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Research Article

Blockchain-Based Model for Intelligent Supply Chain Production and Distribution

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Blockchain is a term in the field of information technology. In essence, it is a shared database, and the data or information stored in it has the characteristics of "unforgeable," "full traces," "traceable," "open and transparent," and "collective maintenance." Based on these characteristics, blockchain technology has laid a solid "trust" foundation, created a reliable "cooperation" mechanism, and has broad application prospects. This paper is aimed at studying a method in view of the integrate of system analysis and system simulation to solve the problems in the production and distribution (P&D) system in the supply chain, proposing a more realistic optimization plan, and then promoting it to various enterprises. This article proposes the idea of using supply chain management, through system analysis, system simulation, case analysis, and comparative research methods, starting from the strategic level, tactical level, and operation level of supply chain management to optimize the P&D system. Pay attention to the P&D system issues in the supply chain environment, and apply the method of system analysis and system simulation to get a better P&D plan. The experimental results of this paper show that the total cost of the supplier selection strategy is 5.204 million yuan, and the delayed delivery rate is 30%. The new reconstruction strategy makes the total cost as low as 3,809,700 yuan, and the total delayed delivery rate is as low as 7%.

1. Introduction

1.1. Background. With the speeded-up of IT transform, Sundry market competition improved global resource reorganization, optimized allocation, and increased uncertainty in supply chain demand forecasts, and the bullwhip effect has been amplified. In addition, the phenomenon of information islands in the supply chain increases the inventory backlog and the difficulty of supply chain system management. In the face of increased randomness of customer demand, reduced delivery lead time, competitive pressure from customer service levels, high-quality product requirements, and improved product supply efficiency, the supply chain urgently needs to adopt a rapid response mechanism to reduce corporate costs and increase economic benefit purpose. Supply chain management is a new management strategy; it integrates different enterprises to increase the efficiency of the whole supply chain, focusing on the cooperation between enterprises. At the same time, scholars have discovered through research that increasing the degree of information sharing between supply chains can effectively suppress the amplification of demand information, the bullwhip effect. This can reduce excess inventory in the supply chain, avoid insufficient production capacity of upstream companies, and optimize operating costs. Manufacturers and distributors make decisions from different angles and can consider problems from various aspects to achieve the best effect of supply chain management.

1.2. Significance. Apply block technology (BT) to optimize supply chain inventory models, explore new supply chain management models, and raise decision makers' cognition of the importance of information sharing and supply chain conformity. Therefore, it is of great practical significance to study how to reduce inventory costs, restrain the time lag of the supply chain, and improve the level of customer service. It provides a reference for enterprises under supply chain management to make P&D plans, making them a unique competitive advantage in fierce competition and promoting faster and better development of Chinese enterprises in the market economy.

1.3. Related Work. In this dynamic business environment, manufacturers are primarily focused on winning orders by offering performance and competitive prices. Surajit's research shows that manufacturers using flexible procurement systems (FPS) in this uncertain environment are critical to business sustainability. His research goal is to determine the elements of FPS and to simulate the relationships between them and the end to know how FPS is related to supply chain sustainability. In addition to a brief conceptual review of FPS, his research primarily shows the use of an innovative multicriteria decision-making method, named Total Interpretive Structure Modeling (TISM). This overall model based on explanatory structural modeling evaluates causality and explains the elements with relational interpretation and shows that the underlying elements are essential to the sustainability of FPS and risk avoidance [1]. The purpose of Hendalianpour et al.'s research is to assign orders to suppliers in an agile and flexible way suitable for the automotive industry. Parts supplied from a single source are not included in the part collection. Best and worst method of fuzzy rough number by mathematical modeling and interval value (IVFRN-BWM), they try to obtain results that can meet the requirements of the proposed model by introducing new models and provide ideal results. By considering five objective functions, some new aspects of the subject are solved and a robust result is obtained. These functions are included: minimize the production line interruption caused by the supplier's performance, minimize the production line's complaints about the supplied parts, minimize the defective parts (PPM) received from the supplier, and maximize on schedule delivery services. It is also optimized to minimize the total cost of parts supply [2]. In the digital world, everything and products are designed and used with the help of advanced technology. Agriculture is no exception. Wal-Mart has begun to solve food safety issues by using BT in the supply chain. Sharma et al.'s research found that because agriculture is one of the most influential sectors of the world economy, it also has a great impact on people's lives. With the development of the agricultural industry on a global scale, it is difficult to issues to be attached great importance to management information for the entire food supply chain. Therefore, food digitization that can increase transparency, food safety, and customer satisfaction is a top priority. In the context of the Indian economy, there is very little research on the use of BT to solve farmers' problems. Their research will help to solve the main problems of traceability, transparency, quality, and trust in the hybridization of food supply chain management and agriculture through the use of BT [3].

1.4. Innovation. (1) The method of system analysis and system simulation is combined together. Through the organic combination of the two, they can make up for their respective shortcomings and better reflect the actual situation. (2) Using the method of comparative analysis, the data results obtained by the production system and the distribution system are analyzed and compared. The P&D plan obtained through a mixed method is more suitable. It can better reflect the actual situation. (3) Flexible supply chain is more flexible and intelligent, which can save time and cost. At the same time, it is more intelligent to deal with the corresponding supply chain problems and find the unreasonable part of the supply chain immediately.

2. BT-Related Algorithms

2.1. Feasible Byzantine Fault-Tolerant Algorithm. The Feasible Byzantine Fault Tolerant Algorithm (FBFT) is to solve the disorder problem of Byzantine algorithm by introducing master node [4, 5].

