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Revenue Model of Supply Chain by Internet of Things Technology

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ABSTRACT Under the condition of elastic demand and different market scales, the optimization of multi-product supply chain by the Internet of Things (IoT) technology was studied from the perspective of overall supply chain revenue in this paper. Particularly, the supply chain revenue model in a two-stage multi-product supply chain is established to analyze the impact of the IoT technology on the overall supply chain revenue. The imperialist competitive algorithm is introduced, and the algorithm is improved to solve the model. The computer simulation optimization method is used to solve the example and to compare the overall supply chain revenue and its changes before and after introducing the IoT technology. The result shows that the application of the IoT technology can effectively optimize the multi-product supply chain.

INDEX TERMS Multi-product supply chain, Internet of Things (IoT) technology, supply chain optimization, imperialist competitive algorithm (ICA), revenue model.

I. INTRODUCTION

Internet of Thing is an intelligent network based on the Internet for information real-time exchange and transmission through radio frequency identification technology, infrared sensor, global positioning system, laser scanner and other technologies to realize recognition, location, tracking and management of things. The ''chains'' constitutes ''net''. Viewing from the virtual form, the supply chain can be regarded as an important ''vein'' of the Internet of Things. From a technical perspective, many technologies (such as barcodes, RFID, etc.) involved in the Internet of Things have been applied in supply chain field very early. The Internet of Things also provides larger room for improvement of the high-end development of the supply chain while bringing new ''intelligence'' to these technologies [1] (Figure 1).

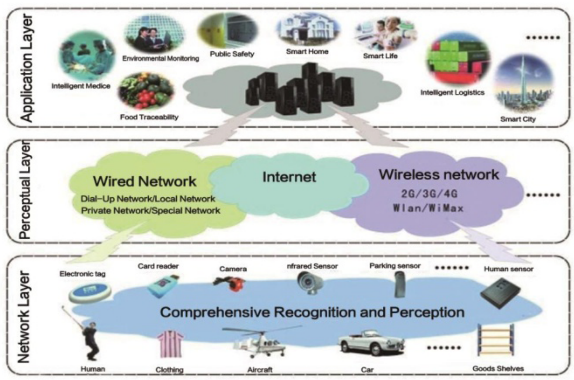

FIGURE 1. Internet of things architecture.

The application of Internet of Things in the supply chain is of great research value due to its technical characteristics. Kevin *et al.* proposed an RFID-based agricultural product supply chain IoT information sharing model, and provided the design of agricultural product supply chain tracking and tracing based on the Internet of Things [2]. To achieve whole process tracing of the aquatic product circulation process, based on three parties of consumer, enterprise and government supervision department from the perspective of the supply chain, aiming at the basic goal of trackability, traceability, recall, Johnston et al designed and developed the aquatic product supply chain traceability platform based on RFID and EPC Internet of Things, which can realize the whole process tracing and tracking of aquatic products from breeding, processing, distribution to sales [3]. Aiming at the special supply chain of fresh agricultural products, Ghose et al constructs the Technology-Organization-Environment (TOE) framework of influencing factors for IoT technology adoption in agricultural product supply chain, and empirically analyzes TOE framework of the proposed IoT technology adoption factors based on actual research data by using the structural equation model (SEM) [4] (Figure 2).

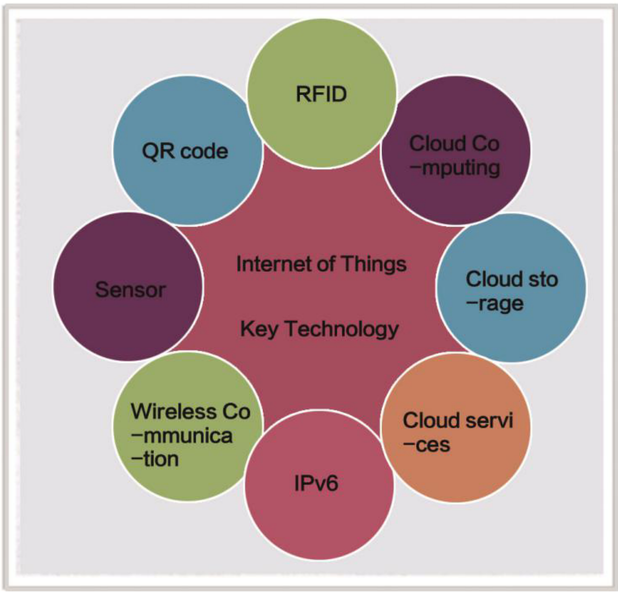

FIGURE 2. Key technologies of the internet of things.

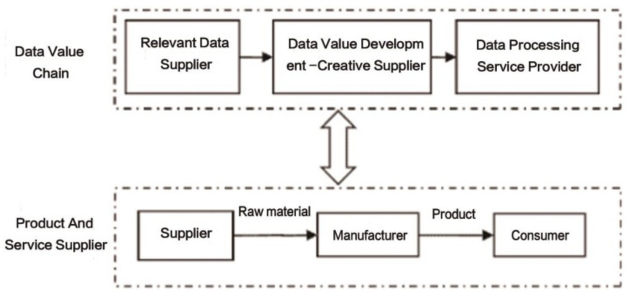

FIGURE 3. New functional suppliers and value creation patterns in supply chain under the environment of internet of things.

Lancioni verified the competitiveness improvement effect of the Internet of Things technology on agricultural products supply chain by analyzing the changes in overall competitiveness level of agricultural product supply chain and each first-grade indicator competitiveness level before and after the application of Internet of Things [5]. Bartol [6] compared the relative advantages and disadvantages of bar code and RFID in the Internet of Things technology, and obtained the specific application modes of RFID in the agricultural product traceability system. Lancioni *et al.* [7] studied the IoT-based cheese production traceability system to monitor the cheese production process and improve product quality and safety. Graham and Hardaker [8] studied the specific application of Internet of Things technology in food supply chain packaging container tracking information system (Figure 3).

