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Research on the Inventory Decision of Company A

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Abstract: The inventory is the focus of various problems. The inventory is closely related to cost and delivery issues. It is an unavoidable topic in supply chain management: the reasons for inventory also cause cost increases and delivery efficiency decreases. This article takes company A as an example to improve customer service and reduce inventory costs by optimizing its warehouse layout.

Keywords: Inventory Decision, Supply Chain management, Delivery Center.

1. Introduction

Supply chain design is to design and optimize product flow, information flow, and capital flow around products and processes, to reduce the cost of the supply chain and increase the speed of the supply chain. Some strategic decisions in the supply chain, such as self-made or outsourced, self-built channels or franchising, global procurement or local procurement, centralized distribution, or the establishment of a multi-level distribution network, can all be included in the scope of supply chain design. The layout of inventory outlets is aimed at the construction of the logistics system and economic benefits of the enterprise, using the theory of systems and the method of system engineering, comprehensively considering the supply and demand of inventory commodities, transportation conditions, natural environment and other factors, the setting and scale of distribution outlets, the scope of supply, etc. for research and setting.

2. Basic Profile of Company A

Company A is a large-scale daily necessities manufacturer in China, mainly producing skin care products, make-up products, body care products, and hair care products. A has two factories, located in Jiangxi Province and Anhui Province. The factory in Jiangxi Province produces the HC-1, BC-2 and DR-3 models with high sales volume, of which the DR-3 model accounts for 90% of the total production. The Anhui factory produces PC-5 to PC-8 products with lower sales volume.

Two factories of company A provide more than 50 kinds of products to the market, and there are two main sales channels: commercial and industrial (C&I) and consumers. For a long time, C&I has been the focus of the company's business. With the development of society, the emergence of related types of sales centers and discount stores has made the scale of the consumer channel larger and larger, and its position in the overall marketing strategy has become more and more important.

Company A is part of Company P, a conglomerate of companies that manufacture numerous other consumer and industrial products. The various branches of P operate independently of each other and cooperate with the overall strategy of P company in different ways. Company A is a mature company that continuously provides stable income to Company P. While revenue is the primary measure of success for each division, management also takes other important incentives to increase the profitability of the business. The most recent one is to promote inventory reduction activities company-wide. Management believes that reducing inventory and strengthening cash flow is the key to improving the company's overall profitability. For managing Company A, this is a new challenge. In the past, managers were concerned with ensuring that there was enough inventory to meet peak demand as well as some special event demands. Until now, inventory costs have not been carefully monitored, so reducing total inventory levels is a completely new concept.

3. Company A' s Warehousing and Inventory Status

3.1. Area Distribution System

Company A stores finished products in five Regional Distribution Centers (RDC) distributed across the country, and each regional center provides sales services for its entire region. See Figure 1 for RDC and factory location. Company A distributes its products to five regional warehouses, located in Shenyang, Xi'an, Shanghai, Wuhan, and Guangzhou. In the current distribution system, the country is divided into five major markets, and each market has a corresponding regional distribution center RDC (warehouse) responsible for supply. Customers are generally consumers and business enterprises, who order directly from the RDC in the region. This means that, in the current distribution system, each customer is assigned to a single market and orders from only one RDC warehouse. Each factory transports goods to RDC in the form of a complete vehicle, with an average of 35,000 products shipped per vehicle. High-volume shipments allow factories to produce in economical batches. Each factory plans production on a weekly basis to minimize the forecast error that occurs in the monthly planned production and reduce the impact of the error.

