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Research Article

Dynamic Scheduling and Optimal Control of Coordination Supply Chain Based on Automatic Allocation of Orders for Multicycle Integrators

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Selecting suppliers and allocating orders scientifically and rationally not only have important theoretical value but also have extremely important practical significance to enterprises. This study proposes an improved multicycle integration method that can effectively determine the optimal number of suppliers under the premise of considering the risk of supply interruption and transaction costs that may be caused by various uncertain factors. The supply interruption risk is divided into two categories: "common risk event" and "individual risk event." On the basis of balancing the transaction cost of the company's choice of suppliers and the financial loss of supply interruption, quantitative analysis methods are used to determine the optimal number of suppliers for the company. The problem is analyzed, the corresponding model is given, and the influence of each parameter on the optimal number of suppliers is analyzed. From the perspective of stochastic uncertainty in both customer demand and supplier supply capacity, this study analyzes the optimization problem of enterprise purchase quantity allocation under the volume discount environment. The relaxation factor is somewhat adaptive because the particle swarm is continuously updated. Aiming at ordering cost, transaction cost, transportation cost, order delay quantity, and product quality, considering random demand constraints, supplier supply capacity constraints, and multisupplier multiproduct situations, we establish supplier selection in an environment of uncertain demand and supply capacity and dynamic relaxation approximation algorithm for order allocation. The research results show that the dynamic relaxation approximation algorithm can not only determine the optimal supplier but also determine the optimal procurement allocation for each supplier.

1. Introduction

The study of traditional optimization problems in multicenter coordination networks aims to minimize the operational costs of coordination networks by optimizing the routes of vehicles in the multicenter [1]. In the context of economic globalization and the rapid development of information technology, there is fierce competition among manufacturing supply chains [2]. Excellent suppliers can play a leading role in downstream companies, integrating manufacturing resources and providing a continuous impetus for downstream manufacturing. At the same time, problems with the supplier's supply capacity not only put pressure on the downstream manufacturer but also lead to a series of chain reactions in the downstream supply chain.

Effective synchronization constraint as a measure to evaluate delivery timeliness can reduce the time interval and waiting time of two-level vehicles in the two-level network serving between facilities through reasonable scheduling of vehicles, thereby reducing fuel consumption and improving the transportation efficiency of the entire network [3]. Therefore, an effective cooperation mechanism and resource sharing mode and synchronization strategy can optimize the distribution services of multicenter and multiperiod networks, improve the efficiency of the transportation system, and realize the rational allocation of resources. The multiperiod distribution network considers the periodic changes in customer demand and facility service quality, as well as the time interval that customers are visited in different service periods, so an effective network design can improve customer service levels [4]. The establishment of a cooperation mechanism can reduce unreasonable transportation through cooperation between facilities, thereby reducing coordination operation costs; an effective synchronization strategy can reduce the waiting time of vehicle services by optimizing vehicle scheduling, thereby reducing fuel consumption and improving transportation efficiency. The resource sharing mode based on cooperation can realize the rational allocation of resources by sharing customer service and transportation resources, thereby promoting the sustainable development of multicenter and multicycle distribution networks and providing a basis for cooperation among organization enterprises [5].

As suppliers have different production resources and manufacturing capabilities, suppliers will inevitably be late in supplying the manufacturer or fail to meet manufacturing requirements, preventing the manufacturer from producing normally at a given time, causing significant losses to the manufacturer, and seriously affecting the efficiency of the supply chain. Incremental insertion of new orders does not result in a high-quality solution when dealing with real-time order data, and approaches based on neighborhood search and destructive reconstruction require the processing of static DARPA that need to be reoptimized for each response, resulting in high computational costs. The available manufacturers are filtered out. By selecting a manufacturer in each process, the actions required for that order are done at that point. A framework for handling dynamic scenarios with real-time orders is needed that continuously responds to new orders and updates the delivery solution based on the execution status of the UAV, maintaining a high-quality solution throughout the process.

2. Related Work

Artifacts are not delivered as early as possible but on a specific date. If a part is delivered too early, the manufacturer will incur some storage and warehousing costs. If a part is delivered too late, customer satisfaction and the company's reputation suffer. Companies must therefore consider the sequence of parts to reduce the impact of lead times. Lead-time planning models have received considerable attention in recent decades, with most research focusing on determining an appropriate lead time were completing before the lead time incurs penalty costs and after the lead time incurs penalty costs. Li et al. used a fuzzy time window treatment scheme to simplify the impact of time windows in multicenter coordination networks [6]. Zhang et al. introduced the concept of vehicle sharing to network optimization of multiple distribution centers with time window constraints to achieve a balance of decisions between multiple centers [7].

Goli and Davoodi proposed an optimization problem for multiple centers with time constraints based on the flexible selection of vehicle docking points [8]. Liu et al. introduced open vehicle paths in a multicenter distribution network optimization problem to reduce the operational complexity of the coordination network under a soft time window constraint [9]. Yu et al. combined the service concept of dynamic changes in customer demand with effective conservation of coordination resources and proposed a multicenter distribution network path optimization problem with a time window constraint [10]. Gharaei and Jolai analyzed the characteristics of dynamic alliances, discussed the key points and difficulties in developing this model for Chinese enterprises, and designed an agile supply chain architecture based on the principles of intelligent agents and reconfigurability [11]. He et al. explored the characteristics of an agile apparel supply chain and built a virtual organization centered on exporting apparel companies to respond quickly to large-scale changes [12]. Goodarzian et al. constructed an agile supply chain selection model that considered six aspects [13]. Batero Manso and Orjuela Castro developed a hybrid multicriteria decision model, used the triangular fuzzy number method to determine quantitative indicator weights, and finally used the fuzzy topology method to select the best model for the supply chain [14]. After an extensive literature review, they concluded that most of the current research has focused on the technical aspects of managing big data itself, rather than applying it to create strategic value and change for businesses and supply chains. It looks at dynamic alliances from a different perspective, considering the alliance phase, partner selection and reconfiguration phase, operation phase, and dissolution phase in building a flexible supply chain.

