to optimize the cost and benefit of the short life-cycle product logistics supply chain under the new retail background and improve customer satisfaction.

The research contributions of this article include the following:

(1) Analyze the cost-benefit optimization of a three-level supply chain network composed of suppliers, manufacturers, distribution centers, and retailers.

(2) According to the network structure characteristics of the three-level supply chain, a new optimization model is designed.

(3) A new nonlinear function is introduced to define the real-time inventory of multimedia products.

The rest of this article is organized as follows. In Section 2, we discuss related work, and then in Section 3, we introduce nonlinear functions to define a real-time inventory of multimedia products. In Section 4, the discussion of experimental results is presented. This summarizes of the paper, and future research directions are given in Section 5.

2. Related Work

The most important thing about "new retail" is the user experience-centered business model. The core is to meet the increasing and changing needs of consumers while considering internal employees and upstream and downstream business partners. The essence is to make products well. At the same time, as service marketing do an excellent job of "people." There are three main modes of "new retail":

(1) Integrate goods and logistics channels while integrating online and offline logistics.

(2) Provide a broader range of experiential consumer services to achieve consumer scenarios.

(3) To create a "new retail" platform model that includes internal employees of retail enterprises and upstream and downstream partners, that is, to create a "new retail" omnichannel industrial ecosystem.

The cascaded deep learning framework is shown in Figure 1.

"New retail" has developed because of traditional retail. It is a new thing in the Internet period that searches for a new way out for the dilemma and drawbacks of conventional retail. The main difference between the two is that traditional retail is a transaction-marketing model aiming at a profit and does not pay attention to long-term cooperation with customers. However, the "new retail" is a relationship-marketing model that pursues consumer scenes and customer satisfaction, focusing on customers. Second, traditional retail pays more attention to the logistics distribution under the conventional way and cannot meet the more requirements of customers; in contrast, "new retail" pays more attention to the application of high-tech technologies such as cloud computing and big data than traditional technologies and makes products, logistics, and customers. Data management emphasizes the combination of information flow and logistics and pursues Omnichannel, borderless cooperation, and mutual benefit. Specifically, "new retail" is actually to promote the development of the traditional physical retail industry with the development of new Internet-based retail formats and integrate new Internet technologies into traditional physical retailing, thereby revitalizing standard material retailing and making Internet retailing gain new growth points [8]. In the past two years, many researchers have analyzed the commodity supply chain from all aspects of the short life cycle. At present, the research in this aspect is relatively mature, and they mainly use the model analysis method to forecast and analyze the order cycle to achieve the expected effect and optimize the inventory of the whole life-cycle [9].

The new and old retail industries promote and integrate each other and connect with the source manufacturing industry in terms of information and services, which can better promote the circulation economy's sound development [10]. There is a clear distinction between new retail and traditional physical retail, which has reflected in the following aspects:

(1) *Business Scope*. The business scope includes the geographical content of customers and the size of business operations. Traditional retail has more limited by physical space, and the business scope is relatively narrow. The location of shops, the selection of goods, and the way of the display are the key factors affecting their development.

(2) *Flexibility of Management*. Physical retail operation is relatively inflexible, limited in terms of the operation time, commodity adjustment, scale expansion, import, and export, while online retail breaks through the time limit. In principle, customers can place orders on the website 24 hours a day.

(3) *Business Aspects*. Most of the physical retailing has been built because of multilevel agents. There are many circulation links, the ability to grasp the

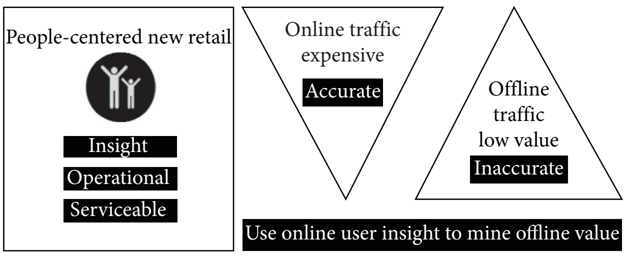

Figure 1: Cascaded deep learning framework.

upstream of the industrial chain is relatively weak, and the operating cost and product price are high. Online retailing can save all unnecessary circulation links and reduce operating costs. Form a price advantage.

(4) The competitive situation. The scope of business limits traditional retail. The economies of scale of single stores are relatively weak. The economies of scale of enterprises have mainly been reflected in the chain. The competition between different formats in the same form and physical retail is relatively weak, and the scale of online retail economy obviousness, at the same time, low consumer conversion costs, fragile customer sticks, and fierce competition, the production, and operation of enterprises rely heavily on economies of scale.

(5) *The Cost and Experience of Consumers.* In addition to paying a higher shopping price, physical retail consumers also need to pay transaction costs such as transportation and time, but they can enjoy the derivative value of entertainment and social shopping, and the scene features are apparent; in contrast, online retail can greatly save consumption [11].

