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The study of improvement of warehouse operations of Panalpina company

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The study of improvement of warehouse operations of Panalpina company

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Declaration

I certify that all the material in this research paper that is not my own work has been identified, and that no materials are included for which a degree has previously been conferred on me.

The contents of this research paper reflect my own personal views, and are not necessarily endorsed by the University.

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Abstract

Warehouse is the most important part of the operational efficiency of its storage business is directly related to profit levels. Trying to reduce production costs , maintaining efficient operation and improve the utilization position is one of the main objectives of storage management, operational efficiency storage will also affect the level of those operational decisions.

In this paper, it introduces some warehouse in Yang Shan FTP, including space layout, facilities and equipment, warehousing processes, warehouse management system of the warehouse. It demonstrates problems as fellows: warehouse does not achieve maximum cargo space, labor efficiency to be improved, warehousing processes are incomplete, and the warehouse management system function can’t meet the higher customer service requests.

Application of ABC analysis, customization, and theory of storage strategies, this paper proposes to change the layout of distribution center space ,and improve storage facilities and equipment, and optimize warehousing processes ,and the develop new features for warehouse management system. Implementation of the optimal schemes, the efficiency is raised and the cost is reduced, it not only solves practical problems of the warehouse, but also provides some measure to make full use of limited source..

In addition, domestic logistic enterprises can study the effective warehousing management of DHL so as to improve their warehousing management.

Key words: Supply Chain, Warehousing Management, Optimization

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Chapter 1.Introduction

1.1 Research background

With thirty years of reform and opening up, China's economic has developed rapidly, international business have become frequency, a large number of small varieties circulation pattern is unable to meet the diversification of products in development, some commercial enterprises and manufacturing enterprises have the need of logistics, in order to reduce costs, increase customer satisfaction and service levels. However, efficient and reasonable storage management can help manufacturers to accelerate the speed of the flow of goods, reduce costs, protect the production carried out smoothly, and also can achieve effective control and management of resources.

Modern "warehousing" is not "warehouse" or "warehouse management" in the traditional sense, but in the context of economic globalization and supply chain integration, warehousing, storage in the modern logistics system, which means that an activity or a process, is to meet the needs of upstream and downstream in the supply chain for the purpose of the use of modern technology on the items out of place in a specific, tangible or intangible, inventory, sorting, packaging, distribution and its information for effective planning, execution and control logistics activities.

Precisely because of the important role of the warehouse, so the study of contemporary logistics including how to solve the problems in the modern warehouse, improve storage management efficiency, reduce its cost has become very important.

1.2 Objectives of the Study

There are many factors affecting the efficiency of warehouse management. The purpose of the article lies in the embodiment of practical experience in warehouse and data, looking for problems, depending on the related model to optimize and improve it by using effective experience.

In chapter III of the paper, firstly overview the concept of the warehouse, then use data prediction to make a prediction on the future storage of goods in circulation. What's more, depending on ABC analysis to analyze the working processes and the level of information, leading to found the shortage in all aspects of warehouse operations, including the number of devices, machinery arrangements, human resource arrangements.

The main content in chapter IV is to improve and optimize the above management issues. First using above forecast data for the optimization of the mechanical quantity, followed by using the Assignment Model goods storage processes to optimize the model, then there will be effective in improving the system, human, and to improve the efficiency of warehouse management as much as possible. Finally, comparing to the data before and after of the entire optimization. And in chapter V is the final summary and also point out the proposed inadequacies.

1.3 Research thought

In this thesis, the main approach is the study of field research and secondary data collection, observation, comparison, prediction and systematic analysis method, also combined with my internship at the data and the overall understanding of the warehouse. While collecting the background of warehouse space layout, facilities and equipment, storage processes, and warehouse management system. In the process of site visits, observation of workers exposed to the actual processes, then using comparative analysis to find the existing problems.

Warehouse management involves a number of factors, such as facilities and equipment, storage processes, IT level, the study of this subject is necessary to use systematic research methods, the overall departure from the warehouse management, research and evaluation system between the various parts role and relationship. This article can't do everything involved in a specific warehouse management factors, but the improvements are actually in the systematic analysis on the basis of detailed analysis subsystem to the conclusion.

Chapter 2 literature review

2.1 Introduction

The logistics industry has become an important industry of the Chinese economic development in 21st century. Storage plays an important role in the logistics system, the healthy and rapid development of modern warehousing industry, which is of great significance for the optimization of logistics and supply chain management system to improve the quality of the operation of the national economy. In this chapter, we will have a view of research status nowadays, no mater domestic or aboard. Also, we will introduce the concept of warehousing and ABC method.

2.2 Research status

Years of economic growth and increased trade is the strong backing of the logistics development of China, but the extensive social and professional level is not high functioning state, resulting in high logistics costs. Its level plays an important role as the most important logistics costs warehousing costs. However, most of the warehouse management still remain in the traditional manual management phase, the backward mode of warehouse management efficiency, high costs, can’t meet the needs of China's rapid economic development. How to improve the efficiency of warehouse management, how to reduce the cost of storage has become one of the issues studied by many scholars.

In the paper of “the process design out of storage warehousing and logistics based on RFID technology”, Wangshirong and Xujianliang combined with RFID technology features out of storage warehousing and logistics based on RFID technology, process design and optimize business processes to improve work efficiency, so as to strengthen management, and improve targets.

In the paper of “bar code technology for logistics engineering control”, Tao Chun referred that based on the bar code technology, the research of warehousing operations, database operations,

picking a library operating system decision-making process, and then discuss a set of cargo area management, vehicle site management issues. Bar code with its low cost and mature technology in the logistics industry has been a rapid promotion and use.

The Liyun Qing introduced within the logistics center facility planning and logistics center in the select of equipment and space layout design, several important operating areas, including channels, storage areas, carried out a detailed plan, and describes the method of calculation of the regional area of operation.

He Zhenbiao, Zheng Ling Ying, Shang Yun Wei referred to cargo space planning principles, and modeling and simulation approach to solve problems.

Yanyun referred to a detailed analysis of three-dimensional warehouse library stacking between the operational efficiency of the relationship.

Liu Jinping proposed allocation method based on the stored signature library.