The traditional supply chain pursues a stable partnership that tends to produce a static or slowly evolving solid structure, a factory-prepared and driven supply chain, in which there is a mismatch of supply and demand information, a severe bullwhip effect, and low flexibility. Traditional supply chains that produce only one or a few similar products are no longer able to adapt to the changing market demand for diverse and customized products. In this study, we explore an agile e-commerce supply chain based on the C2M model, which focuses on consumer demand, forms short-term organizational alliances, uses smart technology to effectively meet personalized demand, and drives the modernization of manufacturing. Promoting innovation in supply chain models focused on dynamism, intelligence, and efficiency.

3. Multicycle Order Allocation Distribution Design

We will analyze the synchronization problem in the automotive industry, which is one of the main concerns of lean management [15]. The optimization process of two-level multicenter and multiperiod coordination network is to study the service optimization problem between coordination facilities and customer points in discrete space. Therefore, it is a typical combinatorial optimization problem, which aims to study discrete space through certain mathematical methods. The solution of combinatorial optimization problem is mainly divided into two parts: mathematical model establishment and optimal solution search process [16]. The intelligent optimization algorithm is the sum of the theoretical methods to find the optimal solution of the problem under the condition of feasible solutions and constraints through a certain optimization process based on a certain search mechanism. The main intelligent optimization algorithms are divided into two categories: exact algorithms and heuristic algorithms. For structured combinatorial optimization problems, the size of the solution space can be controlled and is generally small, so such problems are usually solved using exact algorithms. For large-scale combinatorial optimization problems, the process of optimizing through exact algorithms such as enumeration will bring about an explosive combinatorial amount of computation. Therefore, such problems usually use heuristic algorithms to obtain approximate solutions. We are only concerned with cycle time overlap:

$$\begin{aligned} \max \mathrm{F}(x) &= \left[f_1(X), f_2(X), \ldots, f_m(X)\right] \\ s.t. g_i(x) &\leq 0, i = 1, 2, \ldots, p \\ h_j(x) &\leq 0, j = 1, 2, \ldots, q \\ X &= \left[x_1, x_2, \ldots, x_m\right], \end{aligned} \tag{1}$$

where $f_1(X), f_2(X)$, and $f_m(X)$ are the m objective functions respectively, and under the constraints, they denote the set of feasible solutions that minimize each objective function. Figure 1 Cross transport is also reduced to a large extent.

The trajectory space and MSP values are growing to the extreme case where supply and demand are not correlated. Every deviation between supply and demand is shown in regions A and B, except for perfect synchronization. In the region, demand inventory is higher than supply inventory. Since the manufacturer reliability index of manufacturer 12 is 0.682 and the reliability index of manufacturer 14 is 0.330, manufacturer 14 is selected with the goal of low cost, and then, manufacturer 14 will be selected.

The subject of this study is a coordination company with multiple distribution centers. The operation of a multi-distribution center is shown in Figure 1.

$$\begin{cases} B_0^k = O_k, \\ B_{n_k}^k = \varphi, \\ \left[o_1^2 \notin S_{v_i^k}^k\right] = 1. \end{cases} \tag{2}$$

Unlike traditional coordination networks with collection and distribution, the multicenter multicycle collection and distribution coordination network (MDPLNPD) encompasses both open and closed routes, designed to form effective collaboration and delivery through multiple facilities and service cycles. Figure 1 shows the comparison diagram of the noncooperative network before optimization and the network path comparison after optimization. It is important to use their resources to increase efficiency and deepen cooperation. However, if the assessment finds that the partner is no longer able to meet the requirements of the product order, it can be removed from the partnership and a new partner can be found to continuously improve the efficiency of the agile supply chain. The numbers on each route in the figure represent the transportation time of trucks or cars, respectively. As can be seen from the figure, trucks can realize centralized transportation between cooperative coordination facilities, and the service path from facilities to customer points realized by trolleys has also been optimized, thereby minimizing large-scale long-distance and cross-transportation.

Assigning orders to partners and selecting nodes in an agile supply chain from a pool of companies with the same processing functions is not an easy task. A thorough and dynamic assessment of partners is therefore essential to track their development and help them make the most of it [17].

Each distribution center gives priority to using its vehicles, and in the case of insufficient own capacity, vehicles should only be called to the nearest distribution center with abundant capacity. When vehicles are shared throughout the distribution center, the correct type of vehicle is only hired when there is insufficient capacity.

$$\text{result} = \max \sum_{i=0}^{n} \left(A_i + B_i\right)^2 t_{v_i v_{i+1}}. \tag{3}$$

This study focuses on the business of one of the e-commerce company's brands and its operating model. The sub-brand was established in January 2021 and has expanded from 8 categories to the current 25 and is expanding to at least 8,000 products. The company has more than 300 suppliers, of which about a third are large companies. The main customers are mainly financial companies, Internet companies, etc. These companies are mainly staffed by young people in their late 90s, and together with the company's daily tailor-made service, the diversity of products for the company is shown in Figure 2, a process that can lead to poor quality or late delivery.

The law of two-eight is widely used in business, where quality and quantity are satisfied and customer satisfaction is increased. In practice, however, account managers allocate reliable spare parts manufacturers based on the timing of orders [18, 19]. It is helpful to improve several indicators of network optimization and improve the resource allocation efficiency of the coordination system. Orders from priority customers are placed by manufacturers at different levels who cannot provide better service to their customers. E-commerce companies selling their brands often have a rigorous set of procedures to manage, for example, their ability to prioritize orders by ranking customers according to evaluation criteria and creating a reference point for placing future orders.