At present, many scholars at home and abroad have researched the different issues of the dairy product supply chain. Shen et al. construct a three-echelon supply chain consisting of one global supplier, one local seller, and one logistics service provider for short life cycles [9]. Javad et al. study a coordination approach in a closed-loop supply chain during the product life-cycle including introduction, growth, maturity, and decline phases [12]. To enhance understanding of the interconnected decisions for supply chain management and product design, Yao et al. analyze the existing papers from an operation research perspective [13]. At the same time, Chhetri et al. study models the alignment of supply chain complexity with product demand and design characteristics and formulates appropriate strategies to enhance supply chain alignment [14]. Besides, Reitsma et al. explore how supply chains can be designed during product development [15]. With the same goal of this paper, Hassanpour et al., develop a new mathematical model for integrating decisions regarding food supply and distribution [16]. Diabat et al. proposed a method that addresses the closed-loop supply chain network design problem for durable products with consideration of take-back legislation [17]. Oliveira et al., employ optimization methods in the closed-loop supply chain [18]. Ayag proposed a fuzzy quality function deployment to determine the impact of logistics requirements and supply chain management strategies on customer satisfaction in the dairy industry and applied the research results to a dairy company in Turkey [19]. Manikas and Manos established a traceability system model for the food supply chain that could be used as a basis for the development of product traceability management system web applications in the dairy industry. Miori and Segulin presented a triplet symbol model for the production-scheduling problem of beverage and single line production products such as milk. Lagrange relaxation and dynamic programming methods are used to solve the optimal solution of the problem [20].

3. Cascaded Deep Learning Model

3.1. Model Framework. According to the different management modes, the supply chain can be divided into centralized control and decentralized control. The purpose of supply chain coordination is to benefit the supply chain system more excellent than the sum of the member companies' benefits under the decentralized management mode, equal to or close to the maximum services available under a centralized supply chain structure [21]. The supply chain model is a cross-industry standard supply chain reference model and supply chain diagnostic tool issued by the American Supply Chain Association. It is a comprehensive, accurate, and optimized standardized term and procedure and can be applied to supply chains of various scales and complexity.

The main methods to achieve supply chain coordination are information-sharing mechanism, multiparty cooperation mechanism, and supply chain contract coordination mechanism. The commonality of these three coordination methods is based on the full trust and cooperation between member companies; the difference is that the first two contracts' implementation is more focused on moral constraints, while the realization of supply chain contracts is established. Given the security and incentive characteristics of supply chain contracts, supply chain contract coordination plays an important role in supply chain coordination. Cold chain logistics management refers to a systematic project in which temperature-sensitive products are always in the specified low-temperature environment during production, storage, transportation, sales, and consumption, to ensure the quality of goods and reduce logistics losses. It is a low-temperature logistics process based on refrigeration technology and using refrigeration technology as a means. The cold chain consists of four aspects: freezing processing, frozen storage, refrigerated transportation and distribution, and frozen sales. The transport framework is shown in Figure 2.

The WSN node is integrated with the RFID reader, and the cheaper ordinary passive RFID tag is attached to the cargo. The WSN node and the weakened RFID reader form an intelligent node, and the smart node has been placed in the refrigerated truck according to a specific density. The intelligent node is equipped with a temperature sensor, a gas sensor, and a taste sensor to monitor environmental

