Transformation of Operations Management through Information Technology and Information System in Suning *

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Abstract Information technology and information system today play major roles in companies who are competitive in the global market. In this paper, we will study how Suning Appliance Chain changes her operations by using information technology and information system. Suning’s Strategy, operations structure, especially her logistics system are discussed firstly; how information technology and information system support her operation and logistics to gain competitive capabilities are further discussed. Finally, the operation system transformation through IT/IS in Suning is studied by the use of a stochastic inventory model.

Key words operations management; logistics; distribution system; reenginnering, information technology; information system

In 1990, Suning was founded and did her business of selling Air-conditioner by using about 10 working staff and around 100 thousand capitals in Nanjing, China. As a small company, she faced competition from many big companies. 10 years later, Suning has become one of the largest chain retailers in electronic appliances in China: the number of her suppliers now grow up to over 300 manufactures; her business region expands to almost all the country with more than 200 chain stores, and with RMB 10 billion annual sales, etc. The fast growth makes Suning a famous company in China, and she is awarded one of the Top Ten Companies, and one of the most attractive companies, etc. Now many scholars and businesses ask the same question: What accounts for Suning’s remarkable success? Through our study in Suning, we find that it is almost the same as Wal-Mart’s success: transforming its key business processes for competitiveness through adopting the information technology and information system[1,2].

1 Operation System in Suning

As we have known that operation is playing a key role in doing business in the retail industry. As in Wal-Mart, and 7-seneven, the main function of Suning’s operation system is to make those products required by customers available when and where through its supply chain. However, what is different from Wal-Mart and 7-eleven is that Suning’s final operation happens in customers’ home, not in her chain store, so Suning needs to deliver and install customers’ products.

Based on the business characteristics, Suning’s Operation System includes a network of Chain Stores, Distribution Centers, After-sale Service Department, Customer Complaint Department, Marketing Department, Transportation Department, Operation Planning Department, Information System Department, etc. Those departments are described in Fig.1. Marketing Department is responsible for advertising, market information collection, etc; Chain Stores are the main interface between Suning and her customers, i.e., introducing customers the products information, and selling products to customers, etc; Distribution Centers stock those products purchased from suppliers; Operation Planning Department makes the sales plan, and replenishment plan for the Distribution Center, and negotiate with the suppliers, etc; Transportation

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Department delivers products from suppliers to Distribution Center, to all the chain stores and customers, etc; the Customer Service Department installs and repairs those sold products for customers, etc; Customer Complaint Department is responsible for surveying customers satisfaction, and answering customers’ complaints. All those activities are done based on the information system, which is managed by Information Department.

There are three kinds of important replenishment operations in Suning’s Operation System, the first is replenishing products to the distribution center from suppliers, the second is replenishing product to chain stores from the distribution center, the third is replenishing products to customers’ home from chain stores. At the same time, there are three kinds of transportation operations, the first is outsourced to the third party logistics company to transport products from suppliers’ warehouse to Suning’s distribution center, the second and the third mainly depend on Suning’s Transportation Department to transport her products to chain stores and to customers’ home.

The third kind of transportation operation is in the last stage, and the most important stage, in Suning’s supply chain. In the appliance retail industry, the customer service is mainly represented by this last stage operation, which is a very complex task with characteristics of multiple types of items, small lot size, high delivery frequency, and uncertain demand, etc. Because of high demand variability, Suning does not have available transportation capacity herself in short peak demand period, so she will hire certain transportation capacity from some transportation company to guarantee her commitment to her customers.

After several years’ efforts on building the operation system, Suning has 1 central distribution center, and 18 regional distribution centers, which cover 11 provinces in China. The regional distribution centers cover all the cities around 300km distance, and the lead time for those chain stores is 12 h for distance transportation, those customers whose homes are within 80~100 km can get their products in 12 h, even in at most 3 h if customers buy it for the emergent use.

2 Information System and its Influence in Suning

To promote high customer service level, high inventory tunes and low inventory level in Suning’s supply chain, information technology and information system play the key role for information sharing. In the middle 1990s, Suning began to invest money in the information technology and information system. In 2000, an advanced enterprise system which costs almost RMB 20 million is applied successfully to support her operation system.

There are eight sub-systems in Suning’s enterprise system now, such as distribution management information system, delivery management information system, after service management information system, on-line order management information system, office automation system, customer relation management information system, supplier management information system, and video conference system.

There are two main modulus in the delivery management information system, which are
transportation management modular and warehouse management modular. In the transportation management modular, there are two sub-moduli, which include customer information sub-modular, and transportation management sub-modular. The customer information management sub-modular deals with the basic information about the requirement, and implementation of products delivery and installation for customers; the delivery management sub-modular deals with transportation dispatching, cash collecting, checking bill of lading, etc. The warehouse management modular deals with products receiving management, product consignment management, and products stock management.