Suppose a node belongs to group A, the community key ring $R_A = (pk_1, pk_2, \cdots, pk_n)$, and m is a message to be encrypted, x_i is the secret key, and the community key $pk_i = x_i G$ [5, 6]. The approach of correlative ring cachets is as follows:

Assume the corresponding function, $H_1 : \{0,1\}^* \longrightarrow Z_q, H_2 : \{0,1\}^* \longrightarrow G$, and calculate the public key mirror y' as formula (1):

$$y' = x_i H_2(R_A). \tag{1}$$

Generate a random number $\delta \in Z_q$, calculated according to formula (1):

$$c_{i+1} = H_1\left(R_A, y', m, \partial G, \partial y'\right). \tag{2}$$

In $j = i+1, \cdots, n, 1, \cdots, i-1$, assemble a stochastic number $s_i \in Z_q$, and count c_{j+1} as above (2) can be the following:

$$c_{j+1} = H_1\left(R_A, y', m, s_j G + c_j pk_j, s_j H_2(R_A) + c_j y'\right). \tag{3}$$

Calculate s_i according to formula (3):

$$s_i = \partial - x_i c_i \mod q. \tag{4}$$

Generate signature $\delta_{RG}(m)$ according to formula (4):

$$\delta_{RG}(m) = \left(c_1, s_1, \cdots, s_n, y'\right). \tag{5}$$

The node broadcasts a PREPARE message to the main region node when the ring signature is processed: << PREPARE, $v, n, d, G >, \delta_{RG}(m), R_G >$ [7]. When G is the group, if the node is from the A group, it means $G = A$, R_G represents the community key ring of the members of the G group, and $\delta_{RG}(m)$ represents the node's ring signature of the message [8, 9].

2.2. Signature Core Algorithm. In BT systems, signing algorithms are primarily used to verify the legitimacy of a transaction and the identity information of the transaction sender [10, 11].

A item is flood with n inputs and m outputs and has $\sum_{i=1}^{n} \mathrm{in}_i = \sum_{j=1}^{m} \mathrm{out}_j$. For any i and j, $1 \le i \le n, 1 \le j \le m$, for the purpose of hiding in and out [11, 12]. This article uses an elliptic curve algorithm as protection [12, 13]. Choose G as the generator of F_p, and the transaction forms of in_i and out_j are $I_j = \mathrm{in}_j \cdot G$ and $O_j = \mathrm{out}_j \cdot G$. In line with the calculation rules of elliptic curve, we will know the following [14, 15]:

$$\sum_{i=1}^{n} \mathrm{in}_i \cdot G = \sum_{i=1}^{n} I_i = \left(\sum_{i=1}^{n} \mathrm{in}_i \right) \cdot G, \tag{6}$$

$$\sum_{j=1}^{m} \mathrm{out}_j \cdot G = \sum_{j=1}^{m} O_j = \left(\sum_{j=1}^{m} \mathrm{out}_j \right) \cdot G \tag{7}$$

Through Equations (3) and (4), there is $\sum_{i=1}^{n} I_i = \sum_{j=1}^{m} O_j$, which can verify $\sum_{i=1}^{n} \mathrm{in}_i = \sum_{j=1}^{m} \mathrm{out}_j$, because I_i and O_j are through in_i and out_j [16, 17]. The characteristics and defects of homomorphism in the signature scheme are as follows [18].

In view of the development of quantum computing, homomorphism is an important feature for evaluating the security of algorithms. It can be proved the additive homomorphism of the basic scheme given in formula (7) [19, 20]. Proof: For each i, $1 \le i \le n$, and through the algorithm of elliptic curve, we can get the following:

$$\sum_{i=1}^{n} \mathrm{in}_i \cdot G = \left(\sum_{i=1}^{n} \mathrm{in}_i \right) \cdot G, \tag{8}$$

$$\left(\sum_{i=1}^{n} \mathrm{in}_i \right) \cdot G = \sum_{i=1}^{n} \mathrm{in}_i \cdot G. \tag{9}$$

Further, you can get the following:

$$\left(\sum_{i=1}^{n} \mathrm{in}_i \right) \cdot G = \sum_{i=1}^{n} (\mathrm{in}_i \cdot G). \tag{10}$$

In this article, Equation (10) means that the addition operation is performed first, and then, the encryption operation is performed, and the right side of the equation is the encryption operation first, and then, the addition operation is performed. Express. Therefore, it can be proved that the basic signature format is homomorphic. Because the flexible supply chain model of production and distribution is a single-line model rather than a block model to some extent, only a combination of multiple flexible supply chain models of production and distribution can apply the block chain-related algorithm, so the block chain-related algorithm cannot be used.

3. Establishment of P&D Decision-Making Model under Supply Chain Environment

The systems in the supply chain environment are interconnected and restrict each other. For this reason, in view of the difference between P&D evaluation, it is necessary to establish a fair performance evaluation index system suitable for each field to promote the coordination and connection of P&D in the supply chain. The model only considers the P&D decision-making problem. By establishing this model, the P&D planning problem of the general P&D system can be solved. In a distributed network of flexible supply chains based on BT for P&D, each resource manages its own access strategy only under the control of its owner, resulting in a "decentralized, autonomous organization network" as shown in Figure 1.

3.1. The P&D Decision Model under the Supply Chain Environment

3.1.1. Determination of Variables and Goals of the Decision Model. Production planning and control are mainly the control and process design of the entire manufacturing process, such as material control, scheduling, and inventory control. Distribution and logistics are mainly how to retrieve and deliver products from factories or warehouses to customers. P&D planning is an important factor in the overall optimization of the supply chain, and this problem should be solved under the structure of the overall planning. In order to achieve the overall optimization of the supply chain in the operation process, a supply chain model has been established with deterministic and random methods. However, for the model, it only describes some important factors to be considered in any company and does not propose a specific model to manage the supply chain. The four-tier coordination framework model of the supply chain is shown in Figure 2.