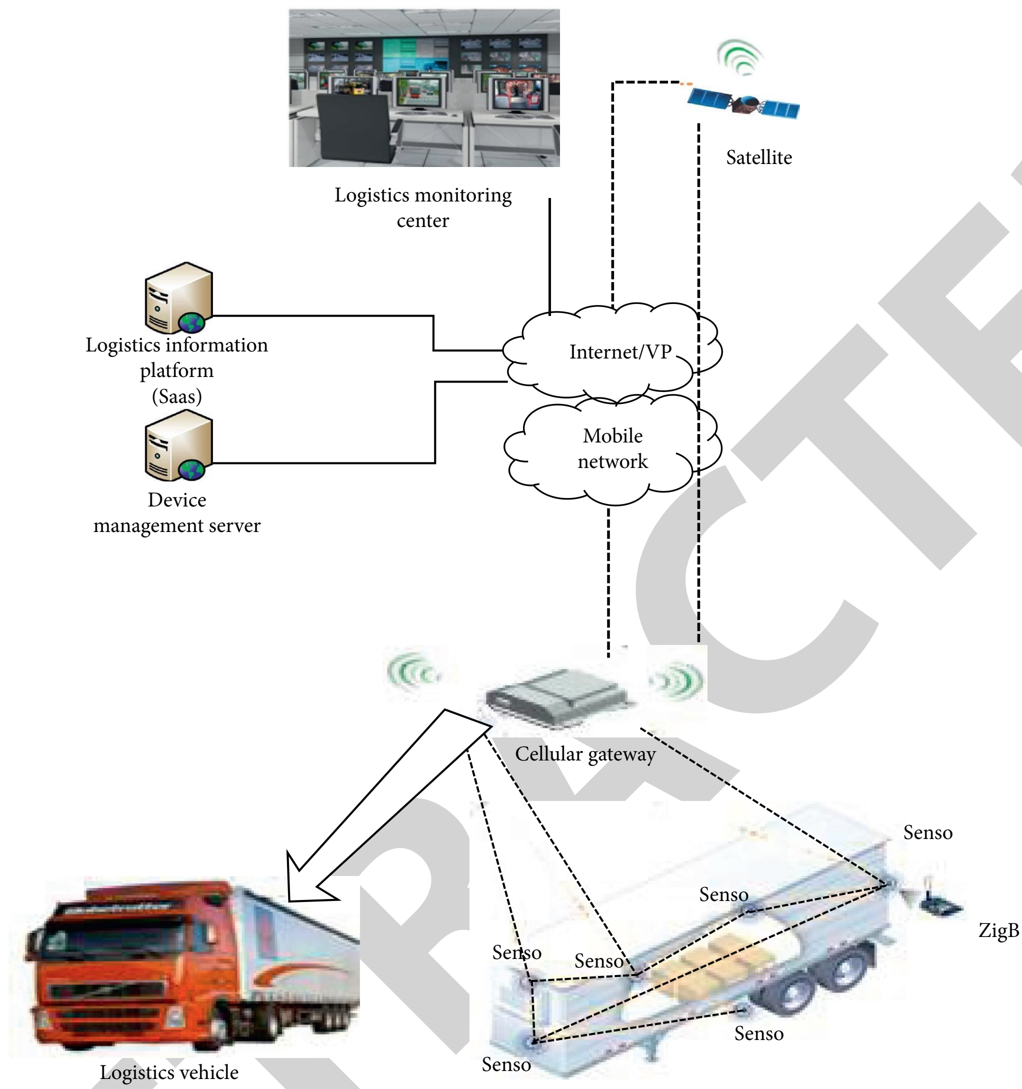

Figure 2: Transport framework.

parameters such as temperature in the refrigerator. Simultaneously, the intelligent node has the function of simplifying the RFID reader and being able to read the information of the RFID tag on the goods [22].

This article uses the smart node mode to control the logistics cost, and a wireless sensor network is formed between the smart nodes. Each smart node transmits the monitored environmental parameters (such as temperature) and the read RFID tag information to the gateway node on the car's roof. And, the gateway node can receive data that have been processed and processed. Communicate with remote logistics monitoring center. When the gateway node processes data, it will send an alarm signal to remind transportation personnel to take corresponding measures and send the corresponding signal to the remote data center or local management center of the cold storage. When the remote logistics monitoring center or the cold storage local management center needs to query some data information on the refrigerated truck, it will also send query commands to the gateway node through wireless communication technologies such as GPRS. The gateway will send query commands to each node. Execute the query. The information has been fed back to the remote logistics monitoring center or the local management center of the cold storage.

3.2. Multistandard Decision Model in Source Search and Procurement. For each market, choose a different distribution center to minimize the total cost of getting products from the distribution center. For C1, there are B1 ⟶ C1 ⟶D1, B1 ⟶ C2⟶ D1, B2 ⟶ C1 ⟶ D1, B2 ⟶ C2 ⟶ D1. Of course, the lowest cost is B1 ⟶ C1 ⟶ D1; C1 is supplied with D1. It is also possible to choose W2 to supply C2 and C3. The three-level supply chain structure is as follows.

By the AHP method, we can select a set of key performance dimensions to determine the relative priority of the dimension and evaluate pending suppliers' preferences based on each performance dimension. Later, we calculate the performance score of each pending supplier based on the obtained information. The priority consideration is directly linked to the score. The three-level supply chain structure is shown in Figure 3.

The detailed steps are as follows:

(1) List the performance priority matrix of the performance dimension, also known as the pairwise comparison matrix.

(2) Under each performance dimension, list the possible supplier pairing comparison matrices.

Each item's score in the matrix has divided by the sum of the corresponding column items to obtain a new normalization matrix. The average score for each row in the normalized matrix can be calculated. For the performance dimension $Y \in \{1, 2, \ldots n\}$ of the normalization matrix, the row average result is the relative priority value of Y. For each vendor's preferred normalization matrix, the row average's result is the relative preference of the measurement to the supplier X, represented as $p(X)$; therefore, the preference is $Y \times p(X)$.

Calculate the total weight score for supplier X, $\gamma(X)$, which is formulated as follows.

$$\gamma\left(X = \sum_{Y=1}^{N} Y \times \rho(X)\right), \tag{1}$$

where n is the number of dimensions.

3.2.1. Weighted Index Evaluation System. The second multistandard decision model introduced in this paper is the weighted index evaluation system. Compared with the AHP method, the model in this part has a more straightforward calculation method. First of all, the users must assign weights ωY to performance measures in advance and score each vendor's performance dimension $\gamma(X)$. This is superior to using a series of paired comparison matrices to prioritize the performance dimension and to assess the supplier's performance level. The total score for each supplier $T(X)$ is calculated as follows:

$$T(X) = \sum_{Y=1}^{N} \omega Y \times \gamma(X), \tag{2}$$

where $\sum_{Y=1}^{N} \omega Y = 1$.