Currently, most researches on the application of the Internet of Things in the supply chain focus on qualitative analysis, but there are few quantitative researches. This paper has studied the optimization function of the Internet of Things technology on the supply chain from the perspective of the overall supply chain revenue, and made quantitative analysis

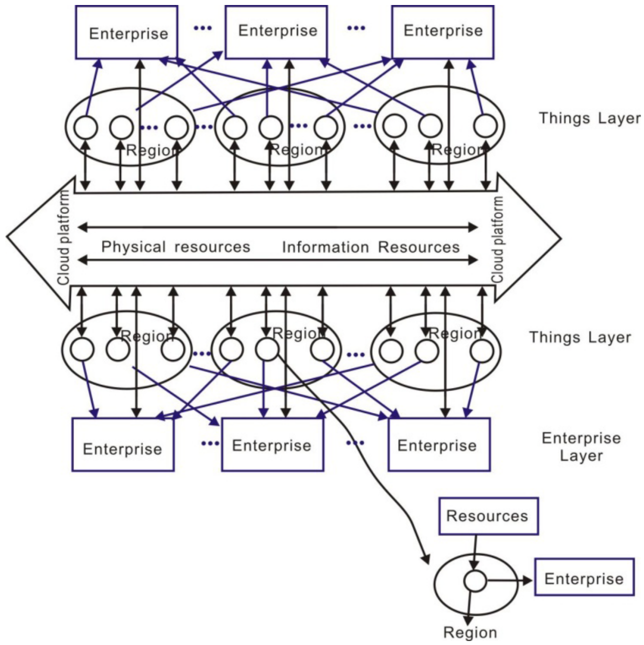

FIGURE 4. A sketch of "cloud" resource allocation architecture embedded in the supply chain of internet of things.

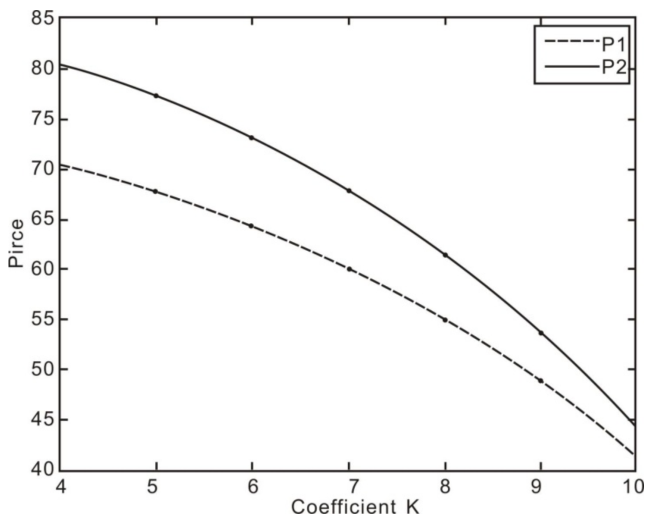

FIGURE 5. Effect of subsidy coefficient on price.

on the influence of the Internet of Things technology on the supply chain costs and revenues under the condition of elastic demands and different market sizes (Figure 4).

This paper used the improved Imperial Competition Algorithm (ICA) to solve the nonlinearity and uncertainty of the revenue model. The algorithm firstly proposed by Lancioni in 2003 has been used in fuzzy controller optimization, picture processing, spacecraft trajectory optimization, etc. Regarding the solving effects [9]–[12] (Figure 5).

Dadzie *et al.* [13] established the bi-level programming model of supply chain coordination and solved the model by using imperial competition algorithm and evolutionary strategy algorithm. The results show that the imperial competition algorithm with fewer iteration times and good

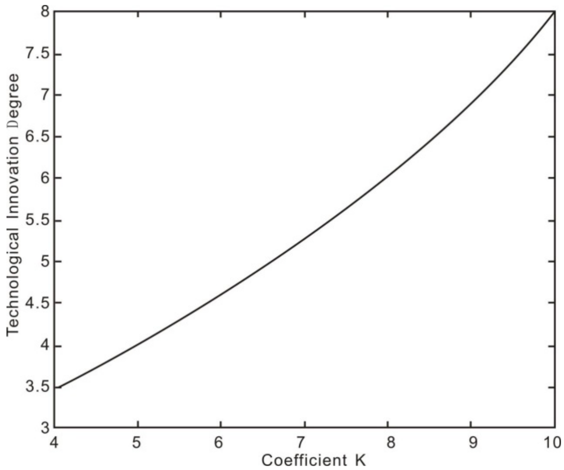

FIGURE 6. The influence of subsidy coefficient on technological innovation.

convergence effect. Currently, there are very few researches and application of the algorithm in China, which means there is still huge research space. This paper has took the initiative to apply the algorithm to the multi-product supply chain optimization domain (Figure 6).

This paper is divided into five parts: Section I elaborates the research background and significance; Section II established model; Section III solved model based on improved empire competition algorithm; Section V is example analysis; Section V summarized the major work.

