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Study on the Optimization of Logistics Procurement Mode in the Background of Supply Chain Internet of Things

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Abstract:
In the traditional logistics procurement model, there are problems such as incomplete information acquisition and information lag. The information between suppliers and purchasers cannot be exchanged in a timely manner, which leads to certain risks and increased costs when both parties formulate strategies. The application of Internet of Things (IoT) technology in supply chain management, through real-time data collection, intelligent processing, and optimized decision-making, significantly enhances the transparency, efficiency, and response speed of the supply chain. It is conducive to promoting internal management innovation and supplier collaborative innovation, reducing the cost of information acquisition and communication with suppliers during the procurement process, and thereby promoting the improvement of total factor productivity. This paper analyzes the problems existing in the logistics procurement model in the traditional environment, compares and analyzes the role and innovation of the procurement model under the background of supply chain IoT, and finally compares and demonstrates the logistics service levels of two companies before and after the optimization of the procurement model under the background of supply chain IoT. The optimization of the procurement model under the background of supply chain IoT can effectively improve the service quality of enterprises, enhance the overall management level, assist enterprises in sharing risks, effectively reduce the inventory costs of enterprises, and effectively strengthen the integration effect of logistics information. Therefore, the research on the optimization of the procurement model under the background of supply chain IoT is very necessary.

Keywords: supply chain management; Internet of Things; procurement model.

INTRODUCTION

The Internet of Things (IoT) technology connects everything through the Internet, achieving efficient information flow and intelligent applications [1]. With the intensification of global market competition and changes in the economic environment, supply chain management, as an important component of an enterprise's core competitiveness, is facing unprecedented challenges and opportunities. The rise of IoT technology, with its unique advantages and innovative potential, has injected new vitality into modern supply chain management. This study aims to explore how IoT technology can optimize the procurement model, enhance its efficiency and intelligence level, in order to create greater value for enterprises and promote industry innovation and development.

THIRD PARTY LOGISTICS PROCUREMENT BASED ON SUPPLY CHAIN

In the supply chain environment, the nature of the third-party logistics has changed. It needs to provide professional logistics services based on the needs of entrusted enterprises to promote the steady development of logistics management. It is a contractual logistics externalization service. Compared with traditional logistics and self-operated logistics, the third-party logistics has more obvious advantages, which can help enterprises effectively improve the overall logistics service quality and enhance their own business competitiveness. At the same time, the emergence of the third-party logistics procurement mode can enable enterprises to strengthen the coordination of supply chain management [2]. It can be seen that in the supply chain environment, the innovation of the third-party logistics procurement model has high feasibility.

DISADVANTAGES OF LOGISTICS PROCUREMENT MODE IN TRADITIONAL ENVIRONMENT

Although the traditional logistics procurement can basically meet the needs of both sides of the supply, but because of its high information closure, it has many disadvantages. To be specific, in the traditional procurement mode, in order to improve its comprehensive benefits and ensure that the selected suppliers have high comprehensive ability and comprehensive quality, the purchasers often intentionally obscure their actual needs, while the suppliers usually do not disclose their own information in order to improve their competitive strength [3]. As a result, the information between the supplier and the purchaser cannot be communicated in a timely manner, which leads to certain risks and increased costs for both sides in the formulation of strategies.

THE ROLE OF THE THIRD-PARTY LOGISTICS PROCUREMENT MODE

First, it can effectively improve the service quality of enterprises. In the procurement work, the work delivered to the third-party logistics, can make the enterprise's logistics organization experience richer, and also can make its own logistics service ability and management ability to form an effective improvement, so as to provide better customers services. For example, there are a large number of products with different specifications in the enterprise, which occupy a high share in the related market. If the enterprise does not cooperate with the third-party logistics in the procurement and distribution stage, but adopts self-distribution, it not only bears higher storage costs, but also generates higher transportation costs, and even causes a certain risk of product overstock and irreparable economic damage [4]. However, if the enterprise can deliver the work to the third-party logistics, then in the collaborative development environment, the third-party logistics can build a more reasonable distribution plan and procurement plan to assist the enterprise to provide customers with high-quality logistics distribution and procurement services, which can not only strengthen the circulation rate of products, but also improve the comprehensive benefits of the enterprise.