It can be seen from Figure 2 that the supply chain is a complex network formed by the interaction between the nodes of each link. Each link node in the supply chain can be regarded as a separate task agent, such as the management and production, planning, purchase and sale of inadequacy products, and final products by manufacturers. Then, the interaction between elements in the supply chain can be described as autonomous operations between agents. In the agent-based supply chain model, the supply chain can be regarded as a network constituted by a multiagent system. Each agent has certain attributes of research work on the operation mechanism of the four-tier coordination framework of the supply chain based on BT and coevolution and can collaborate with other agents.

3.1.2. Conditional Assumptions of the Decision Model. Input various variables into the model for training, and then, reinput data according to the original data can operate independently, and each part has corresponding tasks to complete. Combining the factors mentioned above, the variables to be considered when establishing the supply chain P&D integration model in this article can be divided into the strategic

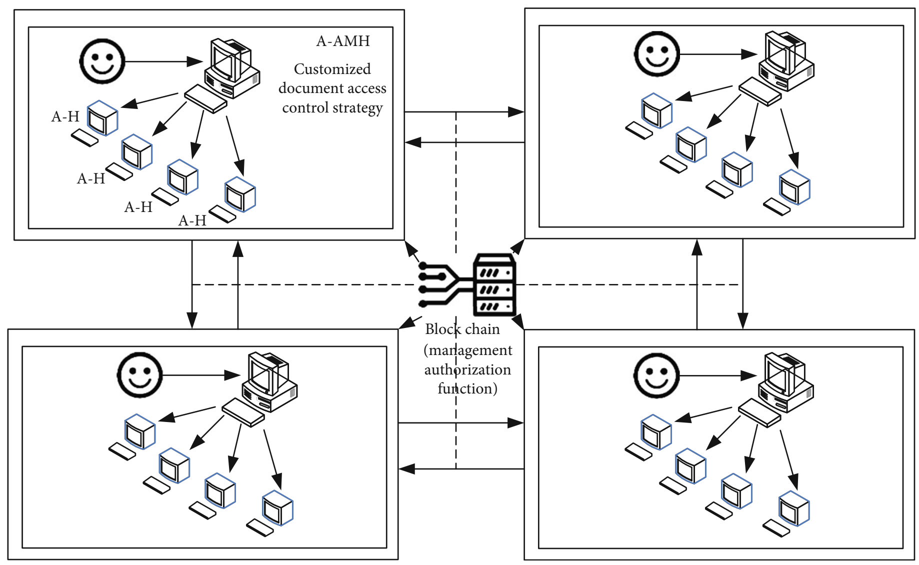

Figure 1: Decentralized supply chain network based on BT P&D flexibility.

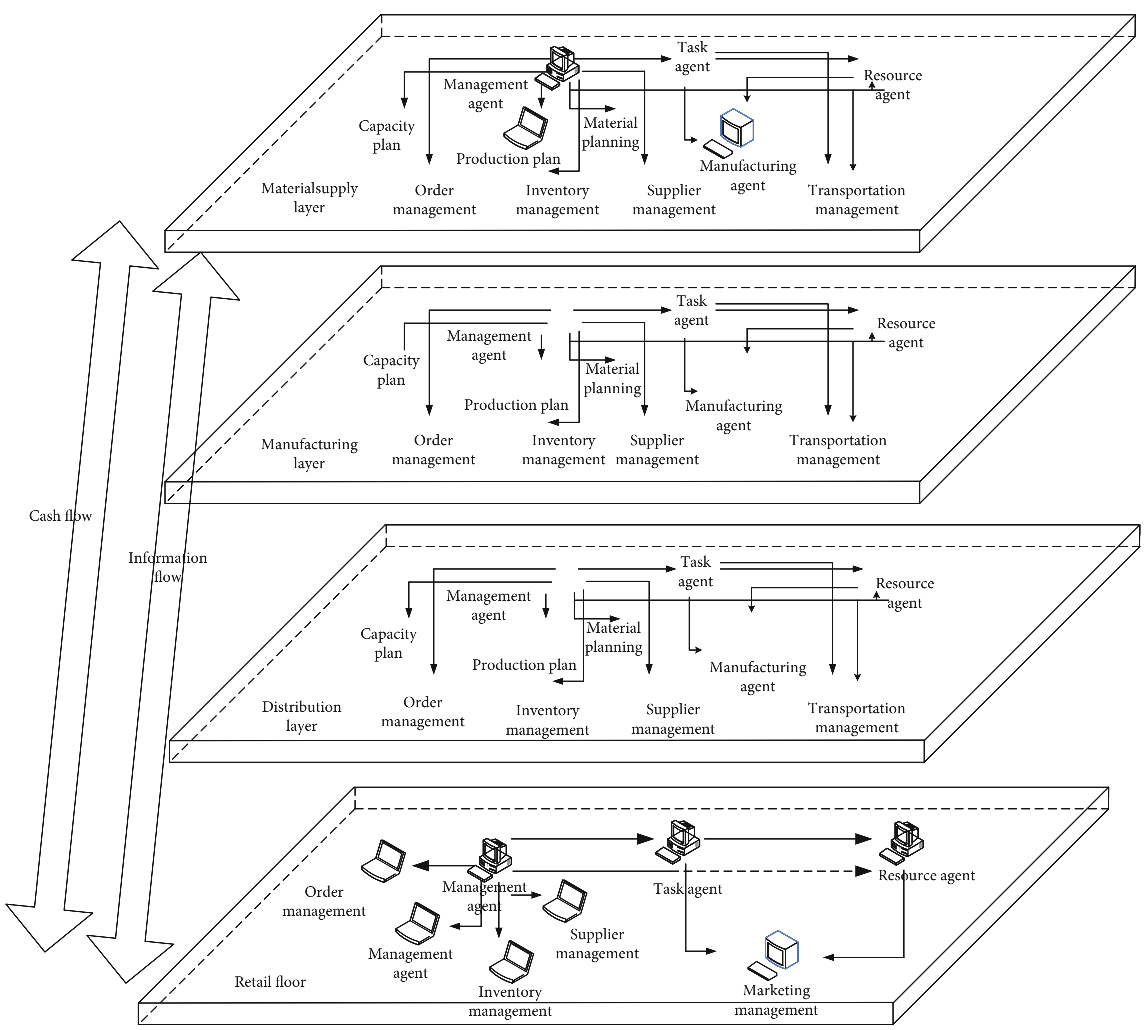

Figure 2: The four-tier coordination framework model of the supply chain.