Warehousing research abroad is much earlier than China. Japanese Logistics Association (the JILS executive director of the rice bundle of the original tree Mr. liken the "human heart" design of the logistics center in Japan) is generally stressed that the three-dimensional and automation. Japanese logistics scholars Suzuki shockthe EIQ methods, its meaning is to set the destination according to the logistics center of the palm of the items of logistics characteristics and logistics status characteristics (size and characteristics of the storage unit) analysis is conducive to the storage and sorting area planning and optimization.

Curt Barry referred to a detailed description of the role of bar code technology in the warehouse. Introduce to regard barcode application as a favorable factor to reduce costs, and control operations. So as to achieve greater management efficiency and the effect of reducing costs.

Frazelle, EH proposed that world-class materials warehouse management system should break through the traditional IT and third-party logistics, rules of operation. Efficiency and accuracy have become the most important part of the successful storage.

Graves, the Hausman, and Schwarz proposed that a calculation model of the operation cycle of the stacker in the case of random access and cargo partition. And regard the ABC model as the best model to improve the efficiency of the model

Based on the research of references which have mentioned in chapter two, this chapter illustrates the concept of warehousing, knowing that the detail activities of warehousing and how the warehousing operates. What's more, this chapter also introduces a management theory called ABC method to help improve the operation efficiency of the warehousing.

2.3 The concept of warehousing

Warehousing means the storage and custody of the warehouse and related facilities and equipment items.

Warehousing is an important part of the circulation of commodities, also an important pillar of the logistics activities, both buffer and regulate the function of the logistics system as a whole, also playing a value-added role.

Storage, or storage of the basic features includes six aspects which are items out, inventory, sorting, packaging, distribution and its information processing. Items out of storage and database management can be said that the most basic warehouse activities, also the basic functions of traditional storage, but management tools and management level has been improved; sorting and packaging of goods, there are some in the past , but now more widespread, deeper and more sophisticated, or even out with the items library and the library management are combined together constitute the basic functions of modern warehousing; reason for the "distribution" as warehousing activities, as one of the basic functions of warehousing, transport and distribution is not a general sense, but storage is a natural extension, warehouse development for the memory requirements for distribution centers, if there is no distribution, warehousing will remain isolated warehouse; information processing, has been a common phenomenon in modern economic activities, should of course be one of the warehousing activities, leaving information processing, will not become a modern warehouse. Its main role is to reduce the number of transactions of goods and circulation,

reduce inventory and improve inventory level of assurance and generate economies of scale.

Warehousing in logistics and supply chain roles can be summarized as four centers:

First, warehousing is logistics and supply chain inventory control center. In addition to the ancient cargo storage warehouse now bear the inventory optimization, optimization including meet the demand at the same time minimize costs.

Secondly, warehousing is logistics and supply chain dispatch center. Embodies many contradictory elements in the warehouse, the more important part of the imbalance, warehouse supply chain, it must be done to alleviate the imbalance, and to resolve all the contradictions of factors before the start of the next link.

Again, warehousing is a value-added service centre in logistics and supply chain. The modern warehouse, not only offers traditional storage service also provides a late assembly and manufacturing postponement strategy, packaging, coding, paste marks, value-added services such as customer service, increase customer satisfaction, thereby increasing the level of service in the supply chain.

Finally, warehousing is modern logistics equipment and technology application center. Software technology, Internet technology, automated sorting technology, the photoconductive sorting, RFID, voice technology, advanced technology application of tools and equipment, improve storage efficiency to realize the conditions.

2.4 The analysis method of ABC

Graves, the Hausman, and Schwarz proposed that a calculation model of the operation cycle of the stacker in the case of random access and cargo partition. And regard the ABC model as the best model to improve the efficiency of the model.

ABC analysis initial comes from population management theory. 19th century Italian economist Pareto found in the theory of the study population, accounting for about 80 percent of the wealth of

the total number of 20% of the total population, while another 80% only 20% of the wealth, the so-called "a small number of minor majority "theory, this is the Pareto principle. Later, it was discovered that this law is also widespread in economic activities, so will this principle gradually in the enterprise to promote the use of。

ABC analysis, as a method of inventory management, was first proposed by GE. Enterprises manage product for a single species, there is no focus and focus points. However, for a variety of product management, there exists the key management, the difference between general management. "A, B, and C 'classification of goods, according to their frequency, quantity and weight of different factors classification out of storage in the digital library layout, the general principle is that the frequent access, a large number of heavy weight class A goods placed closer to a place away from the Tocumen, and vice versa on the more distant from the garage door. This arrangement is conducive to shorten the average transportation distance of goods. Another application of ABC analysis can analyze each specific aspects of the warehousing operations, unloading, loading, packaging, pick the goods, transfer database to analyze which specific operating link is important to Class A minor Class B, as well as unimportant C-class, for an important job to improve operational efficiency and control costs.

Application steps of ABC method:

(1) To collect data

(2) To determine standards, such as value, frequency, quantity, etc.

(3) Multiple ABC analysis

(4) According to the standard classification, calculated and derived analysis form

2.5 Summary

Based on the research of references which have mentioned above, we are able to the analysis of the warehouse operation and then improve the efficiency of it. Secondly, we also illustrates the concept of warehousing, knowing that the detail activities of warehousing and how the warehousing operates. What’s more, this chapter also introduces a management theory called ABC method to help improve the operation efficiency of the warehousing.

Chapter 3. A company warehouse Analysis

3.1 Introduction

In this chapter, we will do the overview of the specific warehouse, and illustrate the systems which the warehouse is using now, including SAP system and WPS system. What's more, this chapter also will show the defect of the warehouse from many different aspects.

3.2 Warehouse overview

A warehouse located in the Yangshan Deepwater Port Bonded Port Area since the last year. Currently occupies about 10,000 square meters which is over the allocation of well-known enterprises in the Middle East, Africa, Asia center. Its services include entry and exit of the customs, warehousing operations, inventory management, temperature control inventory, picking up, transfer database, coming out entire economies of scale and reducing costs. The whole warehouse is a milestone in the supply chain and logistics services, the cornerstone of the international transport of goods. The ultimate goal is to reach 50,000 square meters of inventory.

3.3 warehouse the system status

3.3.1 SAP system

SAP system is Systems, Application, and Products in Data processing system.

SAP R/3 software has the following features and characteristics:

Functional: R/3 in a modular form of a set of operational measures, one of the modules include all the required business function and user and technical application software linked to the formation of

an umbrella system for the companies or enterprises strategy and the use of management.