Second, it can strengthen the enterprise's focus on the core business management and improve the overall management level. For enterprises, if they want to fully realize the positive value of specialized division of labor, they need to establish stable and professional cooperative relations with third-party institutions. For example, the procurement and distribution of products can be transferred to third-party logistics. Compared with this, for other more professional and core businesses within the enterprise, the enterprise staff will have more energy and time to fully demonstrate the economic value of external resources and solve their own problems [5]. For example, Ford Motor Company has established a stable relationship with a third-party logistics company, entrusting its own logistics business to the other party. In the process of development, enterprises can spare no effort to focus on the design and manufacturing of automotive products, which relieves their own operating pressure in a two-pronged environment, and also improves the operation efficiency of automotive logistics and its comprehensive effect.

Third, it can assist enterprises to share risks. At present, China's economy has entered the environment of rapid development, for enterprises, outsourcing logistics business to other enterprises to form a cooperative relationship, has become the main strategy of its development and operation. The emergence of third-party logistics can make enterprises reduce the development time and sales time of products, and effectively reduce the risk of various products caused by objective factors [6]. With the help of the third-party logistics, enterprises can obtain more market information, so as to timely adjust the development strategy, better respond to the changing needs of the market, subtly mitigate their own risks in the environment, and realize risk sharing, and effectively control economic losses.

Fourthly, it can effectively reduce the inventory cost of enterprises. Inventory cost refers to the sum of ordering cost and storage cost in the complete ordering cycle [7]. Compared with suppliers or manufacturers, the third-party logistics obviously has incomparable professional and information advantages in procurement. In the process of cooperation with the other party, the enterprise does not need to be limited by the scale, but can strengthen the communication with the partner through the third-party logistics. Third party logistics can also utilize supply standards more flexibly during this period, enabling enterprises to adjust inventory plans in time and reduce inventory reserves and costs.

Fifth, it can effectively strengthen the integration of logistics information. The third-party logistics has a certain nature of entrustment and cooperation, and is an enterprise with substantial assets. In the process of its development, it needs to provide cooperative enterprises with transportation services, warehousing services, management services and order consulting services, to help enterprises to steadily improve their core competitiveness. And it also effectively strengthens the efficiency of logistics operation of enterprises, and promote them to reduce logistics costs and realize the pull production of supply chains. It can be said that the emergence of the third-party logistics procurement mode is the inevitable development of the industry, which can effectively provide information support for modern logistics, and ensure the accuracy and timeliness of information [8]. Therefore, in the supply chain environment, enterprises need to pay more attention to this aspect, to speed up the construction of logistics information, to promote the smooth construction of the third-party logistics procurement mode, so as to form a perfect logistics operation mode and strengthen the service efficiency.

THE THIRD-PARTY LOGISTICS PROCUREMENT MODE ANALYSIS IN THE DIGITAL MANAGEMENT OF THE SUPPLY CHAIN.

Third-Party Logistics Procurement Process

Objectively speaking, in the supply chain environment, the third-party logistics procurement mode will be more convenient, and the overall process is not complicated, as shown in the figure1.

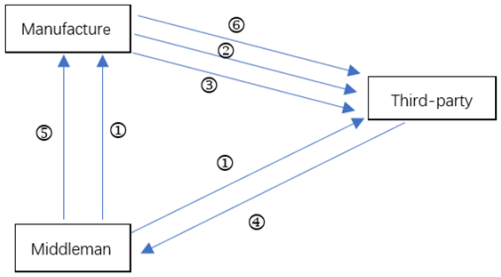

Figure 1. The process of third-party logistics procurement

The numbers represent: ① to the manufacturer and the third party to send a request; ②request services from third parties; ③ receive goods prepared by the manufacturer; ④ provide logistics services; ⑤ allocate funds to manufacturers; ⑥ Pay logistics fees to third parties.