4. Dynamic Planning Analysis of the Coordination Supply Chain

There are two main channels in this process. Account managers of e-commerce companies' delivery dates. Based on this, which generates almost 80% of all revenue, deepening cooperation with these head customers and orders from head customers requires special attention to improve satisfaction. Determine the order priority according to the order data and the historical performance of the manufacturer, and provide the basis for the order arrangement in the next stage. External facilities

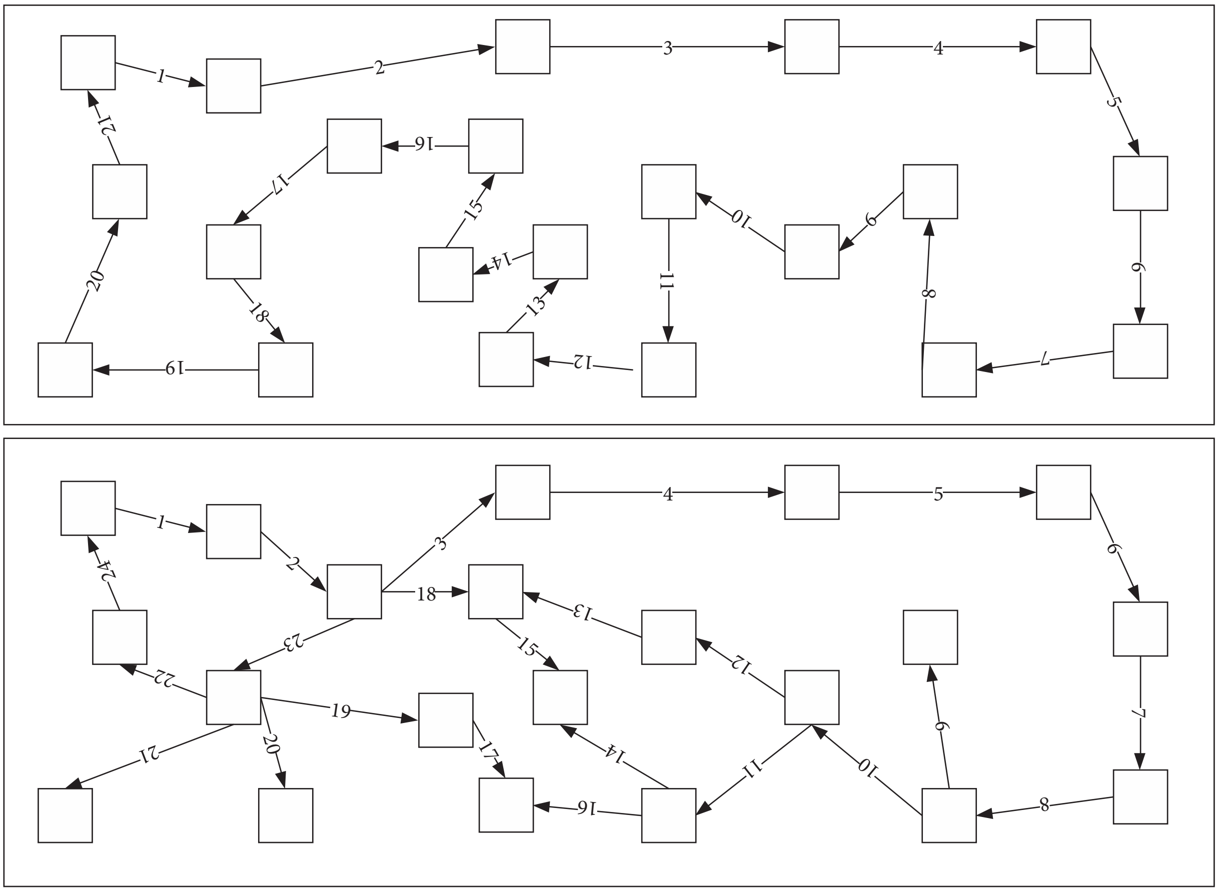


Figure 1: With multiple centers and multiple distribution networks.

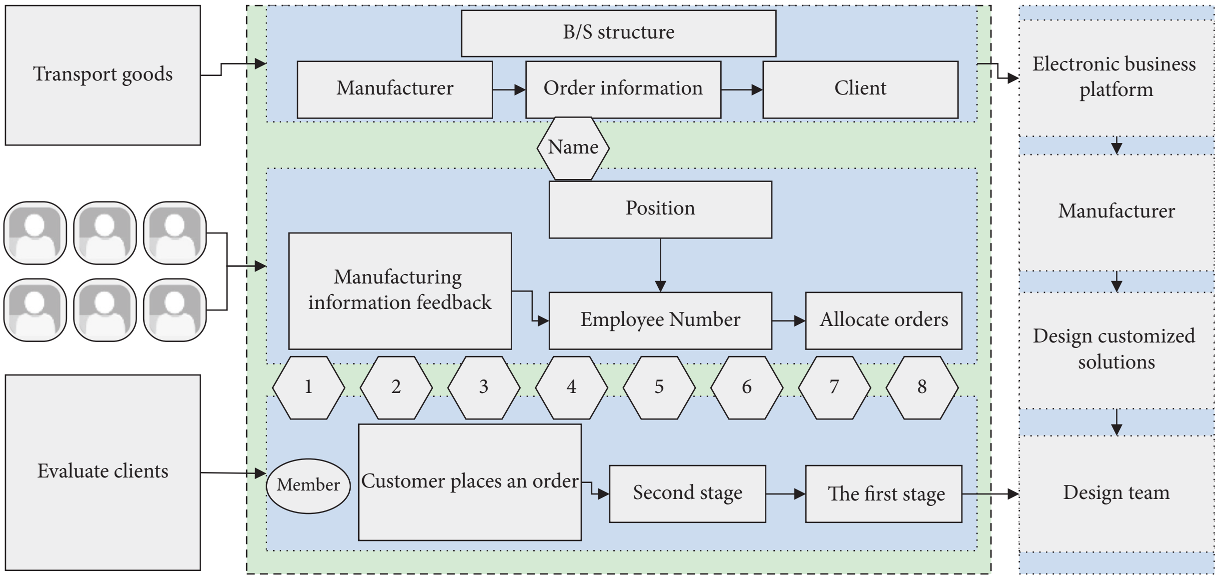


Figure 2: Two-stage business analysis of order scheduling.

such as production sites are visited to examine the production environment and the manufacturer's historical trading performance, whether it can meet expectations in terms of quality and quantity is evaluated, and these data provide the basis for the next stage of order placement [20].

If the order criticality index or customer priority index of the order priority index is greater than or equal to 0.6, this means that the order priority index is high and is usually characterized by high total order value, high order value, frequent customer contact with the platform, high average order profitability, and purchase loyalty.

As shown in Figure 3, the triangular fuzzy membership function for each index is defined in the interval between 0 and 1, where 0 is defined in the interval between 0 and 1, with 0 being low, 0.5 being medium, and 1 being high. The interval [0–1] is set to match the function of the interval [0–1] of the index previously calculated by TOPSIS. The effective combination of cooperation mechanism and resource sharing strategy promotes the formation of a cooperative coordination network alliance and realizes the maximum cost saving of the network from noncooperative to cooperative coordination facilities. The members of the strategic partnership decide which rules apply and a new reasoning system can always be developed if their preferences change.