The performance of the fresh produce produced by its three suppliers was reassessed. In the past, the company assigned orders to these suppliers and accumulated more information about their past performance. It is now necessary to sign a new contract for the ICBS required next year. Table 1 summarizes the performance levels of these three significant suppliers in terms of price, quality, and delivery.

3.2.2. Clustered Supply Chain Decentralized Procurement Model

(1) Basic Procurement Model. In the case of a single purchaser purchasing from a single supplier, it is assumed that

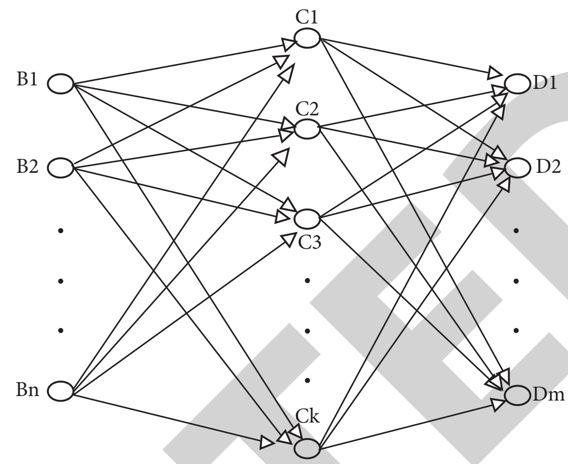

Figure 3: The three-level supply chain structure.

the purchase amount of the purchaser is known and fixed, the supplier is not allowed to be out of stock, and the single purchaser purchases from a single supplier. The total purchase cost per unit time is as follows:

$$\mathrm{TC}_{pij}^{d} = \frac{Sij}{Tij} + \rho\ Di\ j\ Di\ jwij + \frac{Di\ jTijHij}{2}, \tag{3}$$

where S is the fixed ordering or setup costs per lot, T is the reorder period, D is the demand per period, H is the holding cost per unit per period, and is the daily production rate.

The optimal total cost of procurement under the decentralized decision of the supplier i is as follows:

$$\mathrm{TC}_{pij}^{d*} = \rho\ Di\ j\ Di\ jwij + \sqrt{2SijHij\ Di\ j}. \tag{4}$$

The total cost per unit time of the supplier j is as follows:

$$\mathrm{TC}_{sj}^{d} = \frac{Fj\ Di\ j}{Qj} + \frac{Cij\ Di\ j}{Qij^{*}} + \frac{HjQj}{2}\left(1 - \frac{Di\ j}{pj}\right) + HjQij^{*}, \tag{5}$$

where Q is the number of pieces per order and C is unit ordering cost.

The total cost of the supplier j is as follows:

$$\mathrm{TC}_{sj}^{d*} = \sqrt{2FjHj\ Di\ j\left(1 - \frac{Di\ j}{Pj}\right)} + Cij\sqrt{\frac{Hij\ Di\ j}{2Sij}} + Hj\sqrt{\frac{2Sij\ Di\ j}{Hij}}. \tag{6}$$

(2) Decentralized Procurement Model Based on MV-MB Cluster Supply Chain. In the cluster supply chain, the similarity of production products of small and medium-sized enterprises makes multiple buyers in the same chain link in the cluster supply chain. In this multisupplier-multipurchaser procurement system, each supplier is independent of each other [23]. The single-vendor-single buyer system cost function can have easily extended to the multivendor-multiplebuyer cost function:

Table 1: Summary data of three suppliers.

Performance dimension	Company A	Company B	Company C
Price (yuan/kg)	4	5	2
Quality (%)	Failure rate 5	Failure rate1	Failure rate 10
Delivery reliability (%)	On-time delivery rate 95	On-time delivery rate 80	On-time delivery rate 60

$$\mathrm{TC}^{d} = \sum_{j=1}^{m}\left[\mathrm{TC}sj + \sum_{i=1}^{n}\mathrm{TC}pij\right] = \sum_{j=1}^{m}\left\{\sqrt{2FjHj\left(\sum_{i=1}^{n} Di\ j\right)\left(1 - \sum_{i=1}^{n}\frac{Di\ j}{Pj}\right)} + \sum_{i=1}^{n}\left[Cij\sqrt{\frac{Hij\ Di\ j}{2Sij}} + Hj\sqrt{\frac{2Sij\ Di\ j}{Hij}} + \sqrt{2Sij\ Di\ jHij}\right] + \sum_{i=1}^{n}\rho\ Di\ j\ Di\ jwij\right\}. \tag{7}$$

3.3. Introduction to the Distribution Management System. The management system utilizes the logistics center's transportation resources, the supply information of the merchants, and the shopping information of the consumers to optimize the distribution so that the distribution cost is the lowest and the goods are delivered within the time required by the user. The usual solution is to establish a mathematical model, the computer uses mathematical programming methods to give a decision-making plan, and the management personnel then choose according to the actual situation. Typical problems that can only have solved by the distribution system include route selection, delivery order of delivery, type of vehicle being delivered, and delivery time of customer restrictions. The overall architecture is shown in Figure 4.