Integrated: the R/3 put associated parts together logically. Duplication of effort and redundant data are completely canceled, the procedures are optimized, integrated business processes replace the traditional manual operation.

Flexibility: the cutting methods in R/3 system make it flexible and adaptive, so that it can meet various user needs and requirements of specific industries. R/3 is also equipped with the appropriate interface to integrate the user's own software or external software.

Opening: R/3 architecture is comply with internationally recognized standards, enables customers to break through the limitations of dedicated hardware platforms and proprietary systems. Meanwhile, SAP provides an open interface, which can easily be third-party software products effectively integrated into the R/3 system.

User-friendly: icons and graphic symbols simplify the operation of the human-computer interaction. Unified design of the user interface ensures that staff can use the same familiar technology to a different work.

Modular: The modular structure of the R/3 allows the user either have a selection of new utility can also be completely transferred to a new organizational structure.

Reliable: as the user's business partner, SAP is constantly an increasing number of international standards for the quality of the integrated software.

Cost-effective: information processing is one of the main points to gain a competitive advantage.

When competition intensifies, companies must work harder to get its market share. Highly integrated data processing software is in high demand, which R/3 is such an excellent example.
Internationally applicable: R/3 supports multiple languages, and is designed for cross-border operations. R/3 can be flexibly tailored to countries' monetary and tax matter.

Services: in R/3 system implementation process, users will get the full support of the SAP technical experts and services, including organizational structure and technology consulting, project planning and implementation assistance, and training courses.

3.3.1.1 Input work

(1). HU information, shown in Figure 1, In examining “Loading the list”, how to determine whether the goods are correct, you need to use this command, the command execution can see the goods out to my warehouse, as well as PO number of the goods, the most important thing is to have delivery number. This feature can ensure that the goods are not wrong, on the one hand, reduce the operation returned goods sent to the wrong process, making the efficiency; on the other hand, can also reduce transportation costs of transportation back and forth.

CC	Delivery Date	Time	Quantity	Reference	Created on	Inb Detiv...	Item	HL item	batch	M	C	Se
LA	27.10.2011		2000		27.10.2011	180842355	10	0			2	3
AB	04.11.2011		2000	2278573	04.11.2011		0	0			1	1
ZH	01.11.2010		2000	2278573	01.11.2010		0	0			1	2

Source: Warehouse database of Panalpina company

Figure 1 - Cargo information query interface

(2).shift work，scanning HU and scanning BIN bit, as shown in figure 2

F3 Back	F2 Clr	F4 Next
Handling unit number		
CNCC5+21806975		
warehouse		C50
EAB EDC CN SH		
Source bin	327	3270101010
Movement type		999
Destination storage bin		

Source:Source: Warehouse database of Panalpina company

Figure 2 -Cargo shift work storage interface

(3).EDI goods storage (GR), weighing more than 2 percent, GW should be updated in the system

before storage. First of all, according to the weighing data or usingME23N to update the system in gross weight and volume.

Weight	
Tare weight	0.001
Allowed load weight	
Loading weight	1.519
Total weight	1.520
Volume	0.020
Tare Volume	
Allowed load Volume	
Loading Volume	
Total Volume	0.024

Source:Source: Warehouse database of Panalpina company
Figure 3 - GW changing interface

3.3.1.2 Output work

When picking the cargo and scanning HU in output work, while scanning the right HU ,the light will change from yellow to green, the figures under will also change, until the scan complete to reach confirmation. As shown below :

Scanning Handling Unit		
Refresh	check	Finish scanning
Print loading list		
carrier		
Additional information		
Handling unit		

Source:Source: Warehouse database of Panalpina company
Figure 4 - Output HU confirmation interface

If the same HU repeated scanning, the system will prompt whether to remove the scanning of HU, and this HU will be unloaded from the truck or container. If the scanning HU is not this shipment, the green part gets red.

3.3.2 WPS system

WMS System is Warehouse Management System acronym, our company's WMS system has played a input work business, the output work business, integrated batch management, materials, correspondence, inventory, and real-time inventory management and other functions of the integrated use of management system , controls and track warehouse operations, logistics and cost management process effectively to achieve the perfect enterprise storage and information management.

But at the same time, as the warehouse is located in the Yangshan Bonded Port Area, the WMS system must be connected with Custom Yitong system, so that all information in the warehouse can be connected with the customs. The contents include:

(1).Product registration: before the goods into the bonded port area, the goods should be recorded in the customs system, including the names, the customs tariff number, reporting units. Delivery is not allowed until the record is finished. At the same time, the shipping companies must also record.

(2) 10 days Inventory: a supervision of the customs to follow warehouse inventory. The inventory data in the WMS systems should be import to the customs system for review though computer, which manual does not allow. This greatly enhance the convergence of information between the warehouse at the Customs.

3.4 Warehouse Management problem

3.4.1 The facilities analysis problem

In the warehouse, the most important handling tools is the forklift, how to choose the right forklift has become the main factor in warehouse efficiency.

First, the type of forklift affect the placing of the shelves. The ultimate goal of warehouse is to maximize the warehouse median , so as to achieve economies of scale. So far most of the width of the forklift in the warehouse are large, in order to enable them to go though freely, the warehouse shelf distance between the shelves will tend to be larger, leading to the storage-bit to maximize failing, in the future stocks rose sharply, turning out unable to achieve effective management.

Secondly, the number of forklift trucks is a question of efficiency that impacts a warehouse workflow, how to achieve the optimization of the mechanical number, how not to lead the state machinery to idle or in short supply, how to determine the optimal number is a strong guarantee of the warehouse processes.

As the warehouse is new which is put into use for a short time coupled with the rise is still in development stage, facilities and equipment problem is an urgent need to be resolved.

3.4.2 Analysis of the warehousing operations problem

For a manager, warehousing operations is the heart of the warehouse. The efficiency of operations is often a manifestation of market competitiveness of companies. For companies, It's not only to solve the difficult problem, but also to address potential risks, so as to continue to meet customer requests and to adapt to constant changes in the external and internal, meanwhile exploring the potential to reduce operating costs, to innovate own service, to maintain and enhance competitiveness.