Based on this advanced information system, many business data such as sales, inventory, customer requirement, can be easily stocked, processed, analyzed, transported in real time, which makes it possible not only to make effective decision on how much to replenish from her suppliers, but also to integrate her suppliers, distribution system, chain stores etc an integrated chain, and control the information flow, material flow, and cash flow in the chain effectively. Through her intranet, Suning can manage her procurement, warehouse, sales, distribution, transportation, installation, repair, customer service, and office real time integratedly; through Internet, Suning can place electrical order to her suppliers effectively. What is more, the operation system is reengineered after using this advanced information system.

![Fig.2 The traditional operation system](image)

In traditional operation system (see Fig.2), products are delivered to every chain store where inventory is held for her customers from distribution center, products the customers bought in the chain stores are then delivered to them. But the information flow flows in the contrary direction, from customers to the chain stores, then to the distribution center. In such operation model, it always happens that there are large backorders in some chain stores and at the same time there are large inventories at other chain stores in the same region.

![Fig.3 The existing operation system](image)

After using the advanced information technology and information system, the traditional operation system is changed into the existing operation system as shown in Fig.3. In the new system, there is only one item for every product in every chain store, i.e., there is no inventory in chain store. When customer buys the right product, the clerk in the chain store will input all the information about the customer, the product, which will be stored in the enterprise system, by which the staff in other departments, such as transportation, customer service, will have those kinds of information in distribution center, who will make a good plan for the product delivery and installation to customers. There are several benefits from reengineering the operation system for Suning by adopting such advanced information system as follows\cite{3,4}:

1) Less investment on the inventory and higher fill rate. In the existing operation system, products for every chain store are pooling in the distribution. From risk pooling theory, it will decrease the chance that there are a large number of unsold products in one chain store and a large number of backorders in other chain stores in the same city at the same time. That means the average service level such as product fill rate to customer demand can be improved, and the average inventory in Suning’s operation system will be decreased, and the investment on product inventory will be decreased.

2) Better product availability. In traditional operation system, product availability often depends on the ability of Suning to predict every chain store’s demands. Random demand fluctuations often result in...
missed sales. However, in the new operation system, the product availability depends on the accuracy of demand forecasting for all the chain stores. Based on the second forecasting rule, the accuracy of demand forecasting for all chain stores is higher than that on the accuracy of demand forecasting for every chain store. So the new operation system by adopting the advanced enterprise system will have higher product availability than the old one.

3) Shorter customer response time. In the traditional system without information system, the replenishment order, and the shipment order were played in manual way, which takes a lot of man power and trucks, so it takes lots of time for chain stores to replenish products from local distribution center, and for customers from chain stores. Now, all orders are transmitted through this information system, the order transmit time decreases from several hours to several seconds, which makes Suning have higher probability to realize her commitment for customers, that is, the products required by customers will be shipped to customers’ home in 12 h.

4) More effective management of the inventory in the total operation system. By using advanced information technology and communication technology, all information systems in Suning’s different regional areas are integrated, which makes Suning possible to monitor the inventory state in different distribution centers, and the sales in every chain store in real time. Based on such information, the operation planning department will make a better inventory replenishment plan for each regional distribution center.

5) More effective scheduling. Based data in the information system on the customer requirement, transportation capacity, etc, a decision support system is developed to make planning on the truck routing, dispatching of transporting labor, and installation labor, in an optimized way.

6) Lower costs due to economies of scale. The transportation from distribution center can handle much larger quantities of products than those from the chain store. As a result, significant savings will accrue on product handling and warehousing.

7) Less transportation costs: In the traditional operation system, Suning has to first deliver goods from the wholesaler, and then ship them to the customers. However, there are only small batches in the shipment from chain store to customers with high frequency. In the new operation system, Suning ships her products from the distribution center to the customers’ home directly with full truck, which might be helpful to exploit economies of scale by achieving reduced shipping and handling costs.

3 A Simple Model for Suning’s Operations Transformation

In this section, we study the performance improvement of Suning’s Operation System transformation by adopting the advanced information system based on Chen et al’s supply chain model.