To extend the search range of the algorithm and ensure that good genes are not destroyed, this study uses a two-point crossover operation. In addition, the evaluation of manufacturer information is not only to visit external facilities such as production bases, to examine the production environment, but also to include the manufacturer's historical transaction performance, and whether it can achieve the expected goals in terms of quality and quantity. The evaluation of these data is for the next order arrangement of the stage provides the basis. The specific steps are as follows: first, two chromosomes are selected as father 1 and father 2; second, two natural numbers $r1$ and $r2$ of length not exceeding 1 are randomly generated ($r1 < r2$); again, 1 is obtained. The order of all gene segments between gene positions $r1$ and $r2$ is father 2, and this arrangement is to cover the genes between $r1$ and $r2$ in father 1 to become son 1; finally, father 2 and son 2 perform a similar operation.

The qualifications for establishing a sustainable supply network model include preconditions and constraints. Among them, the preconditions are that all customers' orders must be fully satisfied; suppliers have raw material capacity constraints, and production has product capacity constraints; operating costs are fixed during the cycle.

According to the initial position of the individual particle, the function fitness of the individual particle is calculated according to the objective function, which is the total cost value of the supply chain network, the function fitness of the subgroup is calculated, and it compares with the function fitness of all subgroups one by one. If the new fitness is better than the best history record of the current subgroup or the global best history record of the particle swarm, the new best history record or the global best history record of the particle swarm is updated, and the position of the current subgroup is updated. For the new best historical position or the global best historical position, the optimization process of the best particle is shown in Figure 4.

Since the RTC does not know the future requests, schedule generation avoids unnecessary holding costs by proposing an authorized schedule [21]. The typical structure of an authorized schedule contains nonforced idle time slots that minimize the total holding cost. Orders are allocated based on the order priority, and the priority orders are assigned to reliable manufacturers, thus avoiding losing big customers and ensuring their maximum satisfaction. Thus, if the current situation does not require the machine to be fully utilized in the next expected range, the proposed associated schedule suggests leaving the machine idle for an extended period. Specifically, the relevant schedule may recommend leaving the machine fully or partially idle, as shown in Figure 4. As the schedule is implemented, the unused machine capacity will be irretrievably lost.

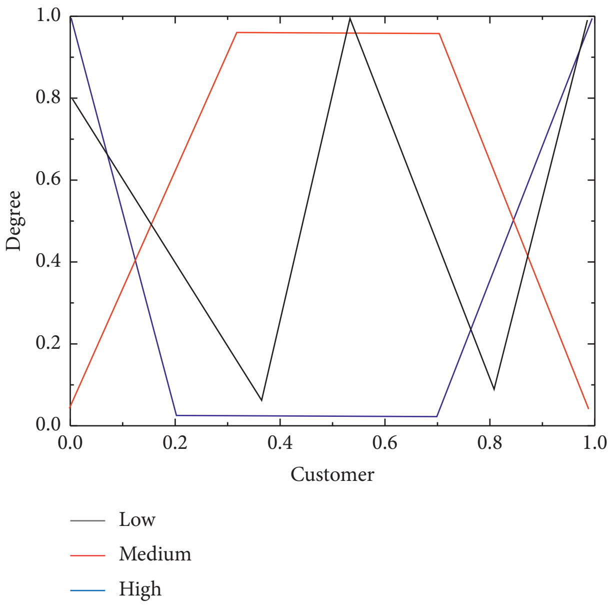


FIGURE 3: Priority attribution function.

After performing the above steps, the supply chain upstream and downstream, for example, if the sum of the assigned quantities in the single-particle network of supplier 1 is chosen to be zero, while the sum of the assigned quantities in the network of supplier 2 is not zero, this implies a certain degree of adaptivity, as the particle population is constantly updated. In the following study, the effectiveness and solution quality of the dynamic relaxation approximation algorithm are experimentally verified.

With the continuous change of individual particles, the selection of suppliers and producers will also change with the change of the value of each particle. For example, if the current position of individual particles selects supplier 1 The sum of the number of network allocations is 0, and the sum of the network allocation quantities of supplier 2 is not 0, indicating that supplier 1 does not participate in the production plan of the supply chain network at this time, and supplier 2 is in the production plan of the current supply chain network, if after updating the current individual particles. In the update position of individual particles, the sum of the network allocation quantity of supplier 1 is no longer 0, and the sum of the network allocation quantity of supplier 2 is 0. Currently, supplier 1 participates in the new production plan of the supply chain network. Supplier 2 is not in the new production plan of the supply chain network.