II. MODEL BUILDING

A. MODEL ASSUMPTION

Considering two-stage multi-product supply chain with single demand cycle, the supply chain members are composed of manufacturer and distributor. The more product categories, the larger the market scale of the company.;

It is assumed that each product has the elastic demands of same elastic factors: among them is constant, $\alpha(\alpha > 1)$ and $\beta(0 < \beta < 1, \beta + 1 < \alpha)$ are elastic factors, is the sales price of the seller, and is sales effort involvement load of the seller when selling the product, such as advertising fees, etc. [14]–[20];

Manufacturer and distributor produce and order products according to market demand, stockout not allowed;

If the seller finds defective quality of the product during the sales process, the manufacturer is responsible for product recall, but the seller will also lose a certain opportunity cost [21]–[25];

The introduced Internet of Things technology means to label RFID tags to product packaging for real-time product monitoring and management through the wireless sensor network. The seller also needs to introduce relevant IoT technology platform facilities, and RFID tags can be partially recycled [26]–[30]; Consider the optimization effect of introducing Internet of Things technology on overall revenues of multi-product supply chain [31]–[36] (Figure 7).

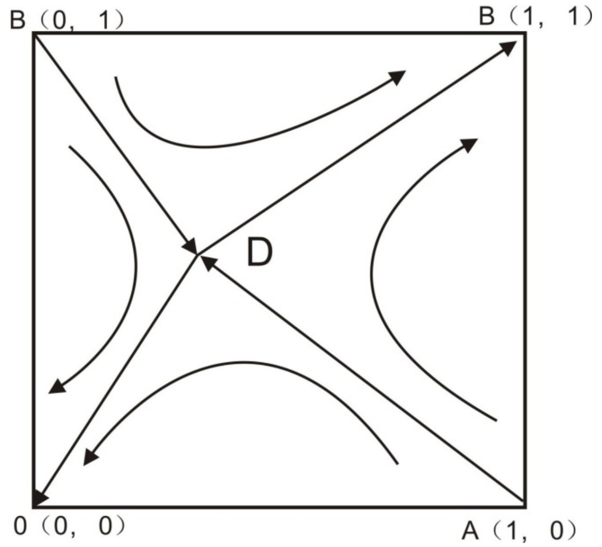

FIGURE 7. Phase diagram of supply chain system evolution.

B. REVENUE MODEL BUILDING

① Considering the revenues of the manufacture without introducing the Internet of Things technology, the revenues of the manufacturer can be obtained by subtracting the cost from the revenue of the product sold to seller, as described below:

$$U_{s1} = \sum_{i=1}^{n}(1-\mu_i)P_{si}D_i - \sum_{i=1}^{n}C_{si}D_i - \frac{1}{2}T_s\rho\sum_{i=1}^{n}C_{si}D_i - \sum_{i=1}^{n}\mu_i C_{si}D_i - C_{ss} \quad (1)$$

In above formula: indicates the manufacturer's revenues without introducing Internet of Things technology; indicates the type of the product; indicates the price of the product sold by the manufacturer; indicates the market demand for the product; indicates the loss rate of the product; indicates the unit production cost of the product; indicates average inventory turnover period of the manufacturer; ρ indicates the daily storage cost rate (proportion of product value); indicates the unit recall cost of the product; indicates the fixed cost of the manufacturer.

② Considering the revenues of the seller without introducing the Internet of Things technology, the revenues of the seller can be obtained by subtracting the cost from the revenue of the product sold to customers, as described below: Seller's revenues = revenues- purchasing cost- stockholding cost- opportunity cost-fixed cost [37]–[45]

$$U_{r1} = \sum_{i=1}^{n}(1-\mu_i)P_{ri}D_i - \sum_{i=1}^{n}P_{ri}D_i - \frac{1}{2}T_r\rho\sum_{i=1}^{n}P_{ri}D_i - \sum_{i=1}^{n}\mu_i(P_{ri}-P_{si})D_i - C_{rs} \quad (2)$$

In above formula: indicates the seller's revenues without introducing Internet of Things technology; indicates the price

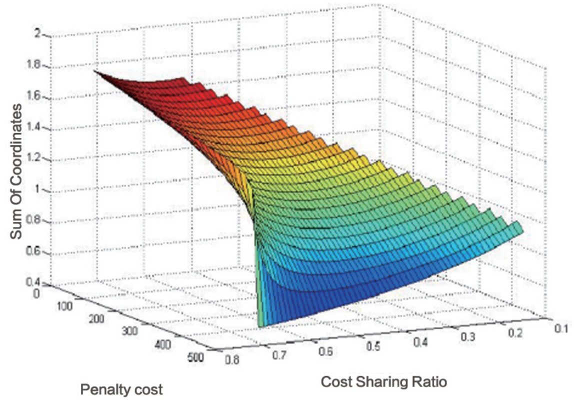

FIGURE 8. The influence of cost-sharing ratio and penalty cost on the results of evolutionary game.

of the product sold by the seller; indicates average inventory turnover period of the seller; ρ indicates the daily storage cost rate (proportion of product value); indicates the opportunity cost of the product; indicates the fixed cost of the seller [46]–[52] (Figure 8).

After introducing the Internet of Things technology, considering the revenue changes of the manufacturer, due to the introduction of the Internet of Things technology, products with problems can be provided timely warning in the production process, and the product loss during storage and transportation can be reduced, thus reducing the scrap rate, reducing the product recall cost and increasing the sales volume, but correspondingly increasing RFID tag costs and fixed costs of IoT facilities, specifically described as follows: Manufacture's revenues = revenues- production cost-tag and maintenance cost-stockholding cost- recall cost-fixed cost-cost of IoT facilities

$$U_{s2} = \sum_{i=1}^{n}(1-\mu_i')P_{ri}D_i - \sum_{i=1}^{n} C_{si}D_i - \sum_{i=1}^{n}(\theta C_{tag}+C_{main})D_i - \frac{1}{2}T_s\rho\sum_{i=1}^{n} C_{si}D_i - \sum_{i=1}^{n}\mu_i' C_{mi}D_i - C_{ss} - C_{sg} \quad (3)$$

In above formula: indicates the revenues of the manufacturer after introducing the Internet of Things technology; indicates the loss rate of the product after introducing Internet of Things technology; θ indicates the recovery rate of the RFID tag. If fully recovered, $\theta = 0$; if cannot be recovered, $\theta = 1$; indicates the cost of unit product RFID tag; indicates the maintenance cost of unit product when using IoT technology; indicates the cost of the IoT technology platform facilities that the manufacturer inputs once to the average demand cycle.