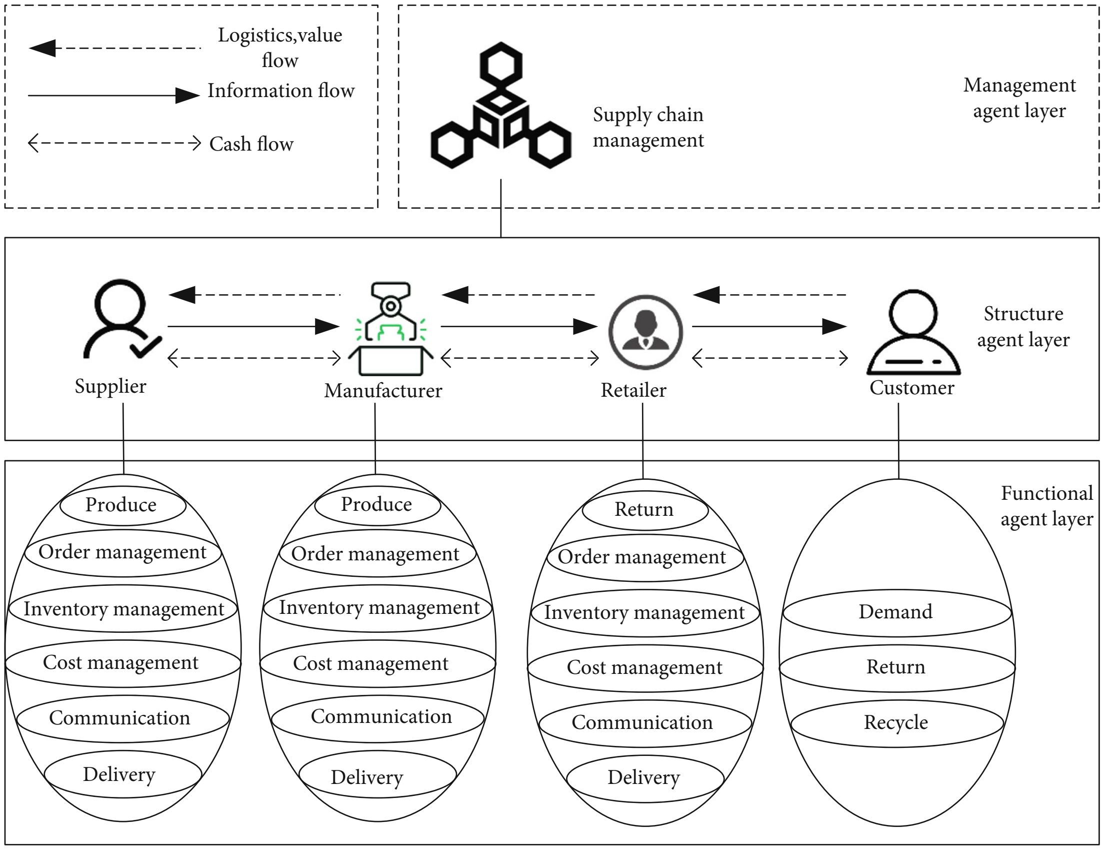

Figure 3: Agent interaction mechanism of each main body of the supply chain.

level and the operational level. The integration and optimization of P&D are to solve strategic optimization problems. The decision variables of the decision model are as follows: the number of raw materials consumed by the production parts and products, the number of final products, the number of finished products at each distribution point, and the factory to each distribution point, each distribution point to each retail, and the total product volume of the supplier. The implementation of the strategic optimization plan requires a detailed operational plan to determine the specific tasks that each member of the supply chain should perform. Only when each member executes the business that should be completed in accordance with the system goal first can the supply chain integration decision played out advantages of the program. Therefore, using the data in the strategy-level decision-making plan can be further applied to the P&D submodels to obtain the specific product order batches, batches, and minimum annual inventory costs of manufacturers and distributors. The detailed plan from the whole to the individual is obtained in this way, and the different subsystems under each entity constitute the functional agent layer. The agent interaction mechanism of each main body of the supply chain is shown in Figure 3.

It can be seen from Figure 3 that each entity agent is composed of the above three types of agents, which are divided according to the working rights of the agents, management agent>task agent>resource agent. The choice of target is the starting point for establishing the model and the key to reflecting the effectiveness of the model. As an important part of the supply chain system, the P&D subsystem has an important function in the actual submission. Its operation status determines the overall target realization status of the supply chain. From a strategic point of view, cost, flexibility, quality, and distribution are not mutually offset but should be optimized at the same time. This is also required by fierce market competition. Just optimizing one of them and sacrificing others will not be conducive to the formation of competitive advantage. Therefore, all factors that affect the decision-making goals must be taken into account. In the entire P&D model studied in this article, cost is also the ultimate goal of optimization. Determine the optimal P&D plan through the optimization of the total cost.

3.1.3. Decision Model Design. According to the previous decision-making parameter selection and model assumptions, the following specific model is established, and the method of system analysis is applied to analyze the model. The system includes two main models: the production system and the distribution system. The objective function is the sum of the P&D system costs of the entire supply chain in the entire cycle. Through the equation description, we can see that the decision-making goal is to decrease the money of P&D. The factors influencing the decision model include the number, location, capacity and type of manufacturing plants and warehouses, supplier selection, and transport channels.