There is a common problem in the existing logistics management system: the efficiency of enterprise management is not high, and most of the reasons have been attributed to the inefficient transportation of vehicles. On the one hand, the vehicle does not travel according to the original route during transportation, resulting in prolonged transportation time [24]. On the other hand, once the vehicle starts, it cannot have monitored, and some transport drivers use the company vehicle to pull the private goods or do things that have not related to the company's business not only reduced transportation efficiency and harmed the company's interests in Figure 5. In response to this problem, the system applies the GIS technology to logistics management. We not only consider the basic functions of logistics management but also combine GPS navigation and positioning functions as well as spatial query and analysis functions to realize real-time monitoring of vehicles. At the same time, we have also realized the location and status of vehicles, spatial information query visualization, logistics vehicle scheduling, and distribution management functions. The logistics distribution management system module is shown in Figure 5.

The system introduces GIS and GPS into the logistics management system and monitors the position of the transportation vehicle in real-time. Once the vehicle does not follow the original route or leaves the route to pull the private goods, the warning is immediately given, and the staff contacts the transportation driver for relevant processing. Of course, the original route of transportation can have adjusted according to the actual situation. This will greatly improve vehicle transportation efficiency, thereby improving the efficiency of logistics enterprise management [25]. The system has divided into five modules: user management, vehicle management, site management, order management, and distribution management. The composition of the system modules is shown in the figure above, and the whole system process architecture is shown in Figure 6.

The feature design is as follows.

3.3.1. User Management. The main functions of the user management module are registered users, update user information, modify user login passwords, log off users, and query user information [26].

Registered users: when you need to add system users, you can register new users by the administrator.

Update user information: ordinary users can update their personal information, such as their own contact information, and cannot change their own site and other information; administrators can update various details of users.

Change the login password: ordinary users can only change their login password. Administrators can change their own and standard user passwords [27].

Logout user: when some employees no longer use the system, the administrator can log out the user.

Query user information: you can query user information based on employee number, name, and site. The preliminary results have displayed in a table.

Click the link for "Detailed Information" for each record to view a user's information.

3.3.2. Vehicle Management. Vehicle management includes basic functions such as adding vehicles, deleting vehicles, updating vehicle information, querying vehicles, real-time vehicle tracking (including alarm functions), and vehicle status management functions. Vehicle status includes availability and transportation vehicles on the way or at a site to facilitate distribution decisions [28].

Adding a vehicle: when a company purchases a vehicle, the administrator can add the vehicle to the system.

Deleting a vehicle: when the company knocks out the vehicle, the administrator can delete the corresponding vehicle.

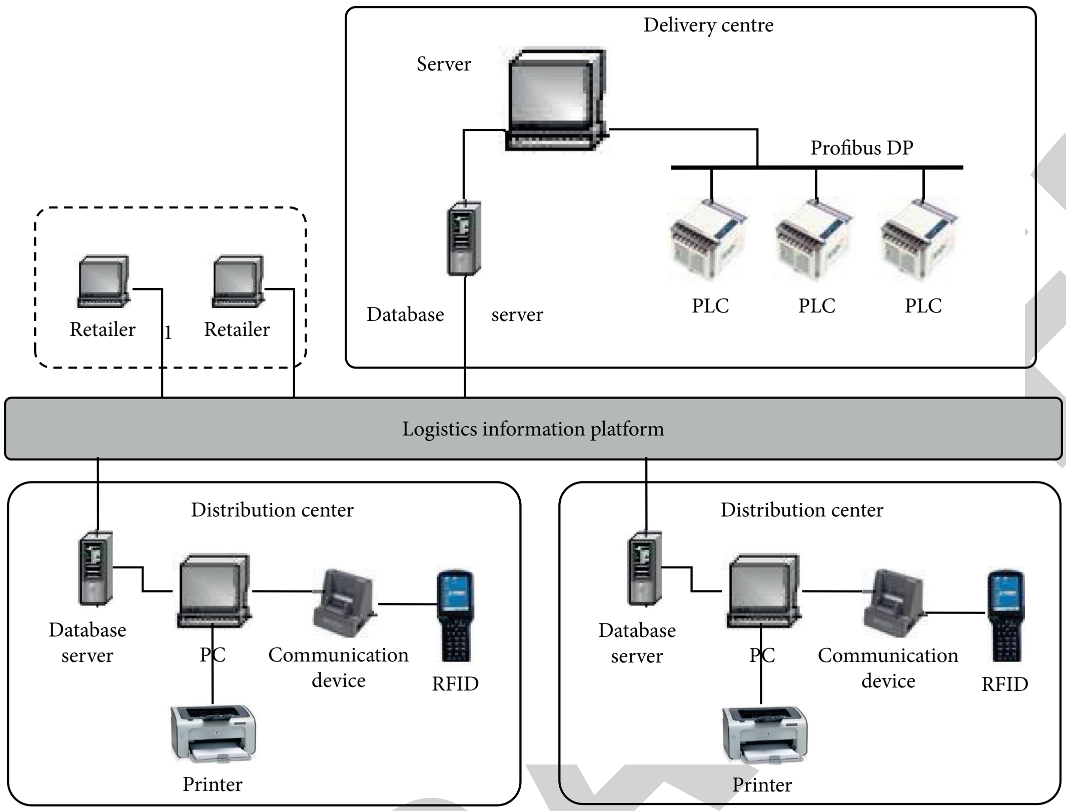

Figure 4: Overall design of the distribution management system.