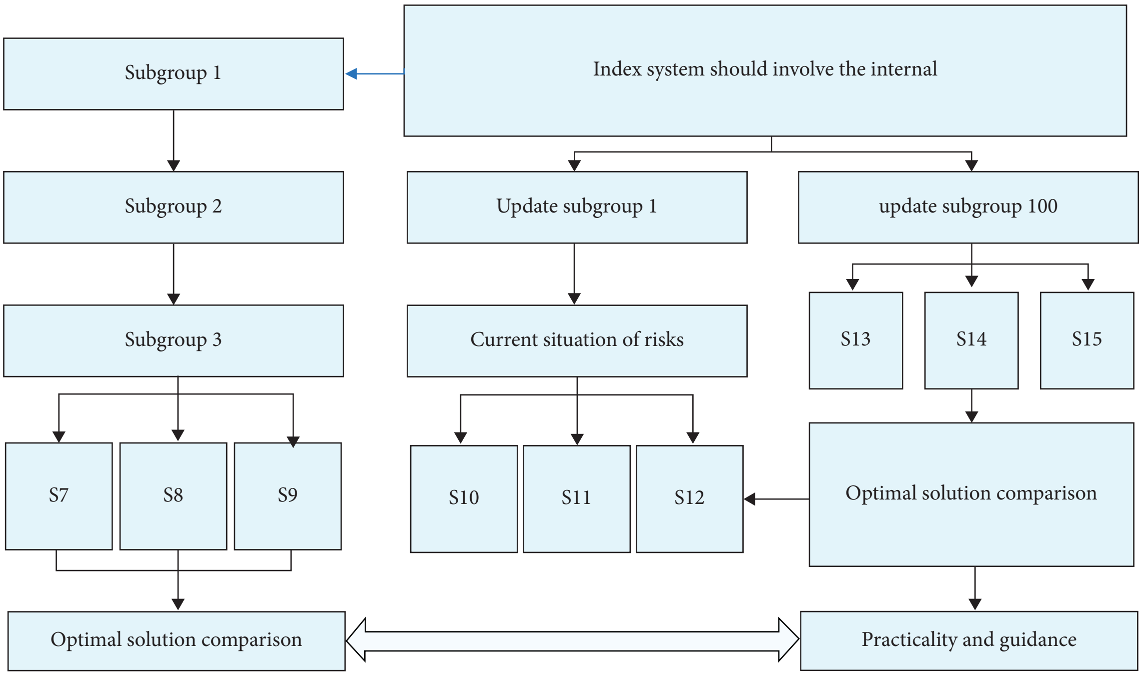


Figure 4: Coordination supply chain optimization process.

In the next section, we use the dynamic relaxation approximation algorithm to iteratively update the allocation number and location decisions of the supply chain network by combining the fitness of the objective function and the dynamic relaxation factor. During the application of SFDDHT-GRASP, the rescheduling process minimizes the loss of scheduling idleness in the scheduling S. This process reschedules jobs without changing the sequence of jobs or the date allocation of the solution and minimizes the total schedule cost within this constraint.

5. Analysis of Results

5.1. Examining the Results of Multicycle Integrator Order Allocation. Due to the sensitivity of customer, order, and manufacturer data on e-commerce platforms, based on practical experience from the internship and with JE-commerce is constantly restructuring and deconstructing its flexible supply chain to respond to new demands for its products from a changing market. With multiple customer-specific orders in the same cycle, multiple manufacturers quickly form a dynamic manufacturing alliance to produce the product the customer wants to be based on the order, as shown in Figure 5.

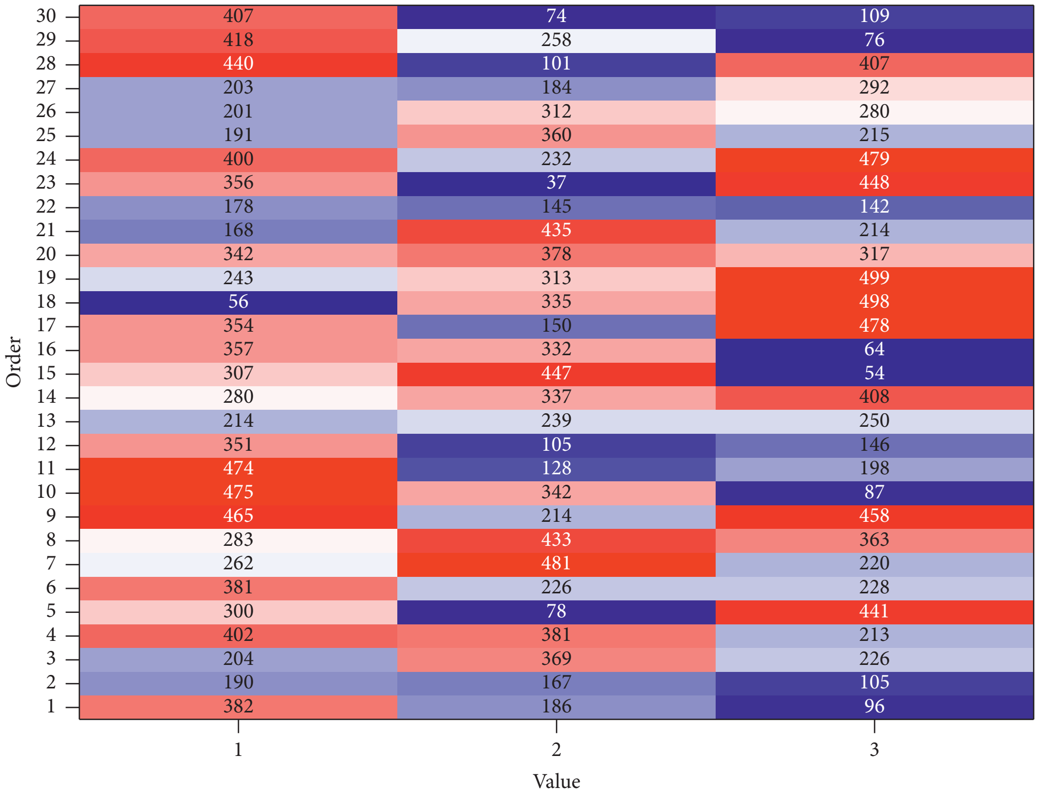
The operational configuration process for each order is determined by the process operation route, through which the 10 orders pass. For example, order 1 needs to pass through operations 1, 2, 3, and 4 in one go to complete the order, meet the product manufacturing process requirements, and finally ship the goods to customer 3.

In this case, when allocating orders, the platform filters out the available manufacturers based on the availability of each operation. By selecting a manufacturer in each process, the operations required for that order are completed at that time. Moreover, the solution quality of the dynamic relaxation approximation algorithm is better than that of the traditional particle swarm algorithm. The corresponding process operations are carried out according to the order's customized solution and the appropriate production partner is selected in each process to place the order.

The platform evaluates customer, order, and manufacturer data based on data from previous collaborations using the TOPSIS method to obtain a customer priority index, an order criticality index, and a manufacturer reliability index, each of which is shown in Figure 6. The red background represents low priority and low-reliability customers and manufacturers. The green background represents customers and manufacturers with high indices, high priority, and needing priority development. In the integer multiobjective programming function, the manufacturer's reliability index and the order priority index determined in the previous stage are included in the solution to obtain a solution for order allocation. The 0–1 integer programming software is first used to find out which manufacturer the job is assigned to, as shown in the job assignment table, and then which manufacturer should be selected for each job in the single-objective case of maximum reliability, minimum cost, and minimum time, or a combination of all three in the multiobjective case.

The track and trace system that has been implemented generates many status messages throughout the supply process.