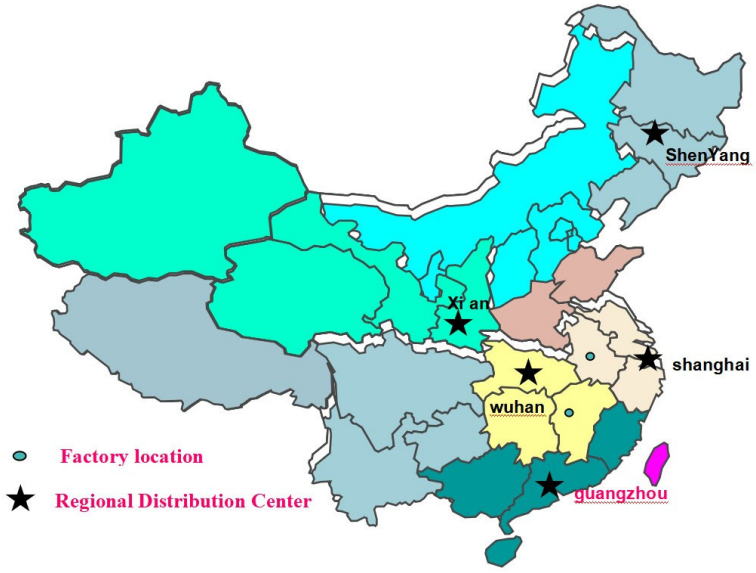

Figure 1. Location of production and distribution center of company A

Each RDC is a hub that supplies the region, and its size is determined by the size of the region's demand. For example, the distribution center in Shanghai supplies eastern China and exports to Europe and North America. Due to the large service scale, the RDC regional center in Shanghai is the largest regional distribution center of Company A. To facilitate control, inventory is generally expressed by the number of unit products. The financial department estimates that the average value of this series of products is 1 yuan, the weekly inventory holding cost rate H=10% (before tax), and the order cost C=654 yuan for an order. After the products are produced, when determining how much goods to allocate to each regional center, the following factors are mainly considered:

(1) Existing customer order quantities that exceed the existing inventory.

(2) The amount by which the RDC's inventory is below the base inventory level.

(3) Forecast sales volume in the RDC service area.

Baseline inventory levels for each product in each RDC are determined based on historical sales levels. The sum of the basic inventory of all RDCs is the product's system inventory target value (Net System Inventory Objective, NSO). NSO is the reorder point where the factory decides the next batch of products. Company A's forecasting system considers the past three years' sales history. Managers adjust forecasts when an anomaly, such as a special promotion, is predicted to be imminent. Generally speaking, the higher the level of forecasting, the higher the accuracy of sales forecasting. For the forecast of the whole market, the accuracy rate is between 90% and 100%. For a certain category of products, the accuracy rate is 70% to 90%. For a certain product prediction, the accuracy rate is 50% to 70%. However, RDC's prediction accuracy for a single product is less than 50%.

The inventory is allocated to each RDC based on regional forecasts and other factors. Due to large forecast errors specific to a certain product, actual sales may be unexpectedly high in one region and low in another. If this happens, then there could be a stock out at one warehouse and excess inventory at another, thus causing a back order for the former, or requiring fulfillment by the warehouse with excess inventory.

3.2. Customer Service Level

Company A measures its operational performance by the ratio of first-time delivery, which it simply refers to as customer service. First-time delivery is defined as the percentage of products that are delivered on time required by the customer to the entire product line. If it is not delivered by the designated source of goods, but delivered by other distribution centers, it cannot be counted as the first delivery. Any reserved orders are not considered for the first time delivery. Table 1 shows the customer service level of Company A in the past 2 years.

Table 1. Percentage of first-time deliveries in each month over the past two years

Year 2020		Year 2021	
January	83.6%	January	78.6%
February	83.4%	February	77.8%
March	87.1%	March	77.9%
April	87.1%	April	79.6%
May	90.3%	May	81.0%
June	91.2%	June	83.0%
July	90.5%	July	84.3%
August	86.4%	August	80.4%
September	81.0%	September	83.5%
October	85.2%	October	84.4%
November	85.1%	November	85.3%
December	84.3%	December	87.2%

Source: Organized by the author

The industry is highly competitive, and customers are demanding more and more from suppliers. One of them is to have a high first-time delivery ratio. Consumer channels expect this rate to be 98 percent or higher, while industrial and commercial enterprises expect 95 percent of shipments to be delivered right the first time. Over the past few years, Company A has been working hard to bring itself up to these requirements. As customers' own ordering policies and inventory policies become more and more complex, they have more requirements for suppliers. Company A is improving service quality and now aims to achieve a service level of 98% or greater across all sales channels, but this requires additional inventory and input to achieve the goal. Table 2 presents the weekly demand data for each regional market in the 12 weeks of the fourth quarter of 2019. Product DR-3 Product DR-3 was ordered by each channel and its service level.