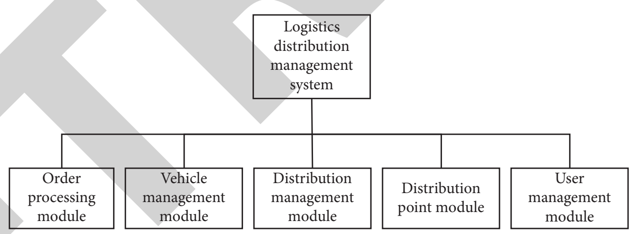

Figure 5: Logistics distribution management system module.

Query vehicle information: the vehicle information that meets the conditions can be queried according to the vehicle number, license plate number, model number, and vehicle status.

Updating vehicle information: there are many vehicle information, divided into several parts, and the vehicle information of a certain part can have updated [29].

Vehicle status update: vehicle status includes unavailable, on the way, and the station number (when the vehicle stops at a certain station, the station number has recorded as the current vehicle status). Because the vehicle status is updated frequently, it is separately updated as an update.

Real-time tracking of vehicle position: the position of the vehicle can be viewed in real-time while the vehicle is in motion.

Alarm information output and query: when the vehicle deviates from the planned driving route, the icon of the vehicle running changes from green to red and an alarm message is given in [30].

3.3.3. Site Management. Site management includes adding sites, deleting sites, updating site information, querying site information, and finding sites.

Adding a site: administrators can add sites when there is more business in a certain area, and a new site needs to be set up.

Deleting a site: when a site needs to be revoked, the administrator can delete the site.

Update site information: administrators can update site information when site information changes.

Query site information: users can query sites based on-site number and site name.

Find a site: when a customer wants to find a site near a location, enter the address to find the site to choose from [31].

3.3.4. Order Management. Order management includes the ability to create orders, delete orders, update basic order

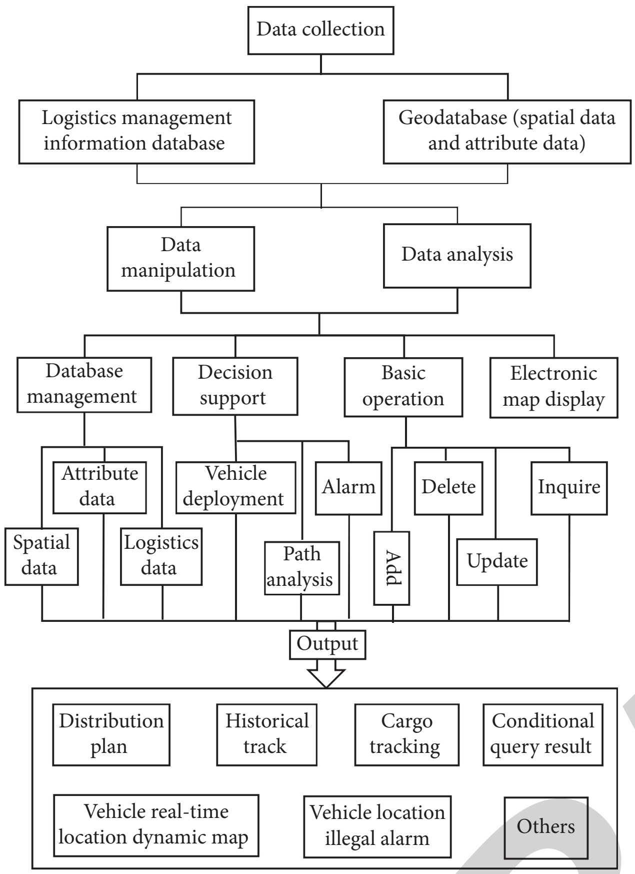

Figure 6: Overall system flowchart.

information, review orders, query multiple ways, and view shipping routes.

Create order: when the company has a customer to place an order, the order taker uniformly enters the order information.

Delete order: the customer can cancel the order before the goods have been sent.

Update order: before the goods have been sent, the order information can be changed if necessary.

Review order: before preparing to send, confirm that the order information is correct and confirm the delivery of the goods [32].

Query order information: compound query and fuzzy query can be performed according to various order conditions such as order number, sender address, recipient address, and order status.

3.3.5. Distribution Management. The distribution management module includes functions such as querying orders to send, creating logistics, deleting logistics, managing orders in logistics, and sending and receiving logistics, logistics query, route selection, and vehicle scheduling.

Query pending order: before determining the delivery plan, Root Art queries the order to send according to the sender's address of the order, the type of the order, and so on.

Create logistics: create the appropriate number of logistics based on the order's shipping address and shipping address.

Manage orders in logistics: add orders to send to the corresponding logistics or adjust the logistics by deleting some orders in the logistics.

Transmission and reception of logistics: during the transportation of goods, when the vehicle departs from a certain station, it records the transmission information; when the vehicle arrives at a certain station, it records the reception information [33].