In the supply chain environment, the basic process of the third-party logistics procurement model is as follows: First, as the main body in the market, the middleman generates demand orders through changes in market conditions. In the supply chain environment, it can directly send the order demand to the manufacturer and the third-party logistics company [9]. After the manufacturer receives the order request, the corresponding production order will be generated. And carry out subsequent product production. At the same time, the manufacturer needs to communicate with the third-party logistics company and request the service from the other party. After receiving the information of the middleman and the manufacturer, the third-party logistics company will integrate the requirements of the two. Third party logistics companies will integrate the requirements of both and generate purchase orders. After the preliminary preparation work is completed, each participating entity needs to synchronously advance their own work. The manufacturer needs to generate the Production plan and prepare the goods needed by the middlemen. The third-party logistics needs to generate the procurement plan and prepare to carry out the procurement work, and the middlemen should not stop there, but should actively conduct market research, understand the market sales situation, and timely solve the existing sales problems. After the overall work is finished, the manufacturer needs to deliver the prepared goods to the third-party logistics company. The logistics company needs to provide a full set of logistics services to the middleman, the whole process will involve the transportation, storage and distribution of goods ， after receiving the goods and ensuring that there are no problems, the middleman can store them and pay to the manufacturer, while the manufacturer needs to pay the service fee to the third party logistics company. In this complete process, the supply chain forms a virtuous circle. The rights and interests of the three parties can also be effectively protected [10].

The Innovation of Third Party Logistics Procurement

In the supply chain environment, there has been obvious innovation in the procurement mode of the third-party logistics. Compared with the traditional mode, many problems have been effectively improved, and its own advantages have been fully reflected, including the following aspects.

Innovation of information transmission mode

In the past procurement environment, many manufacturers will not be able to draw up a reasonable logistics plan due to the block of market information. In the past social environment, it is difficult for manufacturers to obtain accurate market information, and there should be objective contradictions between them and middlemen, so they could not understand each other's sales [11]. Vice versa, the middleman will not participate in the product development of the manufacturer, so for the other party's product development, business operations cannot form a comprehensive understanding, the two sides do not know the other party's actual information, under the premise, it is easy to make wrong decisions, such as cause demand exceeds supply, cause the problem of out of stock or a large number of product production and cannot be sold in time, resulting in unsalable products. No matter which of the two problems is produced, it will affect the interests of both sides. In the supply chain environment, similar problems can be effectively solved. The supply chain platform provides the carrier of information sharing for manufacturers, middlemen and third-party logistics companies, so that the three can give timely information feedback, and such information feedback also exists during the ordering process. In order to facilitate the three to adjust the order plan in a timely manner, to ensure that the order and demand can be at the same level, while meeting the market demand, improve the flexibility of enterprise decision-making. In the supply chain environment, the emergence of third-party logistics has effectively

innovated the information transmission mode of suppliers and manufacturers, and their respective resilience has also been effectively improved, and all kinds of risks and losses caused by information distortion can be effectively controlled [12].

Effective control of product quality

In the traditional purchasing environment, the purchasing relationship between the supply and demand parties is not lasting, and usually exists in the form of short-term purchasing behavior. In this case, it is difficult to effectively control the quality of products and the delivery time. In the supply chain environment, the emergence of the third-party logistics procurement mode can provide stable supply support for both the supply and demand parties and the third-party logistics company, so that the three parties can maintain a stable and continuous supply relationship [13]. In this state, the contact between the middleman and the manufacturer will become closer and closer, and even participate in the manufacturer's product research and development, product production and many other links. While obtaining the production information of the manufacturer, more market information can be transmitted to it. At the same time, the manufacturer can also make appropriate adjustments to the production plan through the other party's information, improve the product quality and reduce the cost. In addition, the third-party logistics company has the advantages that the other two do not have, and the modern logistics resources are extremely rich, in the supply chain environment can deliver the product to the middleman in the shortest time, and ensure the quality of the product. It can be said that the emergence of the supply chain environment makes the alliance of the three parties firmer, and the common interests of the three parties can be effectively maintained [14].