Table 2. Demand data of product DR-3 in the past 12 weeks (unit: piece)

Month	January	February	March	April	May	June
Guangzhou	46370	55013	44683	54528	48492	42230
Wuhan	35026	44630	52364	64001	54265	46598
Shanghai	45897	52134	49865	56987	60321	47968
Xian	54871	49257	39674	46598	39874	49614
Shenyang	58754	49624	48745	61424	46587	50654
			Continued			
Month	July	August	September	October	November	December
Guangzhou	46709	50983	46792	65775	57932	47152
Wuhan	55421	41256	48794	39887	47895	51240
Shanghai	53245	53698	49987	44598	56364	50123
Xian	60254	45874	58842	45691	52147	56148
Shenyang	54781	49631	58745	54297	48751	56324

4. Company A's inventory optimization path

4.1. Company A's Inventory Policy

Each distribution channel has similar demand and inventory requirements, meaning that if weekly demand in one region is higher than the average weekly demand, weekly demand in other regions will also be higher. Many consumers have a ship-or-cancel attitude. If the ordered item does not arrive within the requested time frame, the order will be canceled, resulting in a lost sale. Recently, Company A has noticed a significant increase in competition from competitors and customer pressure to improve service levels and reduce costs. According to the existing distribution system, the warehouse orders from the manufacturing plant, and the manufacturing plant usually takes LT=2 weeks to satisfy the order of any regional warehouse. At present, the level of service provided by Company A to customers is not high, as shown in Table 2. Keeping the total inventory down is a big challenge. To improve service levels and reduce costs, Company A will consider building a large order center (Large Order Center, LOC) based on the original RDCs for national consumers. The LOC will be a new RDC serving all clients. The idea behind LOC is to gather all products in a central warehouse and deliver from this central location. The advantage of this approach is that the customer's ordering pattern is usually very regular, and the inventory quantity ordered by each household is determined at the beginning of the year. The company's top management insists that no matter what delivery strategy is used, the service level must be above CSL=98%.

4.2. Optimization

The original intention of RDC site selection was to set up a regional distribution center in the hubs of major regions of the country. This system has successfully shipped products to customers, but with the passage of time and the intensification of competition, existing inventory insufficient to maintain the level of service requested by customers. Therefore, we can only consolidate the inventory and reduce the number of RDCs, so that the inventory of the new RDC (that is, the aforementioned LOC) is higher than it is now, and the total system inventory is lower than it is now. In addition to changing inventory levels, merging RDCs affects shipping costs and lead times. To make the RDC consolidation more economical, in addition to considering the reduced inventory value, also consider the rising transportation cost. The management personnel of the company investigated the current transportation cost (inward transportation + outward transportation) per unit of DR-3 products, and the results are shown in Table 3. In the current distribution system, inbound transportation refers to the average cost of transporting a unit product from the factory to each RDC warehouse, and outbound transportation refers to the average cost of transporting a unit product from each RDC warehouse to the local market (customer).

Table 3. Transportation cost per unit of DR-3 product (unit: yuan)

RDC (storage)	Inbound Transport	Outbound Transport
Wuhan	0.17	0.25
Xian	0.26	0.35
Shanghai	0.32	0.47
Guangzhou	0.24	0.36
Shenyang	0.34	0.45

Under the centralized distribution strategy, the distribution of products adopts a third-party logistics company with good qualifications, which can ensure that the products reach the central warehouse (LOC) and customers within the specified time. Of course, in this case, The A Company's transportation costs will increase. Therefore, the task of the logistics department of ABC Company is to compare the two distribution systems to see which strategy will have a lower total cost, and to determine which RDC warehouse is more

suitable as the central warehouse LOC. To further compare the logistics operation costs of different systems, the company's survey team also collected some important data - the transportation cost of each RDC to distribute unit products to the region and other regions, that is, to collect the transportation cost of unit products from the existing RDC warehouse to other regions The average cost of the regional market. The specific data are shown in Table 4.

Table 4. Transportation Cost per unit product (unit: yuan)

RDC	Wuhan	Xian	Shanghai	Guangzhou	Shenyang
Wuhan	0.13	0.26	0.35	0.34	0.27
Xian	0.25	0.36	0.28	0.45	0.47
Shanghai	0.54	0.35	0.57	0.61	0.64
Guangzhou	0.65	0.46	0.54	0.47	0.58
Shenyang	0.15	0.39	0.28	0.39	0.24

5. Summary

Based on the analysis of the recent demand data of the DR-3 model product that accounts for the largest sales volume, the annual total cost and average inventory level under the two inventory strategies are compared. The specific calculation process is shown in Appendix 1. In the existing RDC distribution system, the current inventory held is not enough to maintain the basic service level, and its total annual cost is the as high as 9,308,908 yuan, and the total average inventory is also 153,715 yuan. Reduce your company's total inventory costs while improving customer service levels. Another method is to consolidate the inventory, reduce the number of RDCs, and implement a centralized distribution strategy. Although the transportation cost has increased, the total system inventory cost is lower than the existing distribution system, the only 6,183,548 yuan. Simultaneously, through the calculation of transportation costs in various regions, it was finally determined that Wuhan RDC is more suitable as the central warehouse LOC.

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