For example, in the case of order 10, if manufacturer 12 is selected for process 4 with the objective of maximum reliability, as manufacturer 12 has a manufacturer reliability index of 0.682 and manufacturer 14 has a reliability index of 0.330, but manufacturer 14 is selected with the objective of low cost, then manufacturer 14 will be selected.



Order	1	2	3
30	407	74	109
29	418	258	76
28	440	101	407
27	203	184	292
26	201	312	280
25	191	360	215
24	400	232	479
23	356	37	448
22	178	145	142
21	168	435	214
20	342	378	317
19	243	313	499
18	56	335	498
17	354	150	478
16	357	332	64
15	307	447	54
14	280	337	408
13	214	239	250
12	351	105	146
11	474	128	198
10	475	342	87
9	465	214	458
8	283	433	363
7	262	481	220
6	381	226	228
5	300	78	441
4	402	381	213
3	204	369	226
2	190	167	105
1	382	186	96

Figure 5: Specific requirements for each order.

Under different goals, the selected manufacturers are different, such as order 10; in the case of operation 4, if the principle of maximum reliability is the goal, manufacturer 12 is selected to carry out the operation of operation 4, because the reliability index of manufacturer 12 is 0.682, while the reliability index of manufacturer 14 is 0.330. However, if the target with low cost is selected, then manufacturer 14 is selected. Currently, the decision-maker needs to weigh the relationship between cost and reliability, between the two substitution relationships. Customers can get service at a specific time according to their needs for the product. Usually, a manufacturer with high reliability means high cost. At this time, the priority of orders can be compared, and orders with high priority can be assigned to reliable manufacturers first.

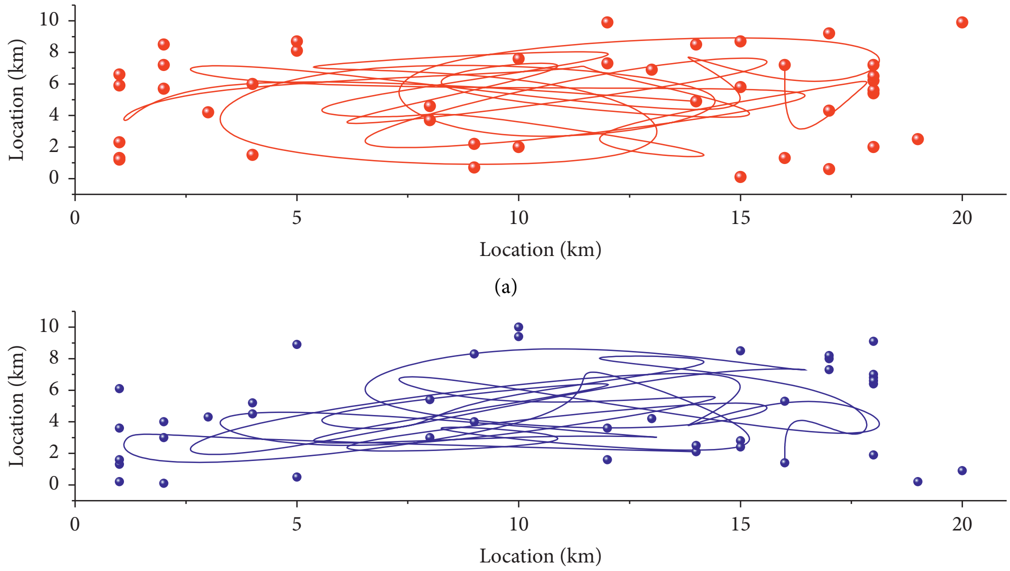
In addition, in different weighting schemes, the partner composition of agile supply chain is the same, but the reliability and total cost are different. This is because the manufacturers allocated in the specific operations in the allocation scheme are different, and the partners in the intermediate business are different. Switching varies, but these manufacturers are all in this agile network, which creates a difference in cost and reliability. This sensitivity analysis is important because decision-makers often cannot accurately define the importance of each objective function. Through the comparison of different weights, decision-makers can better understand the robustness of different schemes, which can be directly used in the business network structure. It reflects the priorities of decision-makers, helps decision-makers better understand, and evaluates the impact of subjective judgments on network structure, and is in line with enterprise development strategies.

5.2. Analysis of the Results of Dynamic Supply Chain Adjustment. The maximum cost savings were achieved in terms of quantity, amounting to US$2,824, 75 minutes, and 19 vehicles, respectively. Therefore, the grand alliance {DC1, DC2, DC3, PC1, PC2, PC3} can be selected as the best alliance for a multicenter, multicounty collaborative collection and distribution network. While the optimized vehicle access routes for the cooperating DC1 and PC1 in the grand alliance are shown in Figure 7, the multicenter cooperation achieves vehicle sharing within and across multiple cycles and improves the utilization of transport resources.

In Figure 7, vehicles can share transport resources within and across multiple cycles, reducing the total number of transport vehicles from 30 to 11 and reducing maintenance costs from $450 to $154. Coordinating pick-up and delivery services across multiple service cycles and enabling the sharing of open and closed mixed paths help to improve several indicators of network optimization and increase the efficiency of resource allocation in the coordination system. A planned work cycle is subdivided into a series of service cycles to ensure the delivery of each product, and the customer can be serviced in one or more cycles.

The average and optimal solutions obtained by the improved adaptive genetic algorithm were calculated and simulated to outperform the genetic algorithm for all three algorithms using seven common vehicles to complete 65

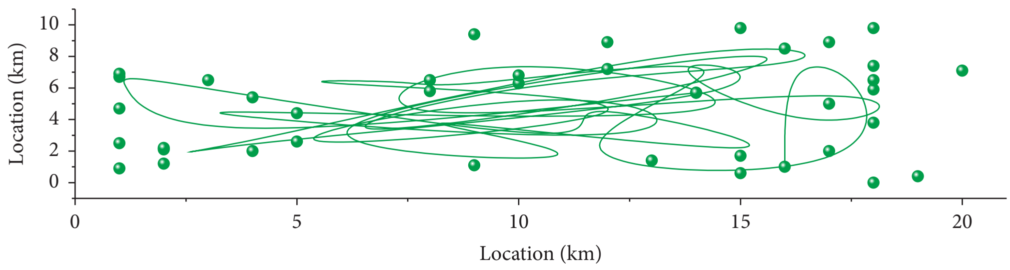
Figure 6: Results of contracting.