Arranging the vehicle: arrange the appropriate vehicle for the logistics based on the cargo's volume and weight in the logistics and the condition of the vehicle that can be dispatched.

Select the path: according to the starting point and the logistics terminal, use network analysis to select the most suitable route to meet the conditions.

Logistics information inquiry: logistics information can be queried according to logistics number, starting station, and terminal station [34].

4. Experimental Result

A logistics park needs to transport fresh food from B1 every year, dairy products from P3, and daily necessities from P4. The distance from each city center and the annual material traffic are known in advance. In this paper, in order to facilitate testing, a random matrix, of which size is , is used for testing, where N represents the number of distribution stations. The diagonal elements of the random matrix are zero, and the other elements are random numbers between 0 and 1000. In this example, $N = \{8, 16, 32, 64, 128, 256, 512\}$ is used to test the transportation time consumed by the optimization algorithm. Transportation time consumed by the proposed method at different N is shown in Figure 7.

From the figure, one can find that as the distribution stations increase, the transportation time also increases to varying degrees. But, when the distribution stations are less than 128, the time consumption is very close. This means that the proposed method is efficient when dealing with a small number of sites.

In order to further test the performance of the proposed algorithm in practical applications, we conducted experiments on some data sets collected by ourselves and compared them with the latest research related to the algorithm in this paper.

We simulated a company that provided about 30 product references to 10 retailers. The product is transferred to customers through two local warehouses storing finished products to be ordered by local and overseas retailers. These warehouses are characterized by limited storage capacity. The compared methods are described as follows. DBL is a logistic growth model for predicting short life-cycle clothing products [35]; APC is a multiobjective metaheuristics model for solving food supply chain network [16]; SPL, proposed in [16], is a new mathematical model for integrating decisions regarding food supply and distribution; CCA is a method for optimizing closed-loop supply chain problem [18]. The method proposed in this paper is represented as CDLM. The experimental result is represented in Figure 8.

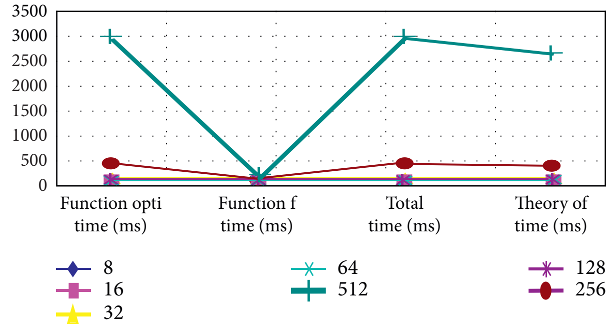

Figure 7: Classification accuracy of USPS data sets at different levels.

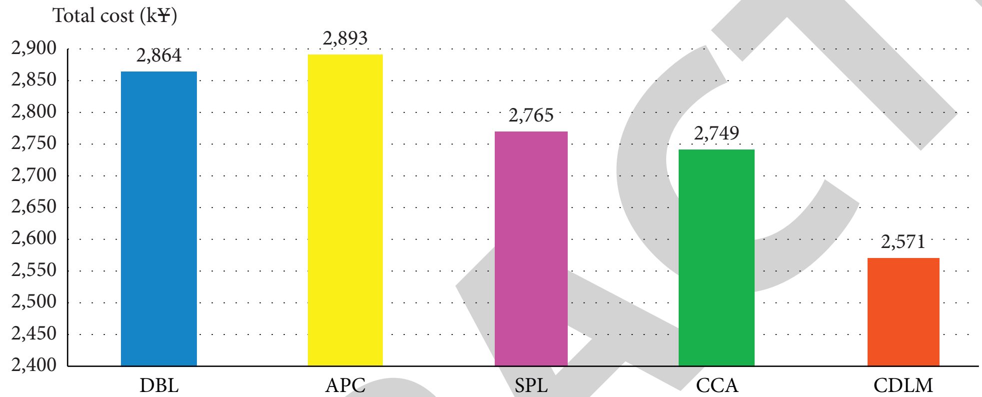

Figure 8: Supply chain cost comparison.

From the figure, one can find that compared with the others method CDLM obtain lowest supply chain, and has a significant reduction.

Next, we will explain the specific deployment problems that the proposed method faces in practical applications and the actual requirements for related information.

4.1. Defining Customer Service Levels. When optimizing the short-cycle product supply chain, the primary task should be based on customer needs, market segmentation according to different customer groups' needs, product differentiation, determination of reasonable customer service levels, and realization through the supply chain [36]. The rapid response of customers requires the supply chain structure to adapt to market changes, and at the same time, to improve the customer-oriented transformation of the short-cycle product logistics network following market requirements to achieve the established service level and ensure profitability [37].

4.2. Enterprise Organization Supply Chain Analysis. Resources are a collection of physical assets, human capital, and intellectual capital owned and controlled by the organization. In the short-cycle product supply optimization, strategic management of the entire supply chain resources should be implemented according to market dynamics so that the entire supply chain can be integrated to ensure optimal allocation of resources. Specifically, it organizes internal resources and external resources according to the product flow, information flow, capital flow, and service flow of the supply chain. Internal resources include production logistics resources (such as land and warehouses), information technology resources (such as land information systems and communication networks), market resources (such as product brand, reputation, and product quality certification), external resources including supplier resources, customer resources, and technical service companies. The parameter combination and optimal path is shown in Table 2. The variety of parameters and the optimal path are shown in Figure 9.