After introducing the Internet of Things technology, considering the revenue changes of the seller, due to the introduction of the Internet of Things technology, products with problems can be provided timely warning in the production process, and opportunity cost caused by product loss can be reduced, order quantity can be optimized, inventory management can be improved and inventory turnover cycle can be reduced. But relevant facility costs will be increased due to the introduction of the Internet of Things technology facilities, specifically described as follows:

Seller's revenues = revenues- purchasing cost- stockholding cost- opportunity cost-fixed cost- cost of IoT facilities

$$U_{r2} = \sum_{i=1}^{n}(1-\mu_i')P_{ri}D_i - \sum_{i=1}^{n} P_{si}D_i - \frac{1}{2}T_s\rho\sum_{i=1}^{n} P_{si}D_i - \sum_{i=1}^{n}\mu_i'(P_{ri}-P_{si})D_i - C_{rs} - C_{rg} \quad (4)$$

In above formula: indicates the revenues of the seller after introducing the Internet of Things technology; indicates the cost of the IoT technology platform facilities that the seller inputs once to the average demand cycle.

In summary, the total revenues before introducing Internet of Things technology to the supply chain can be obtained according to formula (1) and formula (2), the total revenues after introducing Internet of Things technology to the supply chain can be obtained according to formulas (3) and (4). Manufacturer and seller need to formulate optimal and to maximize make the benefits and, minimize, and Establish the minimum objective function:

$$\begin{aligned} \min -U_1 = {} & \sum_{i=1}^{n}(1+\frac{1}{2}T_s\rho)C_{si}D_i + \sum_{i=1}^{n}(1+\frac{1}{2}T_s\rho)P_{si}D_i \\ & + \sum_{i=1}^{n}\mu_i(C_{mi}+2P_{si})D_i + C_{ss} + C_{rs} \\ & - \sum_{i=1}^{n}(1-\mu_i)(P_{si}+P_{ri})D_i \\ \text{s. t. } & P_{si} \le P_{ri} \end{aligned} \quad (5)$$

$$\begin{aligned} \min -U_2 = {} & \sum_{i=1}^{n}(1+\frac{1}{2}T_s\rho)C_{si}D_i + \sum_{i=1}^{n}(1+\frac{1}{2}T_s\rho)P_{si}D_i \\ & + \sum_{i=1}^{n}(\theta C_{tag}+C_{main})D_i + C_{ss} \\ & + C_{rs} + C_{sg} + C_{rg} \\ & - \sum_{i=1}^{n}\mu_i'(C_{mi}+2P_{ri})D_i \\ & - \sum_{i=1}^{n}(1-\mu_i')(P_{si}+P_{ri})D_i \\ \text{s. t. } & P_{si} \le P_{ri} \end{aligned} \quad (6)$$

III. MODEL SOLVING BASED ON IMPROVED EMPIRE COMPETITION ALGORITHM

A. IMPROVED EMPIRE COMPETITION ALGORITHM

The Imperial Competition Competitive Algorithm (ICA) was firstly proposed by Atashpaz-Gargari in 2007, also known as the Colonial competitive algorithm (CCA), an overall optimization evolutionary algorithm. The idea of this optimization algorithm has referred to the process of mutual

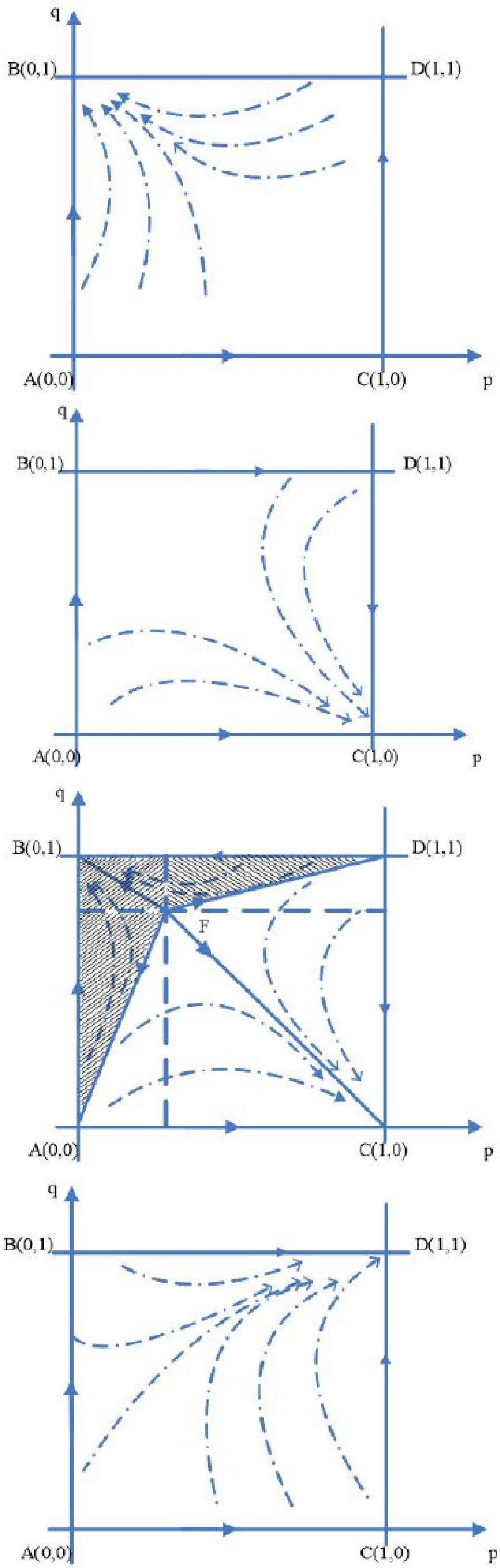

FIGURE 9. **Supply chain balance point.**

competition between the empires during colonial stage and the occupation of its colonies in the evolutionary course of the human political society (Figure 9).