(a)

(b)

Figure 7: Continued.



(c)

Figure 7: Three common paths for DC1 and PC1 in a multicycle collaborative multicenter network.

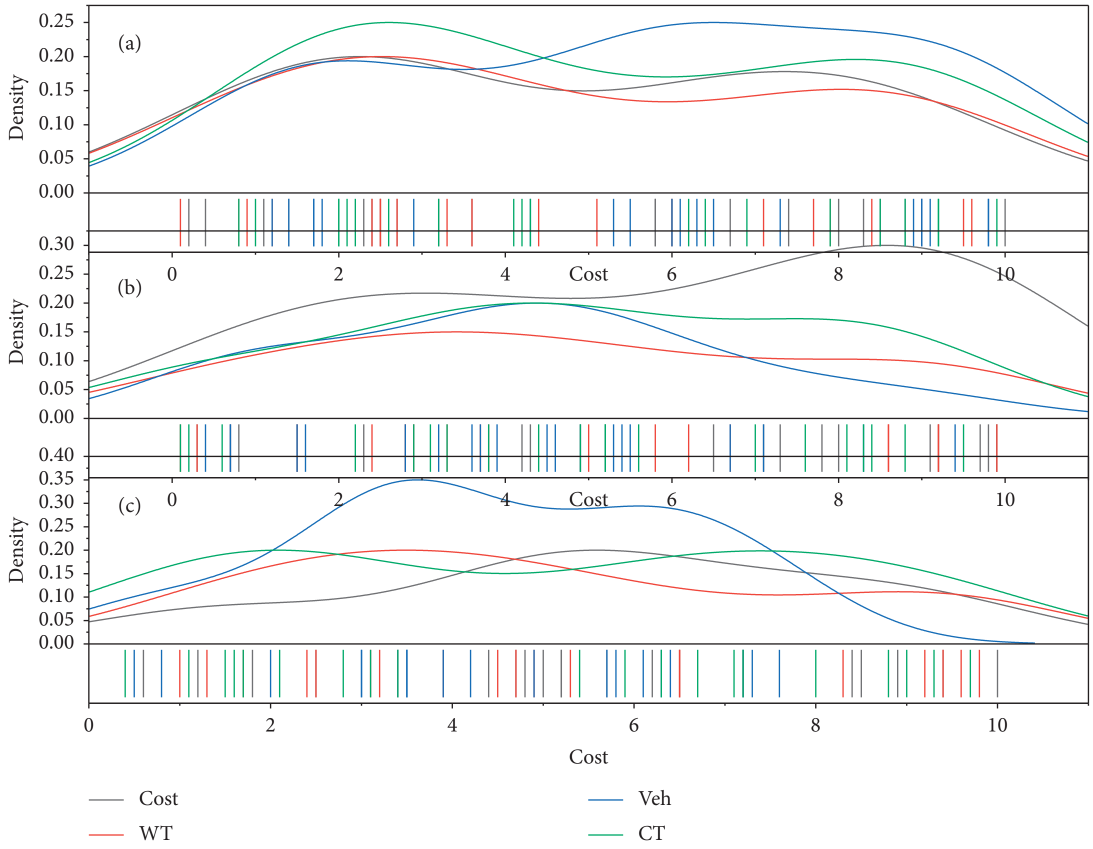


Figure 8: Comparison of the results obtained by the three optimization algorithms.

customer points in the vehicle nonsharing mode. The improved adaptive genetic algorithm obtained an average solution that was 6.73% less costly than the genetic algorithm and 3.73% less costly than the simulated annealing algorithm.

If the integration is successful, the process of implementing the first strategy quickly returns a positive answer to the order request and delegates the final decision to accept or reject the remaining (initially unaccepted) requests to the integration process to be executed within the subsequently expected scope. The default policy of the RTC method is to first apply the integration policy to all incoming requests in order of arrival and then use the optimization policy for all requests where the integration policy fails.

In the vehicle sharing mode, the matching rate for the partner vehicles in the same situation is the same due to the same matching algorithm, and the number of customers completed by the partner vehicles is 65. All three algorithms use seven common vehicles to complete the delivery of the remaining customer orders.

In Figure 8, *t*-tests and *p* values show that there are significant differences between the computational results of the three algorithms, so a comparative analysis based on these results is meaningful and reliable. First, IMOPSO is superior in terms of minimizing operating costs, as all IMOPSO calculations yield smaller cost values than those of NSGA-II and MOEA.

The average operating cost calculated by IMOPSO is US$2937, which is significantly lower than the operating costs of US$3616 and US$3779 calculated by the other two methods. In addition, IMOPSO achieves an average minimum number of vehicles of 13 compared to 16 and 17 for NSGA-II and MOEA, and the computational time required to solve the multiobjective optimization model is also significantly better than the other two methods. The time difference and waiting time for two-level vehicles are reduced in the secondary network to travel between facilities, thereby reducing fuel consumption and improving the transportation efficiency of the entire network.

To calculate the total cost and feasibility of this interim plan, the impact of this new job on the integration of the plan must be considered. This is performed by calculating the completion times of the jobs and recalculating the completion times of the scheduled jobs affected by the job integration, as the local cost optimality of the specification plan is shown, SFDDHT-GRASP calculates the completion times by constructing the specification plan application only in the following way. The reverse calculation of this process starts with the insertion of jobs at the location and continues with the calculation of new completion times for jobs at the previous location of the interim plan.

Compared to the other three cooperative network types, in addition, the total waiting time for the first, second, and third cycle cooperative networks was 47 minutes respectively, significantly higher than the 36 minutes for the optimized cycle cooperative network. When optimizing a network with multiple centers and cycles of collection and distribution, it is, therefore, more beneficial for facilities to cooperate between multiple service cycles than within a single cycle.