4.3. Establish an Information Sharing Incentive Mechanism. Sharing information involves order/delivery, market demand forecasting, inventory levels, production planning, and more. Realizing information sharing can improve the accuracy of demand information, speed up the response to market demand, reduce the processing cycle and cost of trading activities, promote the close cooperation between supply chain partners, improve the trust between partners, and improve the supply chain efficiency. In the short-cycle product supply chain, information sharing will cause the redistribution of information resources among members of the supply chain, change the dominant position of each other, redistribute the supply chain's profit, and cause certain obstacles and difficulties in information sharing. Therefore, it is necessary to establish a kind of obstacle and

Table 2: Parameter combination and optimal path.

Group number	α	β	Θ	Total path-length (km)	Average path-length (km)	Running time (s)
1	1.456734	4.346746	0.463675	269.5	89.7	41.09
2	2.434632	4.643787	0.503634	269.5	89.7	39.01
3	1.036573	4.436724	0.479943	269.5	89.7	33.37
4	3.347349	4.433879	0.496523	269.5	89.7	37.66
5	1.013633	4.528464	0.495385	269.5	89.7	45.42
6	3.237424	4.943464	0.474265	269.5	89.7	39.74

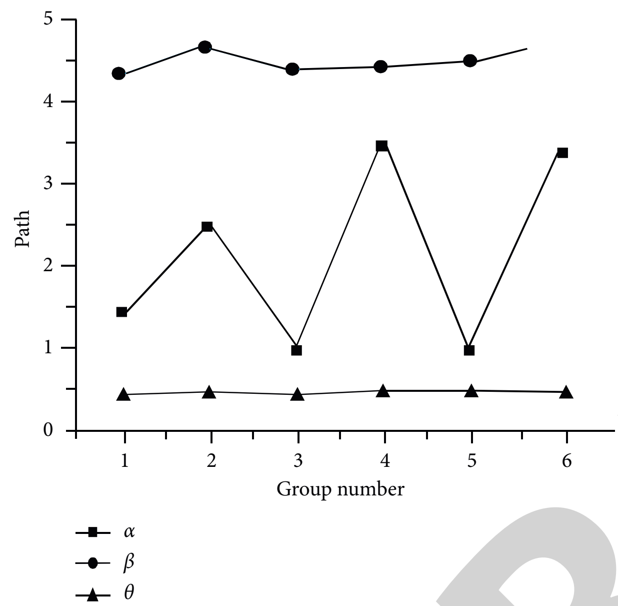

Figure 9: Parameter combination and optimal path.

difficulties in information sharing. The information-sharing incentive mechanism gives appropriate rewards and compensation to information providers. This mechanism can be achieved in two ways: first, saving, and reasonable cost of reducing costs. Since information sharing can reduce uncertainties and reduce the costs of short-cycle product production, inventory, transportation, etc., farmers can transfer part of the cost-saving profits to the downstream links through pricing discounts, which constitutes the profit compensation of the downstream connections. Second, increase the income and increase the reasonable distribution of profits after-sales. The downstream link accurately predicts the demand. Through information sharing, the farmers respond to the demand in the production process in a timely manner, and the downstream link expands the sales and makes a reasonable transfer of profits to the production link.

4.4. Establish a Coordinated, Interest-Integrated Supply Chain Partnership. A good partnership can help improve communication between members and help achieve common expectations and goals while improving resilience and achieving economies of scale in partner selection. According to the market competition environment and resource constraints, the cooperative relationship is evaluated and analyzed in terms of contract performance, reputation, willingness to cooperate, production, service, marketing ability, and participation motivation. This can improve not only the cooperative relationship between the two parties but also improve the efficiency of cooperation.

5. Conclusion

The competition for new retail is not the competition between enterprises and enterprises but the competition between supply chains. The transportation system is an important subsystem in the supply chain. Whether the choice of transportation route is reasonable or not directly affects the operation cost, speed, and efficiency of the supply chain, this paper considers the operation of the three-level supply chain in the context of pull-type production when the seller proposes the demand order, the fastest choice of the corresponding manufacturer and distribution center, to minimize the total transportation cost of the supply chain. The model and theory prove their feasibility, and the example analysis demonstrates that this optimization algorithm reduces the supply chain transportation cost. This paper is from the perspective of supply chain management to minimize transportation costs, modeling and analyzing the three-level network path and intuitively finding the path of minimum transportation cost suitable for each seller through matrix operation. This paper provides a new idea compared to the commonly used dynamic programming algorithm to solve the best path. This article can have extended to the case of multiple varieties of goods. In real life, the network relationship between large supermarket chains and their suppliers and distribution centers is similar to the model in this paper.

Data Availability

The data used to support the findings of this study are included within the article.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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