Based on the basic steps of ICA, the algorithm steps for designing and solving above multi-product supply chain optimization problem are as follows:

Step 1: Initialize the Empire to code decision variables and in the multi-product supply chain revenue model built in the previous section, and to establish the initialized countries, each country is defined as a 2n-dimensional vector: Among all, indicates the price of product sold by manufacturer. indicates the price of product sold by the seller. The objective function value of each country j can be calculated according to the objective function formulas (5) and (6) of the multi-product supply chain revenue model built in the previous section.

$$C_j = -U = f(country_j) = f(P_{s1}, P_{s2}, P_{s3}, \cdots, P_{sn}, P_{r1}, P_{r2}, P_{r3}, \cdots, P_{rn}) \quad (7)$$

The initialized countries are sorted according to the size of the objective function value, the former countries with the smallest objective function are defined as the empires, and the remaining countries are defined as the colonies.

Define the standardized objective function value of the empire as:

$$NC_m = C_m - \max_i \{C_i\}, \quad i = 1-2, \cdots, N_{imp} \quad (8)$$

Define the force of empire as:

$$P_m = \left| NC_m / \sum_{i=1}^{N_{imp}} NC_i \right| \quad (9)$$

The colonies were randomly allocated to the empires according to the proportion of the empires' forces.

Step 2: Assimilation of colonies

In the real world, the process that imperialist countries promote their own culture and rules to the colonial countries to better control their colonial countries are called assimilation, which is reflected as the process that colonial countries approach to their corresponding empire. Set the distance between the colony and the empire as d, the thriving of colony as, $\beta > 1$, the angle between the movement direction and the ligature of the two as θ, $(-\gamma, \gamma)$. Through a large amount of experiments. The process that colony moves to the empire is shown in Figure 10.

Step 3: Transform the place of the empire and colony

In the process of optimizing the colonies, in case of the objective function value of the colony less than the objective function value of empire, the colony will be upgraded to an empire, the original empire will be relegated to a colony. The subsequent colony will approach to a new empire.

Step 4: Competition between empires

Calculate the total objective function value of the empire m. The total objective function value of the empire is composed of two parts: the target value of the empire itself and the average target value of the colonies it owns.

$$TC_m = C_m + \frac{\varepsilon}{n} \sum_{i=1}^{n} C_i \quad (10)$$

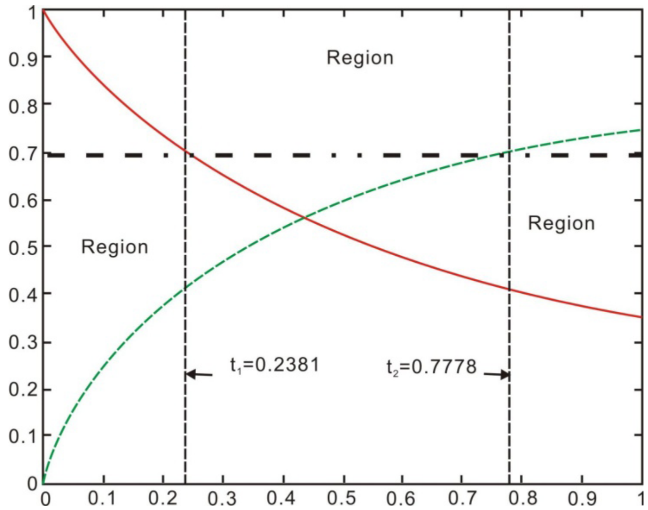

FIGURE 10. R change causes change of loss boundary point and revenue boundary point.

In the above formula: n is the number of colonies, is the objective function value of the colony, and the weight is. Set $\varepsilon = 0.1$.

Calculate the standardized total objective function value of the empire:

$$NTC_m = TC_m - \max_i \{TC_i\}, \quad i = 1, 2, \cdots, N_{imp} \tag{11}$$

Then, the total force of empire m:

$$TP_m = \left| NTC_m / \sum_{i=1}^{N_{imp}} NTC_i \right| \tag{12}$$

Establish reference vector $D = [D_1, D_2, \cdots, D_{imp}] = TP - R = [TP_1 - r_1, TP_2 - r_2, \cdots, TP_{imp} = r_{imp}]$ in which $r_i \sim U(0, 1)$. The largest empire competition D_i in in the vector D was chosen to obtain the weakest colony of the weakest empire.

Due to the rule of competition, it is possible for every empire to occupy the weakest empire's weakest colony in the process of competition, rather than being occupied by the strongest empire, which not only strengthens the local search capability but also effectively avoids local optimum, thus making the algorithm more reasonable (Figure 11).

Step 5: Extinction of empire

After the weaker empires go through empire competition, all the colonies it owns will be occupied by more powerful empires. So, define the empire extinct and eliminate its empire's position. After the empire competition ends, there exists only one empire in the end, and all other colonies are occupied by the empire. Then, the algorithm is over with the output as the optimal solution. Otherwise, return to step 2.