6. Conclusion

A collaborative network distribution strategy for vehicle sharing has been proposed to address the lack of dispatching capacity or transport capacity of coordination companies in multiple distribution centers. Based on the comprehensive consideration of multiple distribution centers, multiple models of leased vehicles, load weight, vehicle speed, and fuel consumption, a vehicle energy consumption calculation method is introduced to establish a vehicle sharing network collaborative distribution model based on considering multiple constraints. This study proposes an assignment goal of assigning prioritized orders to reliable manufacturers. Priority orders depend on both customer information and order information. By integrating these information data, it is possible to grasp the historical transaction status of manufacturers and customers, allocate orders according to order priorities, assign priority orders to reliable manufacturers, avoid the loss of large customers, and ensure their maximum satisfaction through the sharing of open and closed hybrid paths. The mechanism optimizes the collection and distribution services within multiple cycles and between multiple centers, and based on the sharing of vehicles within multiple cycles and between multiple centers, it improves the efficiency of the transportation system and maximizes the utilization of coordination resources. A multiobjective optimization model is proposed to minimize the total operating cost, service waiting time, and number of vehicles of the logistics network, and a combined hybrid optimization method is proposed to solve the multiobjective optimization model, finally, through practical example analysis and algorithm. The feasibility and effectiveness of the proposed multiobjective optimization model and optimization algorithm in solving this problem are compared, analyzed, and verified.

Data Availability

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

Conflicts of Interest

The author declares that there are no conflicts of interest.

References

[1] W. Wang, S. Wang, and J. Su, "Integrated production and transportation scheduling in E-commerce supply chain with carbon emission constraints," *Journal of Theoretical and Applied Electronic Commerce Research*, vol. 16, no. 7, pp. 2554–2570, 2021.

[2] M. Acuna, J. Sessions, R. Zamora, K. Boston, M. Brown, and M. R Ghaffariyan, "Methods to manage and optimize forest biomass supply chains: a review," *Current Forestry Reports*, vol. 5, no. 3, pp. 124–141, 2019.

[3] A. Dolgui, D. Ivanov, S. P. Sethi, and B Sokolov, "Scheduling in production, supply chain and Industry 4.0 systems by optimal control: fundamentals, state-of-the-art and applications," *International Journal of Production Research*, vol. 57, no. 2, pp. 411–432, 2019.

[4] G. Yu, H. Li, Y. Chen et al., "Quantitative study on natural gas production risk of Carboniferous gas reservoir in eastern Sichuan," *Journal of Petroleum Exploration and Production Technology*, vol. 11, no. 10, pp. 3841–3857, 2021.

[5] Z. Wang, H. Hu, J. Gong, X. Ma, and W Xiong, "Precast supply chain management in off-site construction: a critical literature review," *Journal of Cleaner Production*, vol. 232, pp. 1204–1217, 2019.

[6] K. Li, J. Liu, H. Fu, and N. Zhao, "An integrated system with multiple product lifecycles for remanufacturing (IS-MPLR): new opportunities and challenges," *International Journal of Computer Integrated Manufacturing*, vol. 34, no. 1, pp. 20–40, 2021.

[7] H. Zhang, H. Ge, J. Yang, and Y Tong, "Review of vehicle routing problems: models, classification and solving algorithms," *Archives of Computational Methods in Engineering*, vol. 29, no. 1, pp. 195–221, 2022.

[8] A. Goli and S. M. R. Davoodi, "Coordination policy for production and delivery scheduling in the closed loop supply chain," *Production Engineering*, vol. 12, no. 5, pp. 621–631, 2018.

[9] Y. Liu, Z. j Xia, Q. q Shi, and Q. Xu, "Pricing and coordination of waste electrical and electronic equipment under third-party recycling in a closed-loop supply chain," *Environment, Development and Sustainability*, vol. 23, no. 8, pp. 12077–12094, 2021.

[10] G. Yu, Y. Fang, H. Li, C. Wang, and D. Zhang, "Establishment and application of prediction model of natural gas reserve and production in Sichuan Basin," *Journal of Petroleum Exploration and Production Technology*, vol. 11, no. 6, pp. 2679–2689, 2021.

[11] A. Gharaei and F. Jolai, "A multi-agent approach to the integrated production scheduling and distribution problem in multi-factory supply chain," *Applied Soft Computing*, vol. 65, pp. 577–589, 2018.

[12] J. He, F. Chu, A. Dolgui, F. Zheng, and M Liu, "Integrated stochastic disassembly line balancing and planning problem with machine specificity," *International Journal of Production Research*, vol. 60, no. 5, pp. 1688–1708, 2022.

[13] F. Goodarzian, V. Kumar, and A. Abraham, "Hybrid metaheuristic algorithms for a supply chain network considering different carbon emission regulations using big data characteristics," *Soft Computing*, vol. 25, no. 11, pp. 7527–7557, 2021.

[14] D. F. Batero Manso and J. A. Orjuela Castro, "Inventory routing problem in perishable supply chains: a literature review," *Ingeniería*, vol. 23, no. 2, pp. 117–143, 2018.

[15] M. A. Beheshtinia and A. Ghasemi, "A multi-objective and integrated model for supply chain scheduling optimization in a multi-site manufacturing system," *Engineering Optimization*, vol. 50, no. 9, pp. 1415–1433, 2018.

[16] A. R. Pathak, M. Pandey, and S. S. Rautaray, "Approaches of enhancing interoperations among high performance computing and big data analytics via augmentation," *Cluster Computing*, vol. 23, no. 2, pp. 953–988, 2020.

[17] D. F. Batero Manso and J. A. Orjuela Castro, "El problema de ruteo e inventarios en cadenas de suministro de perecederos: revisión de literatura," *Ingenieria*, vol. 23, no. 2, pp. 117–143, 2018.

[18] Z. Chen, Z. Chen, and Y. Geng, "Modelling and empirical analysis of the VMI-3PL system of cloud service platform in industry supply chain," *International Journal of Computing Science and Mathematics*, vol. 15, no. 1, pp. 60–71, 2022.

[19] D. Ivanov, A. Dolgui, and B. Sokolov, "Scheduling of recovery actions in the supply chain with resilience analysis considerations," *International Journal of Production Research*, vol. 56, no. 19, pp. 6473–6490, 2018.

[20] C. Zhang, N. Song, and Y. Li, "Incipient fault identification of distribution networks based on feature matching of power disturbance data," *Electrical Engineering*, vol. 103, no. 5, pp. 2447–2457, 2021.

[21] X. Liu, S. Lu, J. Pei, and P. M Pardalos, "A hybrid VNS-HS algorithm for a supply chain scheduling problem with deteriorating jobs," *International Journal of Production Research*, vol. 56, no. 17, pp. 5758–5775, 2018.