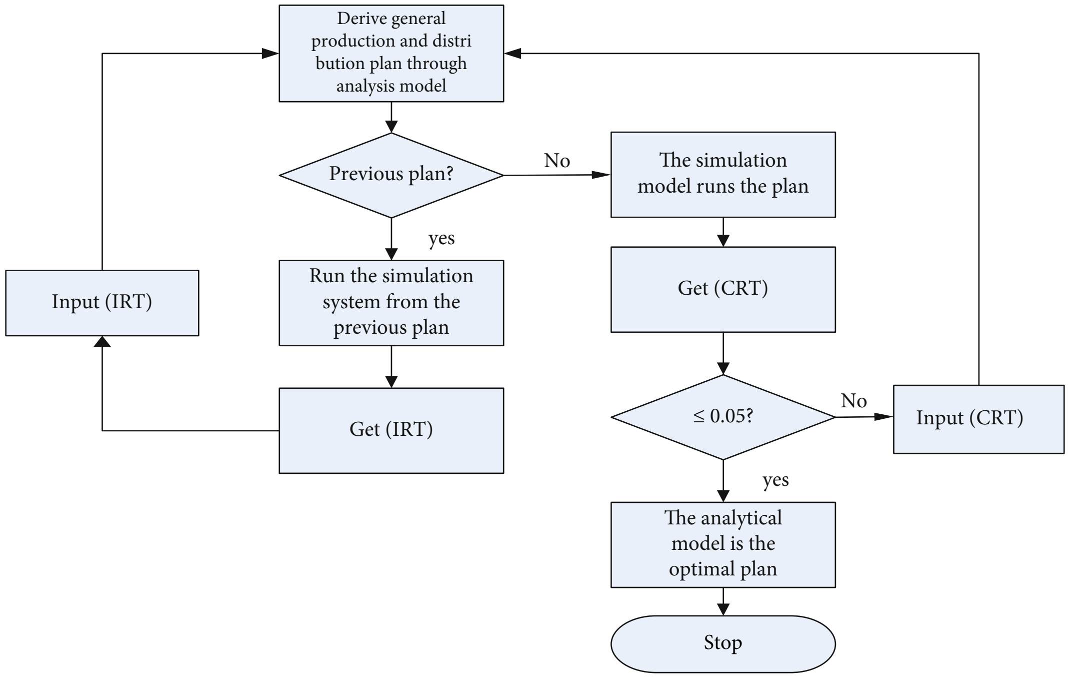

Figure 4: Processing flow based on the hybrid method.

In the production system, the various costs include part i in period t are represented by Equation (11).

$$\sum_{i=1}^{N}\left(ci_{it}X_{it}+hi_{it}li_{it}^{+}+\pi i_{it}li_{it}^{-}\right). \tag{11}$$

Also in the production system, the cost of product j in period t includes production cost, inventory cost, and out-of-stock cost. Due to the product's demand for raw material k, it also includes the purchase cost, inventory cost, and out-of-stock cost of raw material k. The cost is represented by Equation (12).

$$\sum_{j=1}^{M}\left(cj_{jt}Y_{jt}+hj_{jt}li_{it}^{+}+\pi hj_{jt}Ij_{jt}^{-}\right)\sum_{k=1}^{K}\left(ck_{kt}E_{kt}+hk_{kt}Ik_{kt}^{+}+\pi k_{kt}Ik_{kt}^{-}\right). \tag{12}$$

Equation (13) represents the demand cost, inventory cost and out-of-stock cost of raw material r, and the total cost of product j in the distribution system.

$$\sum_{r=1}^{R}\left(cr_{rt}F_{rt}+hr_{rt}Ir_{rt}^{-}+\pi hr_{rt}Ir_{rt}^{-}\right)\sum_{j=1}^{M}\left(SL_{jt}L_{jt}^{+}+SLL_{jt}L_{jt}^{-}\right). \tag{13}$$

Equation (14) represents the sum of the inventory cost and the out-of-stock cost of product j in the distribution system and product j in warehouse q.

Table 1: Product demand plan.

Prt(j)	Cyl(t)			
	a	b	c	d
A	80	80	60	0
B	60	70	60	0

$$\sum_{j}^{M}\sum_{p}^{P}\left(SP_{jpt}P_{jpt}^{+}+SPP_{jpt}P_{jpt}^{-}\right) \tag{14}$$

The sum of the total inventory cost and out-of-stock cost of retailer j in the distribution system is represented by Equation (15).

$$\sum_{j}^{M}\sum_{q}^{Q}\left(SQ_{jqt}Q_{jqt}^{+}+SQQ_{jqt}Q_{jqt}^{-}\right). \tag{15}$$

After the product manufacturer comes out, it is transported to the warehouse by means of transportation. There is a buffer area in between, from which the product can be directly delivered to the retailer. Equation (16) expresses the total transportation cost of the product from the buffer area to the warehouse.

$$\sum_{j}^{M}\sum_{p}^{P}LPC_{p}LP_{jpt}. \tag{16}$$

Table 2: Production route.

Cpt(i) Workshop 1		Ord		Product(j)		Ord Workshop 2	
A	WD1-1	WD2-1	WD3-1	A	WD1-2	WD2-2	WD3-2
B	WD1-1	WD2-1	WD3-1	B	WD1-2	WD2-2	WD3-2

Table 3: Production process time (minutes).