Meeting changes in market demand

In the previous procurement mode, due to the blocked information and the existence of many communication barriers, it is difficult for the supply and demand sides to obtain market information and production information in a timely manner. Under this premise, many enterprises will replenish inventory through procurement to avoid the problem of stock shortage. Over time, the overall purpose of work will change, and they will purchase for inventory. The increasingly weak correlation between the overall procurement plan and market demand will inevitably lead to greater development risks for enterprises. However, in the supply chain environment with third-party logistics procurement as the main body, the behavior of procurement activities has changed and become order-driven. In other words, when the user generates order demand, the manufacturer will carry out manufacturing order production. And the manufacturing order gives birth to the purchase order, at this time, the third-party logistics can provide procurement services according to the purchase order, effectively respond to the needs of users, and the supply chain system reduces inventory costs and improves logistics speed [15]. In the supply chain environment, the third-party logistics has an irreplaceable role, which is beyond doubt. If the third-party logistics is missing, the purchase order cannot be formed, and the purchase order actually represents the purchase of goods is no longer a commodity, but a useless backlog. Therefore, it can be said that only the existence of third-party logistics and the delivery of procurement to it can fully meet the dynamic change of market demand and user demand.

The transformation of cost control

Based on the analysis of the development process of the third-party logistics procurement mode, in the past a long period of time, for third-party logistics, many industry enterprises may have a certain degree of one-sidedness, and they believe that the existence of third-party logistics enterprises will divide their own interests. In line with the idea of maintaining economic benefits and keeping the fat from flowing outside the field, many enterprises will not deliver their own purchase orders to third-party logistics enterprises, but will set up corresponding departments internally, or deliver the project work to the staff of other departments. However, objectively speaking, there are more problems in this move. For example, procurement is not a simple exchange of money, which will contain more professional content, such as, a comprehensive market survey should be conducted before the purchase, to analyze the market price fluctuations, to compare the business industry qualifications and so on [16]. In order to meet the relevant work requirements, enterprises will invest a lot of human costs, material costs and economic costs. And the investment of these costs will inevitably affect its own competitive strength and core advantages. Objectively speaking, no matter the cost of investment is large, enterprises are still weak in logistics procurement and cannot compete with professional third-party logistics enterprises. Moreover, it is difficult for enterprises to quickly adapt to market changes in a short period of time, and blindly catering to them will only increase operating costs and pressure. The emergence of supply chain management mode has formed an effective solution to similar problems, and the traditional communication barriers between enterprises in the supply chain environment can be broken. In the whole supply chain platform, manufacturers, middlemen and third-party logistics companies are involved as the main body, forming a perfect virtualization system [12]. Under the effective support of this system, the total procurement cost can be effectively controlled. In simple terms, the annual demand of one product is set as D, the contract order quantity of a product is set as Q, the ordering cost of each order is set as A, the number of deliveries of each

contract is set as N, the comprehensive cost of each shipment and the annual inventory cost of the unit product is set as F and H, under this premise, the following formula [17] is obtained:

$$Q = \sqrt{2ND(A + NF)/H} \quad (1)$$

According to the analysis of this formula, there are relatively many factors that can affect the total cost of procurement. In other words, it is difficult to control the total cost of procurement only by controlling and managing a certain link. Specifically, the following multi-party control can be achieved in the supply chain environment.

First, it is necessary to control the ordering link. In the supply chain environment, each subject can break through the previous barriers of information exchange and realize the circulation and sharing of information through the network platform, so as to predict the annual demand more accurately. In this way, enterprises can reasonably control inventory under the guidance of specific information to avoid inventory waste caused by information distortion. And in the supply chain environment, the third-party logistics can assist enterprises to properly simplify the ordering procedure, reduce unnecessary links, improve the overall efficiency, but also to control the cost of ordering.

Second, it is necessary to control the sending link. Generally speaking, in the supply chain environment, there is a close relationship between manufacturers, middleman and the third-party logistics. The third-party logistics can be regarded as an important hub connecting the two. In addition, manufacturers usually form a separate management system when carrying out logistics transportation. In other words, the goods sent by each manufacturer may enter the same city, and the city cannot provide a special transportation channel for each manufacturer. As a result, a large number of products are transported to the city at the same time, which will inevitably lead to congestion on transportation roads. It will even cause a serious waste of resources. It can be seen that the more common large-scale procurement mode in the past environment is difficult to meet the development requirements formed by the current market and the future market, and with the dynamic change of the national economic situation, the product demand formed by many users has also changed to a certain extent, more and more users will choose small batch procurement [18]. When the contradiction between users and manufacturers becomes more and more intense, the emergence of third-party logistics companies is very important. Third-party logistics can effectively alleviate the conflict between the two, and meet the needs of both sides at the same time. For example, in the supply chain environment, manufacturers can cooperate with third-party logistics, or join third-party logistics alliances. For their own orders, no matter the size, can be delivered to the third-party logistics company through cooperation. For relatively small orders, the third-party logistics company can properly summarize and repackage the products based on the professional perspective, and provide the best route for them, thus reducing the delivery cost [19].