As table 1 shows, ABC analysis, as the introduction of task analysis, which primarily focus on operational aspects, and aims to improve the efficiency of the key operating aspects of the work. Innovative services

The principle is: To complete the operation flow of goods, you must complete each job links, calculate the operating time, get each specific operating aspects of the standard time in the proportion of working time throughout the task; in accordance with the actual time to complete the job with difference in the amount of the standard time, use ABC classification among specific aspects of the job done, so as to determine what specific aspects need to focus on this task. In theory, the time to complete a task is equal to the sum of each job in the task completion time.

Table 1 - Time weight analysis

	standard time	unit	monthly capacity	standard working time	time weights	real working time	differences	difference weight	classification
unload	2	minute / HU	7169.5	14339	27.40%	2.3	2150.85	25.60%	A

shift	3	minute / HU	5132	15396	29.40%	3.45	2309.4	27.50%	A
system package	2.5	minute / HU	218	545	1%	2.34	-34.88	/	C
load	2	minute / HU	4573	9146	17.50%	2.21	960.33	11.40%	B
pick	3	minute / HU	4324	12972	24.70%	3.7	3026.8	35.5	A

(System packaging: Non-of Edi goods enter the warehouse to produce computer-generated HU number)

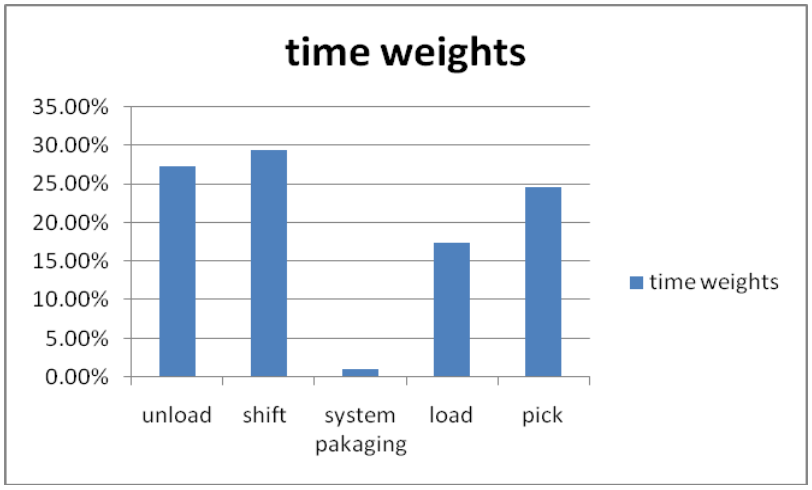

Figure 5 - Time weight percentage Figure

Table 2 is a summary for the stockpiling of the entire warehouse, a good reference for the utilization of the warehouse.

Table 2 - Inventory comparison

	target	unit	status
shelves	60	percentage	50.70%
ground	60	percentage	70%
yard	80	percentage	74%
input goods	12	working time	10.2hours
output goods	12	working time	1.28days
Inventory accuracy	99.9	percentage	100%
The accident rate	1	1	0

3.4.2.1 Input work

(1)Loading list audit problems

The loading list is the information provided by the supplier to warehouse stock, including enter

number, material number, batch number, net weight, gross weight, number, amount and other important information. Rigorous review of all goods must be carried out before entering the zone. However, in practice, we will find that the goods which enter the area have varying degrees of returned. first of all, this operation reduces the efficiency of the warehouse, because the goods must be returned to the first unloading cargo, and then go to the Customs for the return shipment to arrange returned the vehicle. So the no real use operation of machinery caused the waste of corporate resources. Secondly, the transport of goods back and forth, increasing itself to high transport costs for the cost of the entire processes to a large negative.

(2) Customer Management Category

Entire Inbound part which belongs to the assembly line in the form of operations, each step has different people to be responsible for, leading to un-contact with customers fast, also the information can't reach to them immediately, as a result of a stagnant process.

(3)Management and operations departments are not uniform

The operations department receive goods depending on material number of the goods receipt, but management is based on the Chinese name of the goods to the inventory records. The problem appears sometimes a material corresponds to multiple Chinese name, physical inventory and inventory records will not be able to match, which will eventually lead to the insufficient number of inventory within the customs system. When the warehouse can't be shipped, and give the company a great loss of more likely to have a negative inventory, and at that time, customs will be closed to the customs system, process can't be implemented, as to reduce the operational efficiency of the warehouses.

(4). KPI indicator can't be reached

as shown in Table 1, when discharge of a single HU, the actual operating time is 0.3 minutes/HU late than the standard average operating time. This contains two reasons, first, the machinery does not match the quantity to meet the job requirements, on the other hand, the treatment of bulk cargo often spend too much time, because mechanical match is not sufficient for smoother operation.

Secondly, the staffing problem. How to arrange staffing to achieve the best efficiency is an effective way to improve warehouse efficiency. The same problem also exists in the output work operations.

3.4.2.2. Output work

(1)Goods data does not match

When goods move out the warehouse, it often depends on the length, width, height, weight of the goods in the SAP system to book. But in fact, it usually encounter the situation that a large gap in the systems data and the actual goods. The reason is that in the storage of the goods, there isn't a good qualitative indicators of provisions to force that beyond what scope the data must be change in the system. As a result in air transport ,goods can't be loaded in shipping space, shipping heap box plan can't be used, more likely, if original pre-installed plan is two large boxes, which eventually must add a small box to complete. Above all, the results will lead a very big loss of the company and clients will questioned for the efficiency of corporate management.

(2)shipments of vehicles late

As shown in Table 2, the actual shipping process time is much longer than the specified time standard shipping process. Except for the storage of the same personnel and machinery problem, also including lorries too late to reach, under the premise of the shipment area to output goods, arrival time of the lorry directly affect the passage time of the operation of goods output. Have a clear arrival time of the provisions of the whole process should detailed planning for lorries. So how to arrange truck's arrival time is an issue requiring attention.

3.4.2.3 storage operations

(1)inventory accumulation

In the warehouse, inventory optimization is often the buy-to-order stockpiling ideal, the "0" stock, but there are a large number of goods because of previous customer orders and long-term accumulation in the company's warehouse in my warehouse, at the end customer cancel the order of goods from the warehouse. Such large quantities of goods for a long time invalid storage, for warehouse operational efficiency, storage efficiency, or interests are greatly inconvenience.