The specific process of using imperial competition algorithm to solve multi-product supply chain revenue model built in the previous section is shown in Figure 12.

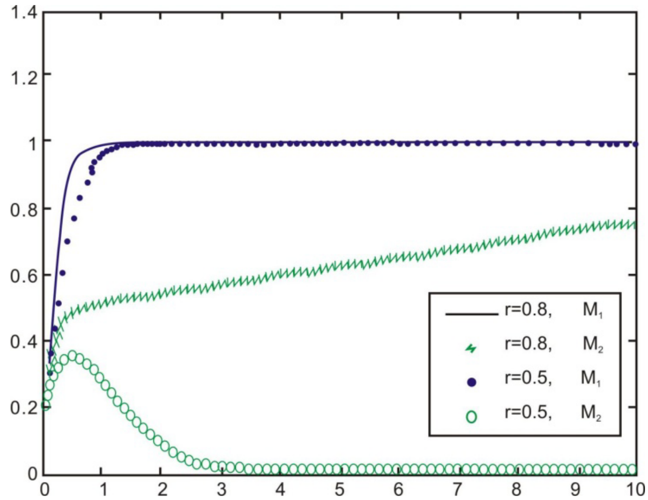

FIGURE 11. Selects cloud platform evolution when r is 0.5 and 0.8.

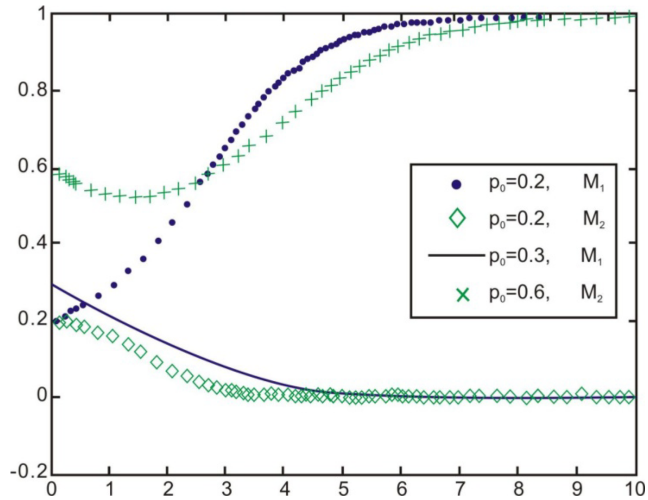

FIGURE 12. Evolution path of two manufacturers choosing cloud manufacturing platform.

B. IMPROVEMENT OF IMPERIAL COMPETITION ALGORITHM

In above process of colony assimilation, the colony moves toward the empire in a random angle θ, $\theta \sim U(-\gamma, \gamma)$. This random angle causes a certain blindness of the movement and reduces the convergence speed. To improve the validity and purposiveness of the movement, a constraint is added to θ: if the previous movement causes the objective function value of the colony to decrease, γ will decrease; if the last movement caused the objective function value to increase, γ will increase. The specific expression is as follows:

$$\gamma_i^{t+1} = \begin{cases} (0.8 + 0.2rand)\gamma_i^t, & C_i^t < C_i^{t-1} \\ \gamma_i^t/(0.5 + 0.5rand), & C_i^t > C_i^{t-1} \end{cases} \tag{13}$$

In above formula: γ_i^{t+1} indicates the angle domain of the t + 1th iteration of colony i, γ_i^t indicates the angle domain of the t-th iteration of colony i, C_i^t indicates the objective function value of the t-th iteration of colony i, and C_i^{t-1} indicates the objective function value of t-1th iteration of colony i.

The above adjustment of the moving angle domain can accelerate effective movement and adjust invalid movement back as soon as possible, thus achieving the purpose of speeding up the convergence. Furthermore, to guarantee the constant high efficiency of movement set $\gamma_i^{t+1} \leq \pi/4$, if beyond the limit, γ_i^{t+1} uses $\pi/4$

IV. EXAMPLE ANALYSIS

A. EXAMPLE BACKGROUND INTRODUCTION

With the aquatic product supply chain in the model of ‘‘agriculture-supermarket jointing’’ composed of an aquatic product manufacturing enterprise and supermarket in Foshan City, Guangdong Province as an example, this paper considers its monthly revenue. The manufacturing enterprise regularly provides aquatic products such as dried fish and scallops to supermarkets. The more product varieties, the larger scale of the enterprise. The market demands of products conform to the elastic demand. Under the influence of the selling price and market input, the price elastic factor $\alpha = 1.2$, the market input elastic factor $\beta = 0.15$. The production cost of aquatic products is generally 10 ∼ 20 yuan. The damage rate of products due to deterioration and damage in the process from production processing and delivery to the supermarket is about 3% ∼ 5%, the unit recall cost is 5 ∼ 10 yuan, the average inventory turnover period of the manufacturing enterprise is 8 days, and the average inventory turnover period of the supermarket is 6 days.

For 3% to 5% loss caused by goods damage, the manufacturing enterprise and supermarket cannot distinguish causes, and hope to strengthen management and improve by introducing Internet of Things technology. The solution is to attach RFID tags to each package of products. Given that the unit price of the RFID tag is 1 yuan, the tag can be recycled and reused, the recovery rate is subject to uniform distribution U(0,1), the maintenance cost of Internet of Things technology unit is 0.2 yuan, the damage rate of damaged products can be reduced to 1% ∼ 2% after using the Internet of Things technology. This improves the reaction capacity of the supply chain, and shortens the average inventory turnover period by 2 days. To introduce the Internet of Things technology platform and facilities, the manufacturing enterprise needs to spend 100,000 yuan, the supermarket needs to spend 50,000 yuan. With 5 years as the depreciation period of the Internet of Things platform and facilities and equipment, converted to every month, the fixed cost of the manufacturing enterprise will increase by 1666.67 yuan, and the fixed cost of supermarket will increase by 833.33 yuan

B. ANALYSIS OF SIMULATION RESULT

The improved imperial competition algorithm was realized by Matlab software, simulation and optimization of the multi-product supply chain revenue model was performed. It is assumed that n takes 1 ∼ 10, and the maximum revenues of the supply chain before and after the introducing the Internet of Things technology were obtained. Set the initial number of countries as 200, the initial number of empires as 8, and the number of simulation iterations as 200.