Components(i)	Machine center(u)			Components(i)	Machine center(v)		
	1	2	3		1	2	3
1	1	1	1	1	3	6	4
2	1	1	1	2	4	7	5

Equation (17) expresses the total transportation cost of the product from the buffer area to the retailer.

$$\sum_{j}^{M}\sum_{q}^{Q} LQC_{q}LQ_{jqt}. \quad (17)$$

Equation (18) represents the total cost of transportation.

$$\sum_{j}^{M}\sum_{p}^{P}\sum_{q}^{Q} PQC_{pq}PQ_{jpqt}. \quad (18)$$

3.2. Solution Method of Decision Model. The model established in this article is a very typical linear programming model, which can be calculated in the linear programming model software. The product production quantity obtained by the optimal solution integration optimization is used as the input variable of the operation-level supplier, manufacturer, and distributor model. The result of the integration and optimization is the quantity of raw materials provided by the supplier to the manufacturer, the quantity of products produced by the manufacturer and the quantity of product inventory, and the quantity of products demanded by the retailer. The transportation volume of the product, the retailer's setting, and the retailer's service to the user area will be the input variables of the distributor level, which restricts the optimization result of the distributor level. These results are substituted into the model formula for calculation. The P&D model is already similar to the decision model for determining the economic order quantity, and the corresponding results can be obtained by the same method. Thereby, the decision result of the whole system in the least cost situation is finally determined. Specific in-depth analysis of the results can be aimed at specific instance data, which is helpful to discover deeper information. Specific examples will be analyzed and verified in the next chapter. Production resources need to be provided by suppliers. In the supply chain, various suppliers need to take detailed resource consideration in order to achieve maximum benefits.

4. Simulation Analysis of Supply Chain P&D Decision Model

The mixed research method of analysis and simulation is a combination of independent analysis models and simulation models to get their own solutions, and finally, the combined solutions are combined to meet the needs of the problem. In this article, first select a rough analysis model, and use it to obtain the output variables of the plan as input variables of the simulation model. The processing flow of the hybrid method is shown in Figure 4.

It can be seen from Figure 4 that the operating time in the simulation model will be used as the running time of the system simulation. It will run through the entire simulation process. It is also the time it takes to produce all products and distribute these products in the analysis model. We will use the running time in the simulation model for operating time in the analysis model. Thence, the operating time in the analysis model is the result of the simulation system, and the analysis model derives a new P&D plan based on this time. And this model also includes the function of predicting production and distribution decisions to promote the balance of supply and marketing. Supply chain is a network line, and the combination of multiple supply chains is a network structure. This process will end when the previous simulation run time (preceding simulation runtime) is close enough to the current simulation run time (current simulation runtime). If they are close enough, we believe that the real situation can be learned through analytical models and simulation experiments, so we can obtain the optimal P&D plan that can well reflect the reality through the analysis model.

4.1. Case Analysis. In the context of supply chain, manufacturers are producing products and distribution is carried out through logistics and express delivery industry. Therefore, supply chain management model can better promote the optimization of production and distribution routes and processes. The purpose of the abovementioned joint research method based on analysis and simulation is to be applied to the P&D system under supply chain management, so as to minimize the cost of the entire P&D system. The distribution system consists of a buffer area, two warehouses, and

Table 4: The number of parts and raw materials required and the number of parts required for raw materials.

Components(i)	Product(j)		Raw materials(k)	Components(i)		Raw materials(k)	Product(j)	
	1	2		1	2		1	2
1	4	4	1	5	7	1	4	5
2	6	6	2	6	4	2	4	3

three retailers. The products are transported to the retailer by a set of transportation vehicles according to the route. In the initial stage, each cycle of the system is 4300 units of time. This time is calculated by the P&D of a certain batch of products. Under the constraints of production capacity and inventory balance, this plan minimizes the sum of production costs, distribution costs, inventory costs, and out-of-stock costs. The following table will give some data required by the production system. The product demand plan is shown in Table 1, and the production route is shown in Table 2.

In the following analysis process of this article, the idea of supply chain management is applied. The production system and the distribution system are considered as a whole. They are both interrelated and affect each other. The decision of any system will affect the decision of the whole system.

First, the simulation model under fixed variables will be analyzed, that is, the damage and maintenance of machines and transportation tools will not be considered.

Secondly, the simulation model under random variables will be analyzed. Through the setting of the functional variables of the machine and the means of transportation, it will obey the normal and exponential distributions.

The traditional supply chain is unable to flexibly rotate the supply route of products, which requires a lot of time cost and transportation cost, while the flexible supply chain is more flexible and intelligent and can operate autonomously to a certain extent. In the model, we assume that there is no quality problem with raw materials. At the same time, we also assume that the inventory capacity in the buffer area is sufficient. Retailers can get products from the buffer area at any time. Retailers are satisfied with the quality of the products. The production process time is shown in Table 3, and the required quantity of parts and raw materials and the required quantity of parts for raw materials are shown in Table 4.

The data required for the model is listed in the chart. In the distribution system, the retailer's demand for products and the distribution time and inventory cost data according to the route will be given in the following four tables. We assume that the inventory capacity of warehouses and retailers is sufficient, and similarly, the inventory capacity in the buffer area is also sufficient. Retailers' demand for products is shown in Table 5, and the transportation time requirements of products in the distribution system are shown in Table 6, and the inventory and out-of-stock costs of products in the distribution system are shown in Table 7.

According to the analysis method, the simulation model concludes that the P&D plan runs in a given period to meet customer needs. The running time of the simulation will be used as the actual operating time in the analysis model for further research.

4.2. Simulation Model Research of Fixed Variables. In the first computer simulation experiment, this article carried out a simulation model without random variables. In other words, the simulation model fails to reflect the random situation in reality, such as random machine failure or repair time. The operating time is used as a fixed variable. The detailed description process is shown in Figures 5 and 6.

As shown in Figure 5, we will find that the operating time of each cycle fluctuates up and down, but we will also find that the amplitude of the fluctuations gradually becomes smaller as the cycle repeats. It shows that as the simulation model runs multiple times, and the operating time gradually tends to a fixed value.

As shown in Figure 6, the different rate of operation time is gradually decreasing as the cycle repeats. Moreover, from Figure 6, we will also find that the difference rate is less than or equal to 5% after the 12th repeat point. At the same time, we will accept the production distribution plan with the 12th repeat point as the operating time as the optimal production plan.

Table 5: Retailers' demand for products.