Secondly, due to the special location of the warehouse which in the bonded port area, the goods entering the zone after one month must apply for a declaration, which means that if the order of such a batch of goods cancelled, it will be returned back home, what's more, the returned goods

also need to be imported in accordance with tax increases way into China, or it will be destroyed under Customs surveillance directly. Whether the two choose are a waste. So how to solve this problem, is a great challenge for the warehouse.

(2). Space use unreasonable

from Table 2, we can easy see that digital library utilization of the entire warehouse is not so reasonable. The utilization of terrestrial digital library is much larger than the standard, this is not what we want to see. Ground storage areas is not conducive to improving the utilization of the storage areas. Some of the goods can’t be stacked, if put on the floor area can only be a prop close to the ground, that would cause a large waste of space. If the stock reaches a certain number, the warehouse is unable to meet demand, the company faces a very large loss of benefit. For management efficiency is greatly reduced, too.

3.4.2.4 Shift library and order picking

Shift library and order picking efficiency is based on the arrangement of the library. Digital library encoding the first three is storage areas, such as "320" shelf storage area, "321", "322" for the ground storage area, "327" open storage area, and more for cable, "861" shipment district, "801 "receiving areas. Followed by six digits is the entire three-dimensional warehouse which divided into the X, Y, and Z axes, such as "320050603" its meaning is the shelves District fifth row of the sixth column of the third layer. This positioning of goods, is also convenient to pick the goods shipped. The goods stored in the bin bit can be scanning with a scanning gun on HU and then scan bin bit number (bar code).

As shown in Table 2, order picking and storage, transfer database operations take up most portion of beyond time in the warehouse operation, Even we have a more complete digital library named library optimization, job path still did not get a reasonable optimization. The optimal choice of the pat becomes a top priority. Library optimization and path selection are very important in storage link.

3.4.3 The staffing

According to data table that Keebler and Durtsche proposed(Table 3). The proportion of the cost of manpower is the biggest. So in terms of the warehouse the rational application of human resources is the basic of operational efficiency, and the foundation of the maximize benefit.

Table 3 - cost percentages

Cost components	Percentage of the total cost
Human resource	56%
space	18%
technology	13%
Loading and unloading equipment	8%
maintain operations On weekdays	5%

3.5 Analysis of system problems

3.5.1 WMS system

In the inventory management of our warehouse, WMS system as a warehouse inventory management system is only limited to correspondence between the name and quantity, did not contribute the efficiency of warehouse operations. As a warehouse management system, addition to enhance the information level of the warehouse, it also must have good for the entire warehouse operation strategies and provide relevant information.

3.5.2 SAP system

Election module of the SAP system as the unit of measurement is usually a single piece of cargo size to select bits, and will also provide 3-4 libraries to be chosen, which will require the manual option, and increase the workload for a large number of goods that is not available.

3.6 Summary

Based on above analysis of the warehouse, we have already pointed out the defect of it. No mater

the operation problems or the system problems, they all need to be improve immediately, so as to achieve the goal of improvement of warehouse operation. In next chapter, we will do the optimization of warehouse management to improve the efficiency of the warehouse operation.

Chapter 4 Warehouse management optimization

4.1 Introduction

Based on the problems referred above, this chapter will attach much weigh on the optimization of more important issues and some aspect which needs further improvement.

4.2 Forecast and Analysis

The exponential smoothing method is a common method of production forecasts. Exponential smoothing rule compatible with the full-period average and moving average director, which does not abandon the past data, but only to give a diminishing extent, that, as far away from the data, given the gradual convergence of the zero weights. The principle is that each exponential smoothing value is the average weighted of the current actual observed value with an exponential smoothing value. The formula is following:

$$S_t^{(1)} = \alpha y_t + (1-\alpha) S_{t-1}^{(1)}$$
$$S_t^{(2)} = \alpha S_t^{(1)} + (1-\alpha) S_{t-1}^{(2)}$$
$$\hat{y}_{t+T} = a_t + b_t T$$
$$a_t = 2S_t^{(1)} - S_t^{(2)}$$
$$b_t = \frac{\alpha}{1-\alpha}\left(S_t^{(1)} - S_t^{(2)}\right)$$

Table 4- the forecast HU of following month

2011.11	2011.12	2012.01	2012.02	2012.03	2012.04	2012.05
5947	6532	10007	6933	12035	26183	20510
exponential smoothing	ó=	0.8				
year	throughput	$S_t^{(1)}$	$S_t^{(2)}$			

Original value	6239.5	6239.5	6239.5			
2011.11	5947	6005.5	6052.3			
2011.12	6532	6426.7	6351.82			
2012.01	10007	9290.94	8703.116			
2012.02	6933	7404.588	7664.294			
2012.03	12035	11108.92	10419.99			
2012.04	26183	23168.18	20618.55			
2012.05	20510	21041.64	20957.02			
2012.06	?					
2012.06	20787.78					

the number of HU from the current data warehouse, close to 22,519 in June. Comparing to the actual result, the difference is about 8% as predicted. To sum up, the predictions are relatively available, in other word, this method of prediction of HU is available. This prediction result will be used to the number of machines optimization in the following part.

4.3 warehouse facilities and equipment optimization

Loading and unloading is one of the seven functions in the operation of the logistics which is best embodies part of the efficiency of logistics operations, plays an important role in the entire logistics system. It is estimated that in the warehouse or logistics jobs, 75% of the time spent on the cargo loading and unloading process, this process of optimization and planning, will be able to greatly reduce the amount of work, reduce the use of equipment to improve operational accuracy, accelerate the speed of response to customers, improve the efficiency of the entire logistics system. Equipment selection, cost, quantity, etc. are all factors.

4.3.1 site utilization optimization

Lateral forklift can greatly enhance the number of existing warehouse storage areas. There are many factors to be considered in the process of forklift moving, first of all is goods or wooden pallet length (L), then the surface of goods to the forklift drive shaft centerline spacing (D), because the

forklift you want to rotate, this time there is the outside radius of the rotating (R), and finally, the remaining steering pulley operating margin (C).

At this time the channel width (W) can be expressed as a formula:

W=L+D+R+C formula (5-1)

Lateral forklift operating principle does not need to rotate. When forklifts work in the loading and unloading cargo ,it inserted from the side of the wood care, then lift the good. This benefit is greatly reduced channel width. You do not need to consider too much on the outside radius of gyration. If the goods or wood care of the length (L) is greater than the width of the forklift (M), the width depends on the length of the wood shot and add some of the remaining operating (N); forklift width (M) is greater than the length of the wood care (L), the width of the channel width of the forklift plus some of the remaining operating (N).