With n = 5 as an example, the computer simulation results with the optimal solution of the objective function before and after introducing the Internet of Things technology are shown in Figure 13.

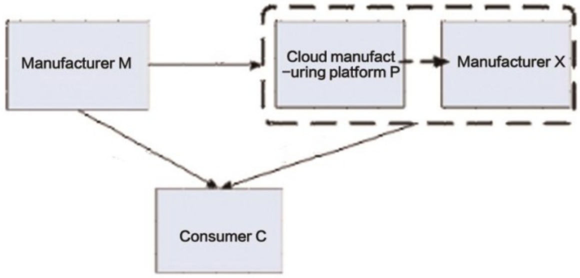

FIGURE 13. Supply chain system diagram based on manufacturing capability sharing.

TABLE 1. Revenues of multi-product supply chain and its changes before and after introducing the internet of things technology.

n	1	2	3	4	5
U_1	21697	43124	64589	85096	105753
U_2	20634	42827	65139	86648	108816
ΔU	-1063	-297	550	1552	3063

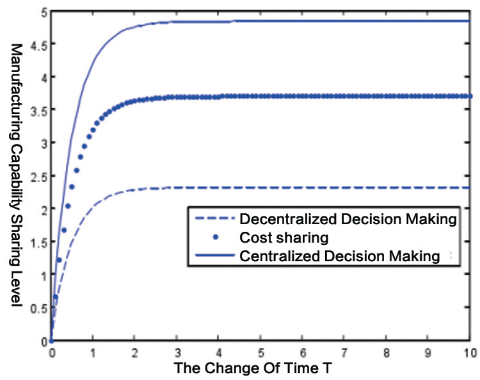

FIGURE 14. Optimal trajectory of manufacturing capability matching in three cases.

To make the simulation results more accurate and reliable, take the average after simulation for 20 times and take round numbers to obtain yuan,. Therefore, the supply chain revenues increase by RMB after introducing the Internet of Things technology. Similarly, the revenues of multi-product supply chain and its changes before and after introducing the Internet of Things technology when n takes 1, 2, . . . , 10 are as shown in Table 1 and Figure 14.

It can be seen from Table 1 and Figure 14: When n takes 1 and 2, the overall revenues of the supply chain reduce after introducing Internet of Things technology. Despite the enterprise's introduction of the Internet of Things technology can realize information real-time monitoring, reduce the damage rate of products, and improve the reaction capacity of the supply chain, the small scale of the enterprise and the small market demand make the effect not obvious. In addition, the excessively high costs of IoT facility introduction lead to the decrease of the overall revenues of the supply chain (Figure 15);

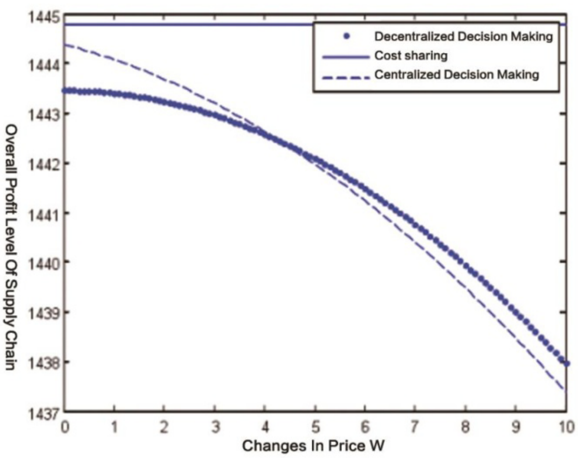

FIGURE 15. Comparison of total profit of supply chain under three scenarios.

When n takes 3, 4, . . . , 10, the overall revenues of the supply chain increase due to the introduction of Internet of Things technology, and it shows an increasing tendency. Because with the expanding market scale, the superiorities of the Internet of Things technology emerge gradually, which promote information sharing among members of the supply chain, reduce the damage rate of products, enhance the supply chain reaction capacity, improve inventory management, and reduce the opportunity cost loss, improve customer satisfaction. The rising overall revenues of the supply chain can embody the promoting role of the Internet of Things technology in supply chain competitiveness (Figure 16);

When n takes 8, 9, 10, the rising speed of overall supply chain revenues slows down because the expanding market scale, enterprise tag cost and maintenance cost are also increasing, which hinders revenue increase. So, enterprises should reasonably apply IoT technology to achieve the utility maximization of IoT technology (Figure 17 -19).

Based on above results and analysis, this paper provides recommendations for introducing IoT technology to improve the competitiveness of the aquatic product supply chain as follows: Optionally use RFID tags in high value-added aquatic products and use barcodes in low value-added aquatic products; Use different IoT technologies in different links of aquatic product supply chain, such as using cheaper bar codes in aquatic product retail to reduce operating costs, and using safer RFID tags in the upstream links of the aquatic product supply chain to increase supply chain information flow speed and transparency; Expand individual application to group application, such as in breed link, regarding a stock of fish of the same category with similar characteristics in a fish pond cage as an IoT application unit.