Cyl(t)		A		B		C	
Prt(j)		a	b	a	b	a	b
Retailer	1	30	30	20	25	20	30
	2	25	15	30	25	20	15
	3	20	15	30	20	20	15

Table 6: Transportation time requirements of products in the distribution system (minutes).

Warehouse	1	2	Retailer	1	2	3	Retailer	1	2	3
Buffer	15	20	Buffer	40	35	50	Warehouse	25	30	25

Table 7: Inventory and out-of-stock costs of products in the distribution system.

Cyl(t)		A		B		C	
Prt(j)		a	b	a	b	a	b
Buffer		3 (5)	2 (6)	2 (7)	3 (8)	3 (5)	2 (6)
Whs	1	3 (8)	4 (6)	4 (8)	3 (7)	3 (6)	3 (8)
	2	5 (9)	5 (9)	4 (8)	5 (7)	4 (6)	4 (8)
Rtler	1	2 (8)	4 (7)	2 (5)	4 (6)	3 (8)	4 (6)
	2	3 (8)	3 (7)	4 (7)	5 (7)	4 (6)	4 (7)
	3	4 (9)	2 (5)	3 (8)	2 (5)	4 (5)	5 (5)

4.3. Simulation Model Research of Random Variables. The combination of supply chain management and model parameter selection is to optimize the route of supply chain. The best optimal distribution scheme can be found in the distribution of goods in the supply chain. The above simulation model does not take into account the random damage and repair time of machines and vehicles. The next model will add these random variables. For the random use of machines and vehicles, we assume that the obey period of machines and vehicles is the exponential distribution of 500 hours, while the maintenance time obeys the normal distribution of 20 hours and 2 hours.

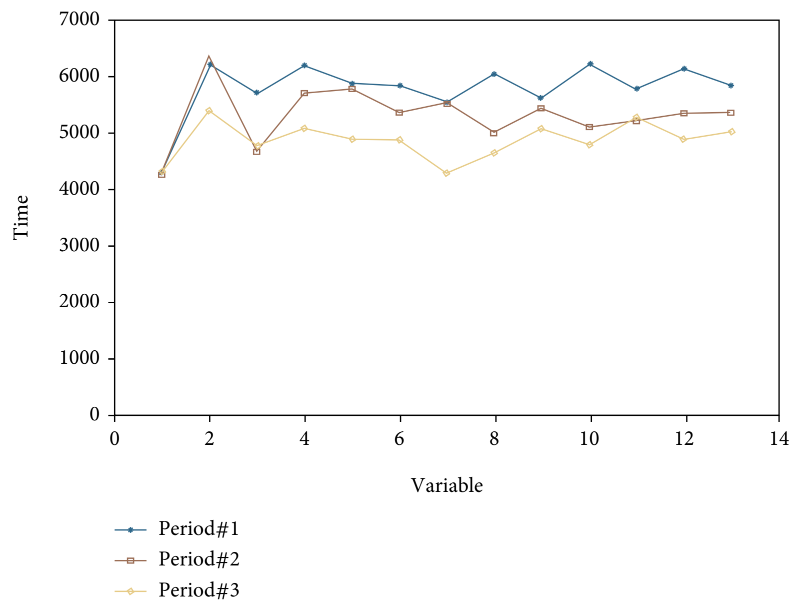

Figure 5: Operating time of each cycle based on the fixed variable simulation model.

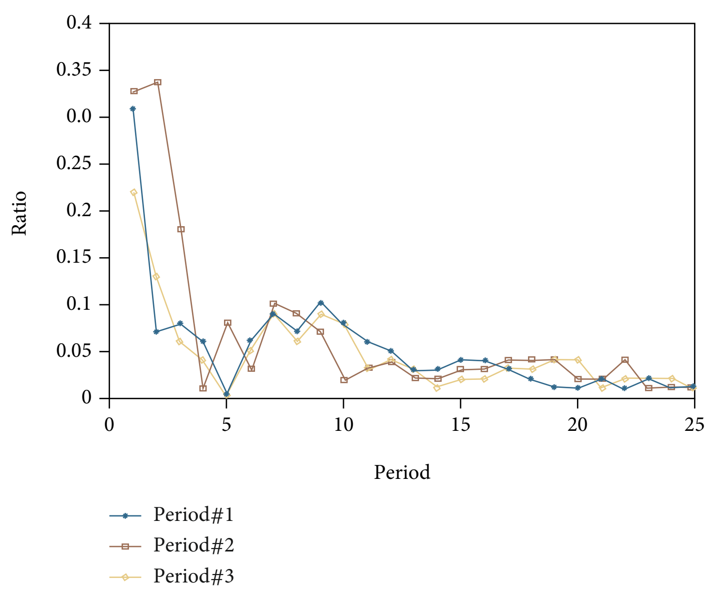

Figure 6: The different rates of operating time in each cycle based on the fixed variable simulation model.

When we think that random phenomena fail in the model, we will run the model more times in order to get the running time. In the research of this article, the average operating time is obtained by running the model multiple times. Although it cannot be guaranteed to be very accurate, it can be guaranteed that the obtained operating time is within the normal range of values under repeated operation. The specific process description is shown in Figures 7 and 8.

From Figures 7 and 8, we can see that the production system under random conditions and the production system under fixed conditions have not changed much. Also in the different rates of operating time, the simulation model under random conditions is not significantly different from the simulation model under fixed conditions. From the figure, we will find that the difference rate is less than 5% after the 22nd repeat point, so we will accept the 22nd repeat point as the operating time as the time point for formulating the optimal production plan in the analysis model. Through the analysis model, we can get the production, inventory, and distribution of products in the P&D system. The integration of production and sales is a vertical sales system that combines production enterprises and selected sales enterprises in the form of joint operation.

