A Study on Warehouse Management in Distribution Centers - Taking Company X as an Example

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Abstract: With the continuous development of technology in the logistics industry, big companies are gradually pushing forward the construction of modern intelligent supply chain system, and the planning and development of distribution centers is an important part of advancing the construction of modern intelligent supply chain system. Company X has typical business pain points, for example, the existing personnel and storage equipment can not quickly respond to the inbound and outbound business needs since the rapid increase in business volume,and the existing warehouse is not large enough to meet the storage needs due to the increase in backlog. In the face of technological innovation and business pressure, the distribution centers of Company X is therefore carrying out intelligent construction of warehouses to realize the digital transformation of warehousing business. This thesis takes the distribution centers of company X as the research subjects, starting from warehouse management system and warehouse space. Through various methods such as interview research method, literature research method and qualitative/quantitative analysis method, the current problems are analyzed and optimization solutions are proposed. It can effectively enhance the material storage capacity of Company X's distribution centers and increase the turnover rate, thus improving the material supply capacity.

1. Literature Review on Warehouse Management

In this paper, we study the current situation from two aspects, that is warehouse management system and warehouse haul.

1.1 Current Research of Warehouse Management Systems

At present, the warehouse management system is at the steady development stage in China, and the high-end enterprises and the middle and low-end enterprises show a clear trend of polarization, those tend to adopt the mainstream brands that are basically mature abroad and the domestic self-developed brands respectively. Analyzed from the viewpoint of application, the existing warehouse management systems can be divided into the following four categories [1].

1) Warehouse management system based on business of distribution centers. Mainly exists with the manufacturing industry and other supply chain management, is the most common, common warehouse management management system, providing basic data management, inbound management, order management, inventory management, picking management and other basic functions, providing information technology means to assist distribution center operations.

(2) Warehouse management system based on the warehouse operation center. Warehouse management system as a warehouse operation center, with different automated equipment in the warehouse for operational interface, the formation of automated or semi-automated assembly line operations. At this time, the warehouse management system as a warehouse operations center, its main role for the issuance of operational instructions, to achieve the docking flow of operational data.

(3) Warehouse management system based on the e-commerce management center. Warehouse management system extended to warehouse and distribution integration system, so that the e-commerce industry warehouse management, logistics and distribution to reach information flow through, in order to facilitate unified scheduling. Warehouse management system and distribution system closely together to achieve is the unified management of physical flow and logistics.

4) Warehouse management system based on the management decision center. Mainly for the provision of flexible billing system, accounting system and customer management system, in order to provide information support for management decision-making.

1.2 Current Research of Warehouse Haul

Warehouse goods allocation optimization is used to assign the most suitable storage location for each material. The rule making of goods allocation optimization, such as the law of relevant demand, the principle of homogeneity, the principle of complementarity, etc., It helps to plan the optimal storage position in the existing warehouse space. In the premise of achieving the most reasonable storage location, the appropriate picking path to improve the overall efficiency of warehouse access is considered synchronously. Storage space optimization can be an independent set of software, but also it can be combined in the warehouse management system.

(1) Integration optimization software of storage space and warehouse management system. Foreign ManXattan Associates Slot Info software contains cargo level optimization (Slotting Optimization) module, mainly from the balance of the work to take the workload dimension to optimize the cargo level. Domestic independent research and development, such as Haier materials LES (Logistics Execution System), mainly with ERP for information interface, from the inventory dimension, real-time monitoring of the warehouse inventory status [2].

(2) The goods allocation optimization software is separated from the warehouse management system. Foreign EasyProfiler, a software designed specifically for small and medium-sized warehouses, is a software for locating goods based on click input and visual layout diagrams of cargo levels.

2. Problems of Warehouse Management

2.1 Warehouse Management System Issues

Through two weeks of field research in X Company's distribution center, we interviewed the warehouse team leader, warehouse manager and auxiliary workers in X Company's distribution center, and took some system data to compare and analyze with the actual material storage situation in the warehouse.

The warehousing team leader introduced the overall warehouse access business process. Through the business observation of Company X's distribution center, it was found that in the access business, there is a common situation that more than one person works together to complete the access operation. By combing the warehouse operation process, it is found that the fundamental problem is the existence of multiple systems in the distribution center of company X, ERP system, warehouse management system, warehouse control system, the failure of these three systems to complete the connection of information flow, resulting in the flow of information and physical flow in the flow process is not synergistic, low integration of hardware and software leads to the duplication of personnel synergy links.

Through the information provided by X distribution center, after finishing the analysis, it can be found that based on the warehouse layout of different distribution centers, the current situation of stored materials, storage equipment, X distribution center has realistic problems that are different from other distribution centers, including the problem of warehouse volume, business specificity, the type of stored materials, so X distribution center is not applicable to the general strategy, the existing storage strategy is unreasonable, it is necessary to develop X Company X's distribution center needs to develop personalized strategies.

Through the study of inventory data of warehouse management system and actual inventory storage data, it is found that the storage location of Company X distribution center is unreasonable, basically distributed in outdoor yard area, and a small amount of materials are on automated three-dimensional shelves, which leads to low utilization rate of automated three-dimensional shelves.

Based on the above research, data analysis and field observation, it can be concluded that there are three major problems in Company X's distribution center: unreasonable distribution of goods space, unreasonable storage strategy and low integration of software and hardware.

2.2 Storage Space Issues

Through the observation and study of the daily operation of the distribution center of Company X and the analysis of the historical inlet and outlet data, the distribution center of Company X has a low utilization rate of the automated equipment and cannot bring the maximum efficiency of the automated equipment into play, which is mainly reflected in the following two aspects.