Formula as follows:

When L≥M， W =L +N (5-2)

When M≥L， W = M +N (5-3)

The warehouse is installed a total of 67 rows of shelves, which shelf is 5.5 meters high, divided into six layers, composed of a set of two rows of shelves shelf(totally 32 groups), and another three rows of independent shelf. Each group shelf is 2.6 meters wide, the middle of which have 32 channels, in order to ensure the high forklifts normal work, the channel width is 3.5 meters. While using lateral forklift, the channel can be reduced from 3.5 meters to 1.5 meters. So that 32 channels can save a total of 64 meters, a set of shelves shelf layout of 2.6 meters can theoretically increase to 30 sets of shelves, as a result the distribution center shot will increase. This is a very considerable increase in the amount of .

These are just purely theoretical calculation for the external factors, on one hand which need to take into account is the higher cost of increased lateral forklift, also the required to phase out the existing truck. The other hand, the increased utilization of the venue does a lot of shelf storage areas, improve space utilization, the formation of scale effect, but afterwards if you can take full advantage of, still need to be examined. If idle is equal to the cost of waste.

4.3.2 the number of machines optimization

Decided that the loading and unloading equipment requirements: (1) workload (V); 2 equipment per

trip to the handling of materials the amount of (C); equipment round trip time (T); 4. To complete the provisions of job time limit (AT). Based on these data, applying the following formula to calculate the requirements of Materials Handling equipment. Operating here include both indoor operations, and also include an outdoor job. This method not only applies to large-scale operations, also applies to small-scale operations.

formula：$(V \times T) \div (C \times AT) = R$

V=(20787.78+29204.89)/4=12498.1775. HU quantity (the basis of predictive value (average of the two predicted values), as HU packaging has different sizes, each handling 2 or 3, the overall proportion I took 1 /2 of the sum as the number of actual shipment HU).

C=10	The number of pallets per trip carrying
T=(2.3+3.45)/60 =0.096	The number of hours in a roundtrip
AT=15 hours	Time for complete the job
R=(22519×0.096)÷(10×15)=14	The required number of tractors

In conclusion, the optimized number of forklifts is 14, nowadays the number of company forklift is only 7, and the operator in June, there is no way to meet the future volume growth. Coupled with the forklift is the use of electricity, it will result in the forklift caused by the insufficient number of loading and unloading of goods longer shortcomings. So, when the number of forklift trucks in the actual purchase, you must also consider this point factors.

4.4 storage and operational efficiency optimization

4.4.1 Labor Efficiency Management Optimization

Workers who take two work shifts to ensure that the shipment of the warehouse in one day is available. The morning class is an early shift from 8:30 am to 17:30 and afternoon class is from 14:00 in the evening 10 point. According to the actual workload to do the deploy of workers is saving labor costs.

For the handover of tasks in two shifts because of the intervening two hours to work together, so it will not cause the increase in the chance of error or confusion and reduced efficiency; if we don’t use two shifts of workers, long working hours will bring the work no efficiency, rising security

risks.

Following is arrangements of different staff working:
Unloading and loading: the ocean transport has different sizes of boxes, whose width and height of the space allow one forklift get into the conduct for loading. Shown in Table 2, the standard unloading time is 2 minutes/HU, as observed, if using two forklift at a time to shipping a truck can greatly reduce the turnaround time, which also do not need to use too much involved machinery in handling. This way will reduce excessive waste of resources.

Shift library and pick the goods: you can see from the entire Table 1, pick the goods and transfer database take up most proportion of the whole process. The improvement program is "a person with 2 cars". Take shelf group for example, we can deliver the library which need to shift or pick out the goods to different workers according to the shelf space allocated, three workers take responsible for a set of shelves, two workers take responsible for handling the cargo, and the other on is responsible for the terminal bar code scanning. Also some people suggested that a person can use a car, but from personnel costs aspect, we have the time difference in forklift handling cargo to cargo storage bit or placed in the shipping area, the scan can take advantage of this time difference of bar code for scanning which save a person's efficiency and cost savings for other operating processes. As a result , this method can improve the efficiency of 30% of the staff.

4.4.2 Warehousing operations optimization
(1).Cargo input is a very important process. First step is a rigorous examination for Loading List. Secondly, to develop rigorous error range for the size of the goods, as in the system, if the goods weighing more than 2% of the book in the system must be re-change the length, width, high value ,the good must change and adopt a unified unit, in order to avoid can’t be boxed or inconsistent with the air transport accommodation.

(2)Mentioned in the article chapter 3, if inbound shipments sent to the wrong, as goods in warehouse are divided into two, one is BUY TO ORDER, another PICK FROM STOCK.

BTO is 0 inventory procurement can be achieved in accordance with orders from abroad but when facing the situation that the customer cancel the order and the goods have been customs, first of all,

trying to prevent this situation from the source. We must confirm that the good whether have been sent to the warehouse when receive the the supplier's delivery telephone; Secondly, if the goods have been sent to warehouse the goods, but the foreign customer cancel the order, they may consider whether the goods themselves have the value to transfer to other customers as other customers may also want to order this goods. In this situation you can notify the supplier temporarily without delivery; if it is unable to resolve, the only way is to choose the import tax increases or by officers of the destruction of or auction.

PVS means there is inventory left in the warehouse, then according to the order to pick singled out to generate a HU to transport. If the goods sent to the wrong warehouse, you can ask whether the supplier of the goods remain in the warehouse waiting for next order, which reduce transportation costs to some extent.

4.5 Warehouse Management System optimization

The optimization of the warehouse management system is not only the technical level of the system itself but also can be coordinated to assist in all warehouse operational processes by optimizing the management system, which has reached the level of IT to enhance all process information, technology, cancel human factors to improve the accuracy and efficiency.

4.5.1WMS system optimization

4.5.1.1 to increase the forecast module

In the information age, the warehouse management system can not only meet the timely transfer of information and inquiries to provide logistics, forecasting information is also essential. The future logistics predict is to try to estimate the future needs to guide warehouse management to meet anticipated customer demand. One of the prediction function is passive arrange logistics operations to change for the active control of logistics operations in order to make accurate and timely response to problems of all aspects of the logistics activities.