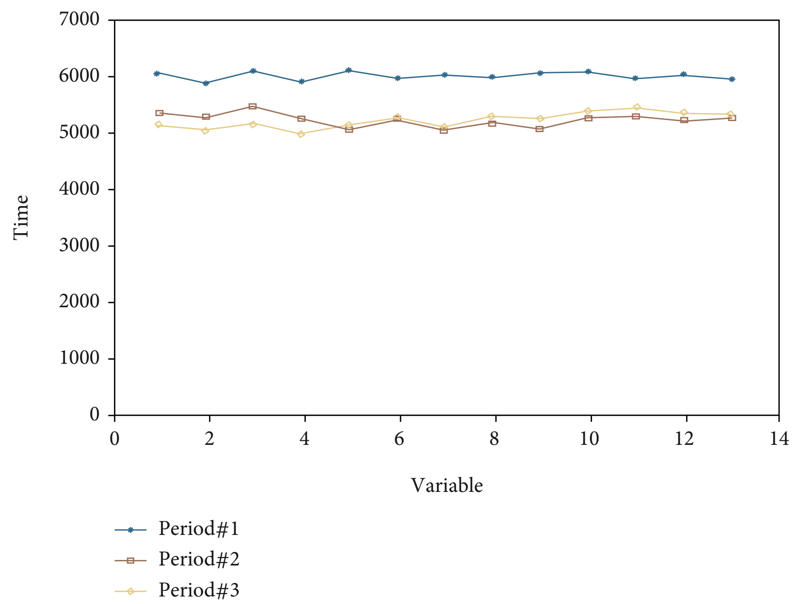

FIGURE 7: Operating time of each cycle based on random variable simulation model.

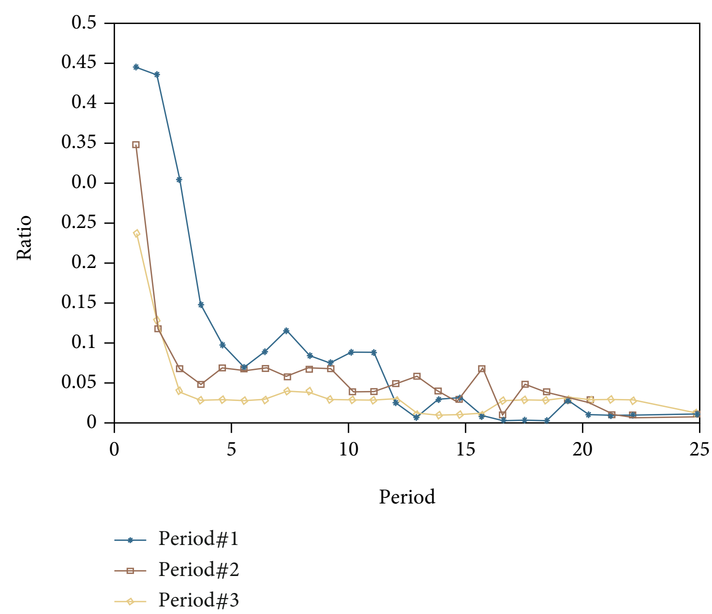

FIGURE 8: The different rates of operating time in each cycle of the simulation model based on random variables.

5. Conclusions

The thesis mainly applies the management ideas of supply chain. First, it analyzes the P&D system in the supply chain environment through the method of system analysis, and through the further study of the model, it is found that the system analysis method does not reflect the reality well, and the operation time is total. It appears as a fixed value, and system simulation can make up for this shortcoming. Therefore, this paper proposes a combined analysis method of system analysis and system simulation. The data obtained through system simulation is applied to the analysis model, and then, the system analysis method is used to study the P&D system. The following conclusions are obtained: The comprehensive idea of supply chain management can reflect the relationship between overall efficiency and local efficiency and reflect the interdependence and interaction between overall efficiency and local efficiency. Although the independent decision-making of the parties can achieve the optimal, the overall decision-making is more effective.

It is not only a simple summation of the system, but also the utility of the mutual cooperation. In establishing the supply of chain management, in order to benefit the research of this article, this article puts forward some assumptions, so in the decision-making model, the operation time is always regarded as a fixed variable. Therefore, it cannot effectively reflect the actual dynamic characteristics, including machine damage and vehicle damage. Therefore, the P&D plan obtained only by the system analysis method cannot reflect the actual situation well; based on the problems of the system analysis method, the system simulation method can well reflect the dynamic and randomness of the system, and it just makes up for the system analysis method. For the shortcomings, this paper proposes a combined method of system analysis and system simulation to study the P&D system. Apply system simulation for simulation operation, and compare actual operation time through a large amount of data and graph comparison. Reuse the system analysis method to get the optimal P&D plan. However, the researcher in this paper cannot take many uncertain factors into account, so it is hoped that future research can take these uncertain factors into account.

The problems faced by artificial intelligence cannot be solved by traditional technologies. It may be a wise choice to turn to blockchain, which is also an emerging technology. Under the premise of data centralization, there is also a lack of transparency in how data is used. When data providers cannot effectively manage their own data, many people choose not to share data. And blockchain can solve this problem. On the chain, the uploader, usage flow, and results of each piece of data can be traced. Users have ownership and autonomous right to use the data. The data uploader will also receive the digital cryptocurrency provided by the user as compensation. When the user can realize the data generated by himself and control the flow of the data, it is believed that more people will be willing to provide relevant data. For AI, secure data sharing means more data, then better models, better actions, better results, and better new data. Faced with the high cost of computing power, the AI industry may be helpless, but the most important thing in blockchain is probably computing power. Mining is an extremely difficult task that requires a lot of electricity and money to lay out computing power to complete. Redundant computing power can completely save costs for AI. In turn, AI has been proven to be an effective means of optimizing power consumption, providing similar solutions for application in blockchain. This may lead to lower investment in mining hardware. Blockchain can bring bright prospects for the artificial intelligence industry, and artificial intelligence can in turn cheer the blockchain.

Data Availability

No data were used to support this study.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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