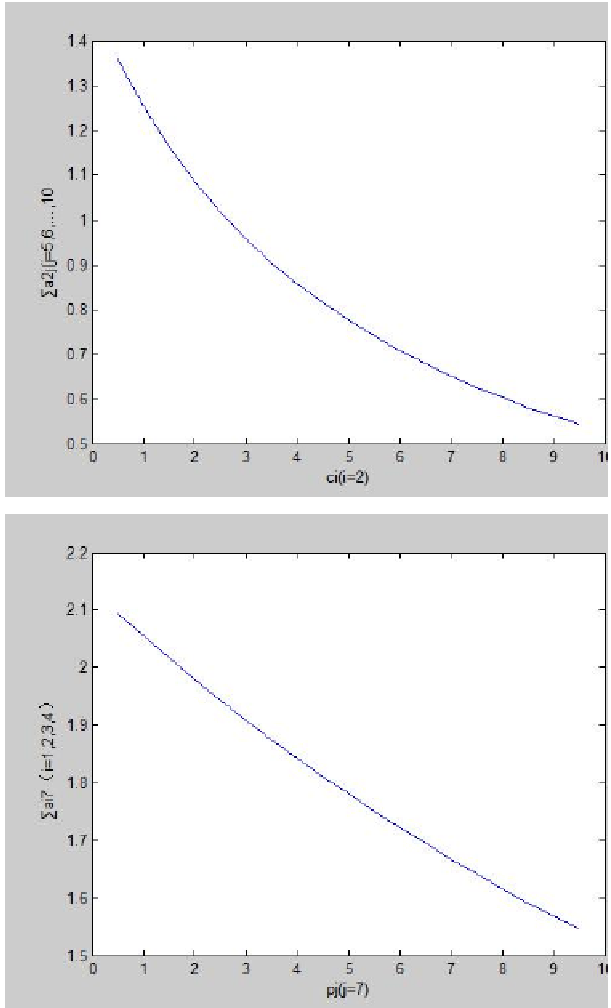

FIGURE 16. Trend chart of parameter change.

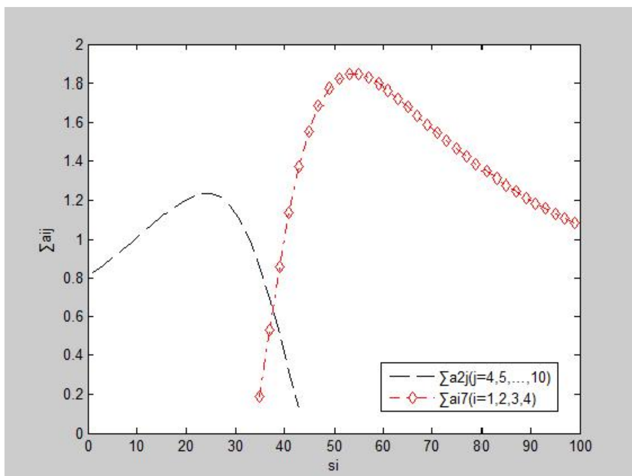

FIGURE 17. Resource supplier and resource demand curve.

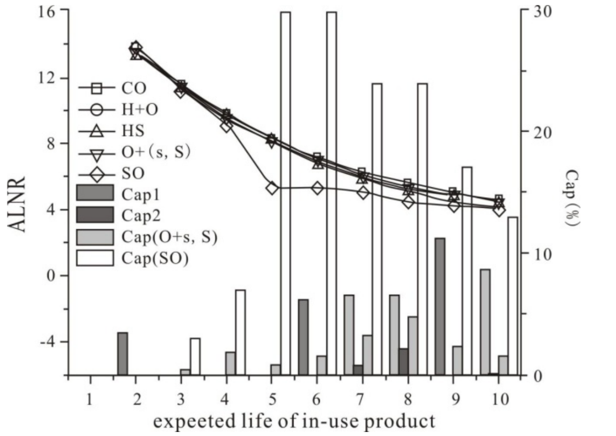

FIGURE 18. Average long-term Net income and deviation of strategies under different recession.

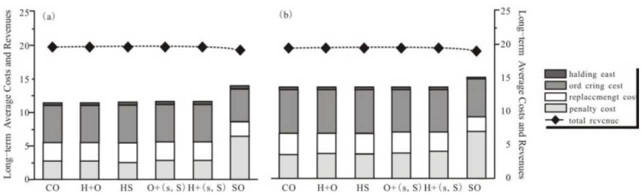

FIGURE 19. The long-term average costs and revenues of different policies.

V. CONCLUSION

Under the elastic demands and conditions of f different market sizes, this paper established a revenue model of two-stage multi-product supply chain, and made quantitative analysis of the impact of Internet of Things technology on multi-product supply chain revenue. This paper introduced Imperialist Competitive Algorithm (ICA) into multi-product supply chain optimization field, and improved the algorithm to further accelerate the convergence speed of the algorithm. By comparing and analyzing the changes of the overall revenues of the multi-product supply chain before and after introducing Internet of Things technology, this paper made quantitative research on the promoting role of the Internet of Things technology in supply chain competitiveness, provided suggestions for the application of the Internet of Things. At present, it is not suitable for small-scale enterprises to introduce IoT technology due to its high costs. In the process of introducing IoT technology, large-scale enterprises should make reasonable use of IoT technology and improve the utility efficiency.

CONFLICT OF INTEREST STATEMENT

The authors declare that they have no financial and personal relationships with other people or organizations that can inappropriately influence the work, and there is no professional or other personal interest of any nature or kind in any product, service and/or company that could be construed as influencing the position presented in, or the review of, the manuscript entitled.

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