Third, it is necessary to control the inventory link. In the supply chain environment, information can be transmitted synchronously. Under the influence of information synchronization, manufacturers and middleman need to take orders as the core for production or sales. In this way, the work efficiency in the logistics stage will be greatly improved, while the inventory capacity can be effectively reduced. With the effective assistance of third-party logistics, the functions of traditional warehouses have undergone a transformation, shifting from traditional storage to circulation and transit. It can be said that the fundamental purpose of the development of third-party logistics is to reduce inventory, or even the pursuit of zero inventory, effectively reduce inventory costs [20]. In addition, further improvement of the third-party logistics procurement mode under the supply chain environment can also promote the continuous improvement of the logistics service level of the company. In Table 1 and Table 2, it is confirmed by comparing the logistics service level before and after the improvement of the two companies. By improving the third-party logistics procurement mode under the supply chain environment, companies A and B have significantly increased the delivery cost qualification rate, timely delivery rate, account and goods conformity rate, warehouse goods integrity rate and other indicators, and significantly decreased the complaint rate. After the improvement, the Sigma level of each indicator has also significantly improved. The following two tables are the comparison of the logistics service level of the two companies before and after the improvement.

Table 1. Comparison of the logistics service level of Company A before and after the improvement

	Qualification rate before improvement	Qualification rate after improvement	Sigma level before improvement	Sigma level after improvement
Delivery cost qualification rate	90.06%	95.97%	2.8	3.25
Customs declaration cost qualification rate	90.87%	94.60%	2.8	3.125

Delivery quotation timeliness rate	91.87%	96.11%	2.9	3.25
Delivery timeliness rate	87.90%	91.67%	2.7	2.875
Delivery goods completeness rate	99.9797%	99.9854%	5	5.125
Account goods conformity rate	99.9965%	99.99957%	5.4	6
Warehouse goods completeness rate	99.9216%	99.9592%	4.625	4.875
Customs declaration timeliness rate	95.83%	98.34%	3.25	3.625
Container picking timeliness rate	89.04%	97.04%	2.75	3.375
Complaint rate	0.3133%	0.0512%	4.125	4.75

Table 2. Comparison of the logistics service level of Company B before and after the improvement

	Qualification rate before improvement	Qualification rate after improvement	Sigma level before improvement	Sigma level after improvement
Delivery cost qualification rate	88.13%	93.44%	2.7	3
Customs declaration cost qualification rate	91.87%	97.05%	2.875	3.375
Delivery quotation timeliness rate	90.62%	96.82%	2.8	3.375
Delivery timeliness rate	86.49%	90.42%	2.6	2.8
Delivery goods completeness rate	99.9785%	99.9792%	5	5.125
Account goods conformity rate	99.9953%	99.99942%	5.4	6
Warehouse goods completeness rate	99.9138%	99.9616%	4.625	4.875
Customs declaration timeliness rate	96.24%	98.92%	3.3	3.75
Container picking timeliness rate	89.53%	94.67%	2.75	3.125
Complaint rate	0.3742%	0.1045%	4.2	4.625

CONCLUSION

To sum up, the advantages of the third-party logistics procurement mode in the supply chain environment are more obvious, which can assist enterprises to improve their own service quality, strengthen the effectiveness of business management, and also help enterprises to appropriately weaken risks and reduce inventory costs. Therefore, enterprises need to follow the call of the supply chain environment, take the initiative to optimize the third-party logistics procurement process, and innovate the procurement mode. On the one hand, it is necessary to innovate the way of information transmission and strengthen the control

of product quality; On the other hand, we should pay attention to meet the changes in market demand, but also change the cost control method. Enterprises should identify the focus of third-party logistics procurement, concentrate on core business, reduce operating costs, so as to improve operating profits.

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