So increasing the prediction module for our warehouse can be more reasonable with the resources

to meet customer needs. According to a half months, month, half year and a different time segment to calculate the cargo demand to promptly adjust the storage of the digital library will make full use of shelf storage, as well as the demand for manpower. The predicted results can be compared with the actual to compensate for forecast accuracy, and then adjust the forecast assumptions to adjust the accuracy of the forecasts.

4.5.1.2 Increase negative inventory alarm module

There is one significant deficiencies in the directly connected with Excise Department system of the Customs. for example, warehouse today need to output A for 100, respectively, in order to in the form of 50 and 50 out of library. The inventory of the customs system was only 99. when the first consignment of 50 smooth delivery, the system inventory only in the pre-reduction state does not actually deducted, so when deliver second vote 50 A , company still can be smoothly shipments, but in the end, inventory will become of a negative value, the company bear the a considerable largest the risk.

Consider the situation above, increase the stock alarm module in the WMS system can manage risk for the company, let alone will not work

4.5.1.3 Increase inventory optimal module

Goods like PVS need to have a good inventory model. According to business needs, the warehouse allows out of stock (out of stock required to make up), the production of economic mass production model required a certain period of time, aiming to achieve inventory optimization, the minimization of the cost.

Inventory control major procurement parameters:

C3—order cost of each shipment

K—cost of unit of goods

C1—Storage cost per unit time per unit of goods

C2—Out of stock fee per unit time per unit of goods

P—Supplement amount of goods per unit time

R—The demand of goods per unit time

T—Order cycle

Q—Order quantity of each shipment

S—Safety stock

Data model

The model is based on the following conditions:

(1)Demand is continuous, uniform, and the demand for speed R (per unit time demand) is a constant;

(2)Production in a certain period of time is a continuous, uniform, and its production rate P (per unit time of production) is a constant;

(3)Each production is constant, set Q, assembly fee is constant, set C_3;

(4)Unit storage costs is constant, set C_1;

(5)Unit shortage costs (losses) on is constant, set C_2。

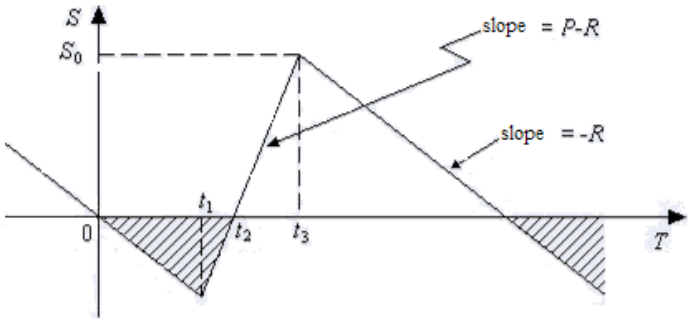

Figure 6 Storage capacity of the EOQ model changes Figure

Take [0, t] for a cycle, set time t_1 to start production.

during time period [0， t_2] the storage is zero, B is the maximum out of stock

during time period [t_1，t_2] in addition to meet the demand, the complement of out of stock within the time period[0， t_1].

during time period [t_2， t_3] the products which meet the demand enter the storage， Storage capacity increases at the speed of (P-R), S is the storage volume, maximum storage amount is at the t_3 time, when get to t_3 time, stop producing.

during time period [t_3， t] Storage reduced at the demand speed R.

As figure 6 shows：

Maximum out of stock $B=Rt_1$ or $B=（P-R）（t_2-t_1）$

$R_{t_1}=(P-R)(t_2-t_1)$, get $t_1=\frac{(P-R)}{P}t_2$

Maximum storage $S=(P-R)(t_3-t_2)$, or $S=R(t-t_3)$

$$t_3=\frac{R}{P}t+\left(1-\frac{R}{P}\right)t_2$$

$(P-R)(t_3-t_2)=R(t-t_3)$, get

or $t_3-t_2=\frac{R}{P}(t-t_2)$

Cost during the period time [0,t]:

Storage cost : $\frac{1}{2}C_1(P-R)(t_3-t_2)(t-t_2)$

Out of stock cost: $\frac{1}{2}C_2Rt_1t_2$

Assembly cost: C3

In the time period [0,t], derivation t, t_2, the optimal solution is followed:

When $t=t_0, t_2=\frac{C_1}{C_1+C_2}t_0$

we can get the minimum cost in the period time of [0,t].

The best ordering cycle is $t_0=\sqrt{\frac{2C_3}{C_1R}}\cdot\sqrt{\frac{C_1+C_2}{C_2}}\cdot\sqrt{\frac{P}{P-R}}$

Optimal order quantity is $Q_0=R\cdot t_0=\sqrt{\frac{2C_3R}{C_1}}\cdot\sqrt{\frac{C_1+C_2}{C_2}}\cdot\sqrt{\frac{P}{P-R}}$

Maximum storage volume $=R\left(t_0-\frac{R}{P}t_0-\frac{(P-R)}{P}\cdot\frac{C_1}{(C_1+C_2)}t_0\right)$

$=R\cdot\frac{(P-R)}{P}\cdot\frac{C_2}{(C_1+C_2)}\cdot t_0$

Maximum out of stock $=R\cdot t_1=\frac{R(P-R)}{P}\cdot t_2$

minimum cost $\min C(t_0,t_2)=C_0=\sqrt{2C_1C_3R}\cdot\sqrt{\frac{C_2}{C_1+C_2}}\cdot\sqrt{\frac{P-R}{P}}$

By using this model as the optimum model in storage, we can finally achieve the best order of the

optimal order quantity, and the optimal cost. So that effective in helping to improve operational efficiency and cost control of the warehouse.

4.5.2 The SAP system optimization

SAP system as described in chapter 3,it has the query and changing function, also can recommend storage areas. These functions are very significant to help the overall operation of the warehouse and operational more efficiency. The following is the improvement

4.5.2.1 Library stock alert optimization

The digital library here is not just talking about one packaging cargo loading in one library, it refers to minimize the number of packages for the unit of measurement on the digital library, because usually the goods on the digital library is not divisible. For example, each library (1.3 metre long, 1 meter wide) can be installed four boxes of goods, only three cases of this order, so a location is free, then on another library, which have been removed three boxes, only one box left that occupied the entire digital library. If this box is transferred to another library which has one location free, we can free up a library, put more goods to improve efficiency. In accordance with the functionality of the existing warehouse management system, when distribute the allocation of storage areas, the SAP system only considered idle library occupied by the new distribution center goods, regardless of the digital library digital library on the idle position. When library bit is out of use, the adjustment of library goods is particularly important.