The average total cost of echelon inventory in long term proved by Chen et al. is [5-7]

\[
C_2 = \frac{\mu K_2}{Q_2} + \frac{\mu K_1}{Q_1} + h_1 E[I_{L_2}(t + L_2)] + h_1 E[I_{L_1}(t + L_1)] + (p + H_4) E[B(t + L_1 + L_2)]
\]

also \( h_2 = H_2 \), \( h_1 = H_1 - H_2 \), so the formula can be rewritten as

\[
C_2 = \frac{\mu K_2}{Q_2} + \frac{\mu K_1}{Q_1} + H_1 E[I_{L_2}(t + L_2)] + (H_1 - H_2) E[I_{L_1}(t + L_1 + L_2)] + (p + H_4) E[B(t + L_1 + L_2)]
\]

(1)

after innovation, only distribution center is kept, so the correspond average total cost in long term is

\[
C_1 = \frac{\mu K_2}{Q_2} + H_2 E[I_{L_2}(t + L_2)] + (p + H_2) E[B(t + L_2)]
\]

(2)

In traditional pattern, the echelon inventory policy is \((R_2, nQ_2)\) in distribution centers, and the one in retail store is \((R_1, nQ_1)\), the total average cost formula is Eq.(1). After pattern innovation, suppose the echelon inventory in distribution centers is \((R, nQ)\), its total average cost in long term is Eq.(2), and we will
analyze their effects on the supply chain performance under the same service level.

\[ VC = C_r - C_g \] is the performance improvement caused by the operation’s transformation, so we have

\[ VC = \frac{H}{Q} + H_d E[I(t+L_1)] - H_o E[I(t+L_2)] + (H_1 - H_2) E[L(t+L_1) + L_2] + (H_1 - H_2) E[B(t+L_1 + L_2)] \]

Like Chen et al. (1998), we usually cannot get the exact formula of the decision variables in optimal form, and only calculate the value of these decision variables by some iteration formula. The method to check the movement of \( VC \) is done by numerical calculation, and the process is too complex and there is not a certain algorithm. In this paper, we suppose the demand in every period is comparatively stabilized, so we only analyze the problems in EOQ policy.

First, we make sure of the relationship of parameters of inventory policies in two patterns. From EOQ, suppose we can find that the demand per period is \( \mu \), and their distribution functions are the same, so average demand per period is \( \mu \), the economic order quantity is: \( Q = \sqrt{2K_2 \mu / H_2} \). In the new pattern, the EOQ, according to distribution center, is \( Q = \sqrt{2K_2 \mu / H_2} \), and accounting to the inventory policy in the distribution center, the average demand per period is also \( \mu \), so the economic order quantity is \( Q_2 = \sqrt{2K_2 \mu / H_2} \). And we get \( Q = Q_2 \). In the new operation system, the policy \( (R_2, n_Q_2) \) is to meet the demand from customers in a certain service level in lead time \( L = L_2 \). But in tradition, the policy \( (R, n_Q) \) is to meet the demand from customers in the same service level in lead time \( L = L_2 + L_1 \). From the definition, we know that \( L_2 \) means lead time from the supplier to the distribution center and \( L_1 \) means lead time from the distribution center to the retail store. Usually, the distribution center and the retail store are in the same city and are close to each other, so \( L_2 \) is greatly more than \( L_1 \). Also we consider \( R \) is probably equal to \( R_2 \), i.e. \( R = R_2 \). In the stabilized state, \( IP(t) \) and \( IP_2(t) \) are uniformly distributed in \{ \( R_2 + 1 \), \( R_2 + Q_2 \) \} \([6]\). So

\[ E[IP(t)] = R_2 + (1 + Q_2)/2 = E[IP_2(t)] \] (3)

From Eqs. (1) and (2), we have

\[ VC = \frac{\mu K_1}{Q_1} + (H_1 - H_2) E[I(t+L_1 + L_2)] + E[B(t+L_1 + L_2)] \]

(4)

From the definition, \( B(t+L_1 + L_2) \) means negative part of \( I(t+L_1 + L_2) \). So \( B(t+L_1 + L_2) = (I(t+L_1 + L_2))^+ \);

When \( IL(t+L_2 + L_1) \geq 0 \), \( B(t+L_1 + L_2) = 0 \), and \( VC = \mu K_1/Q_1 + (H_1 - H_2) E[I(t+L_2 + L_1)] > 0 \), and when \( IL(t+L_2 + L_1) < 0 \), \( IL(t+L_2 + L_1) < 0 \), so

\[ VC = \frac{\mu K_1}{Q_1} > 0 \]

which means that the cost is decreased at the same service level after adopting the advanced information system and transforming the operation system. From Eq. (4), the extent of decreasing cost is related to demand scale \( \mu \), order batch in retail store \( Q_1 \), holding cost in distribution center and retail store \( H_2 \), \( H_1 \), average inventory level \( E[I(t+L_2 + L_1)] \), backorder \( E[B(t+L_1 + L_2)] \).

4 Summary and Conclusion

In this paper, we have studied how the information technology and information system change the operation system, and the performance improvement of the business transformation through the adoption of the information technology and information system in Suning., one of the largest appliance chain stores in China. We can see that the business operation is not only changed in the existing system, but also changed into new system in a innovation way after the adoption of the advanced information system, and the performance is dramatically improved in the area such as investment on the inventory, product availability, the customer response time, the management and the scheduling in the total operation system, and operating cost, etc. That is one reason why Suning can be one of the most successful companies in China.
References


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