1)Concentrated stacking in outdoor area

The storage personnel in the distribution center of Company X have not changed the traditional storage concept and have certain resistance to the automation equipment. The outdoor yard area is sufficient to load the daily throughput of the distribution center. Therefore, suppliers deliver to the warehouse and store directly in the outdoor yard area; when receiving or distributing out of the warehouse, they pull goods directly from the outdoor yard area. A few materials, due to the low turnover rate, the warehouse staff choose to place in the indoor automation area. The outdoor yard area of the warehouse management system adopts the management of large cargo space, and the

same cargo space is used for inlet and outlet distribution, so as to reduce the workload of system operation.

It can be seen that the management mode of Company X's distribution center still favors the traditional mode, and the warehouse management system is only a simple bookkeeping system. The indoor automation area evolved into storing stagnant materials or visiting use, deviating from the initial construction goal.

2) Uneven distribution of aisles

After the research can be found, the indoor automation area mostly stores materials with low turnover rate. When the storage personnel make the automated shelf designation, they do not adopt a suitable space allocation strategy, resulting in the materials being stored on one side of the aisle, which makes the stacker crane handling time long and the automated shelf has a certain degree of insecurity. When leaving the warehouse, the warehouse personnel adopt the system default FIFO strategy [3], but due to the unreasonable allocation of inbound cargo space, which leads to a long time for the material leaving the warehouse operation. At the same time, due to the low frequency of incoming and outgoing materials stored in the automated storage area, the problem of long incoming and outgoing time caused by this phenomenon becomes the bottleneck problem of X's distribution center.

3. Optimization Measures of Warehouse Management

The warehousing business of Company X distribution center can be summarized into two aspects: inbound business and outbound business, which are closely related to the horizontal department and are affected by many factors, greatly affecting the overall efficiency of its warehousing, so we conduct relevant optimization analysis from these two aspects, including the inbound management mode and outbound management mode of Company X distribution center.

3.1 Optimization Principles

The above-mentioned chapter mentions that the distribution center of Company X has a certain degree of information construction and introduces automated equipment, but through the analysis of its management status, the distribution center of Company X has problems such as unreasonable allocation of cargo space, unreasonable storage strategy, and low integration of warehousing software and hardware, so in general, the distribution center of Company X has the following aspects that can be optimized in terms of warehousing management to optimize the inlet and outlet efficiency and improve the management value of the distribution center of Company X [4].

(1) Optimize the storage space and coordinate the outdoor area and indoor automation area

Therefore, we can analyze the turnover rate of the stored materials in the distribution center of company X, adopt ABC analysis method, divide its important level, combine the space layout and storage capacity of outdoor yard and indoor automation, and propose a reasonable synergistic plan.

(2) Optimize the storage operation process and integrate the informationization of Company X's distribution center

The informationization of Company X's distribution center is semi-silo, and the separate operation of warehouse management system and warehouse control system leads to cumbersome operation process. Therefore, we will combine the actual business scenario and personnel division of Company X's distribution center, re-plan the warehouse operation process, connect the warehouse management system and warehouse control system, clarify the positioning of each system, and complete the distribution center operation in cooperation.

(3) Optimize warehousing access strategies and allocate reasonable storage space

From the perspective of cargo space optimization in X's distribution center, we make a comprehensive consideration, combine the storage space planning, design the inbound (storage) optimization scheme, and allocate the materials to the appropriate cargo space to improve the warehouse space utilization and handling cost [5]; by considering the batch combination of orders and the reasonableness of cargo space placement [6], we design the outbound strategy optimization scheme to play the maximum utility of information technology and improve the distribution outbound timeliness [7]. Effective cargo space planning can improve the overall operational value and core competitiveness of the warehouse [8].

3.2 Optimization of Material Entry

By analyzing the inbound process of the original distribution center of Company X, we found that one physical flow corresponds to two information flows, which leads to the increase of personnel operation cost. Therefore, through the optimization design of the inbound process of Company X's distribution center, the physical flow and information flow are integrated and the inbound process of Company X's distribution center is re-planned. On the basis of this, on the one hand, we analyze the rationality of stored materials and classify their importance level by combining the demand of Company X's distribution center in the past years through ABC analysis method. On the other hand, we follow the principle of priority of outbound efficiency, and carry out inbound priority planning for light and heavy shelves. Based on the importance level of materials and storage priority analysis, different storage solutions are planned for different materials in Company X's distribution center, and the storage optimization process is combined to guide the storage operations in Company X's distribution center.

3.3 Optimization of Material Releasing

Based on the two business scenarios of active material collection and on-demand distribution in Company X's distribution center, the outbound process is re-planned to integrate the outbound information flow in Company X's distribution center and optimize the outbound operation process. At the same time, on this basis, consider the ability to improve the efficiency of warehousing operation by referring to the combined order picking out of Company X's distribution center. Therefore, intelligent wave rules are designed in the WMS system based on demand factors. In the wave order combining rules, the basic principle of material overlap is used to make the combining results meet the actual business requirements. Based on the above analysis and rules, design the outbound strategy optimization plan for X company's distribution center.

4. Conclusion

This thesis mainly focuses on the distribution centers of Company X. Through a combination of interview and research method, literature research method, qualitative/quantitative analysis method and so on, we analyze and study the warehouse management problems of the distribution centers of Company X at multiple levels. Integrated with the current situation of equipment and operation of Company X's distribution center, the problems of Company X's distribution centers can be shown: storage management system problems and storage space problems. Therefore, storage optimization solutions that is suitable to the distribution centers of Company X has been proposed from the aspects of process optimization and cargo space optimization in this thesis both the inbound and

outbound. From the above analysis and argumentation, it can be seen that the warehouse management optimization solution of Company X distribution center reduce distribution center operation cost, improve storage capacity and response efficiency under the premise of ensuring supply.

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