In the remind management module, it’s necessary to increase the storage areas of goods adjustment function. The logical process is as follows:

(1).In addition to providing the part number, order number, the number of pieces of information, the system needs to provide the number of packages stored in the storage areas, and prompts the library spaces are filled, that is, if the number of boxes equal to 4, labeled as "FULL"; if smaller than 4 ,the system need to show the library size and the size of the first store of goods.

(2). Data processing clerk should make adjustments according to the results shown in judgment, and adjust storage areas of goods in the warehouse management system .

(3)Then passing the adjust bill of the storage areas of goods to forklift operator, he will do the adjustment according to the bill.

In this way, there won't come up the digital library of unreasonable application. This method can be used to meet future inventory storage problem, and to arrange the library to the size of a wrapper, even more greatly improve the library use of packaging in the same digital library rate. Coupled with IT technology to prevent the artificial inspections, improve operational efficiency.

4.5.2.2 optimize the selection judge module

Selected bits of optimization can help select the optimal path to the operations of the library to pick goods and reduce the picking time, so as to improving efficiency. This method provide good suggestions for the storage of goods choosing the library , including the size of the goods, the flow of cyclical weight. Locating optimal management is used to determine the appropriate storage methods for each product regulations under appropriate storage space for storage allocation. The optimize management pursues the characteristics of different devices and shelf type, the grouping of goods, cargo planning, labor costs built factors in order to achieve the best repository layout, and can effectively control the commodity changes, to maximize cost savings and operational efficiency to maximize .

4.5.2.2.1 path optimization

Assignment Model:

$$\min \sum_{i=1}^{n}\sum_{j=1}^{n} c_{ij}x_{ij}$$

$$\text{s.t.} \quad \sum_{j=1}^{n} x_{ij} = 1, \quad i = 1,2,\cdots,n$$

$$\sum_{i=1}^{n} x_{ij} = 1, \quad j = 1,2,\cdots,n$$

$$x_{ij} \in \{0,1\}, \quad \forall i, j$$

x_{ij} = 1 If assigned i goods to the j library

0 If not assigned i goods to the j library

Optimization of the path is not a single piece of cargo, but the optimal path of the goods. To shift the library, for example, after the goods enter the purchase area, by using of SAP according to the cargo length, width, high , to recommend storage areas in the warehouse, however there will be a lot of sizes of the library, or there are many different sizes of cargo storage areas. At this time we can use the assigned model to analyze the entire ticket list, then provide a copy of all the goods from the optimal path to reach the storage areas and optimize operational efficiency.

Though these improvements, the SAP system will reduce the waste of resources caused by human factors to some extent, improve the efficiency of the entire warehousing operation which also enhance the efficiency of the forklift workers to the maximum possible extent.

Now having existing shipment, the following details：

Table 5 - goods details (meters)

library	Goods 1	Goods 2	Goods 3	Goods 4	Goods 5
1	48	44	58	32	37
2	41	38	48	26	33
3	58	53	71	36	43
4	88	79	108	57	67
5	68	62	83	40	44

Optimal solution is：48+48+53+57=250Metres

Just as before, based on the first come first put principle, the path is 32+33+53+88+83=289Metres

Compare the optimal solution with the previous first come first put principle, the difference is 39 meters, now we only refer five kinds of cargo , if the goods reached a certain number of the optimization of the path there will be a lot of room for improvement. However, this model has one limitation is that only for all goods can be loaded to the selected storage areas. More limitations.

4.5.2.2.2. Warehouse storage rule optimization

Divided into four categories, A, B, C, D, the difference lies in the cargo space can accommodate different size cargo, which can even be flexible deployment of cargo space in our warehouse, so as to accommodate large, especially small pieces goods, in the end increasing the utilization of the warehouse.

Warehouse input work goods are only obey the rule of the size of the goods, or based on primarily the weight on storage. As a result, the efficiency of the storage shift work is not very high, so in addition to these two rules, the selected bit of the system can be increased:

(1).A turnover rate of the basic rule. By ranking goods turnover rate, in accordance with the principles of positioning or classification storage method, then specify a storage area for each commodity, the higher the turnover rate should be the closer from the entrance.
(2) product-related rules. This can reduce short extraction distance, reduce staff fatigue, and simplify inventory work. The correlation between size of the product can take advantage of the historical order data for analysis.
(3) the identity rule. The so-called identity principle means the same items stored on the same principle of custody of the location. In this way the goods custodian position is simple and familiar for workers. Otherwise, when the same goods is dispersed in multiple locations in the warehouse, the items in the store remove operating is inconvenient, which may cause difficulties in the mastery of inventory and operating on the rack items.

Or we can classify the storage of goods to be by size, weight, circulation rate and other important factors directly, corresponding to the different types of shelves like A, B, C, D, and others. These types of shelves is a fixed size, other goods shall be classified as E class to adjust its shelves. Finally, we can get the optimal path to the storage areas for all goods.

4.6 Analysis of optimization results

Table 6 - the effect after optimized

	Standard time	Standard working time	Time weight	Actual working time	optimized
discharge	2	14339	27.4%	2.3	1.9

Shift work	3	15396	29.4%	3.45	3.1
System package	2.5	545	1%	2.34	2.34
charge	2	9146	17.5%	2.21	1.84
Pick work	3	12972	24.7%	3.7	3.23

Table 7 - Digital library optimized contrast

	standard		before Optimized	After optimized
Shelves	60%	percentage	50.7%	59%
Ground	60%	percentage	70%	61%
Yard	80%	percentage	74%	74%
Input	12	Working time	10.2hours	10hours
output	12	Working time	1.28days	11.5hours
Inventory accuracy	99.90%	percentage	100%	100%
The accident rate	1	1	0	0

4.6.1 Data Analysis

1. 1 The above two tables is the effect of optimized by the analysis of operational processes. The time of unloading and loading efficiency is greatly improved. From the original failed to become in the standard time frame. In the shift of the library and pick the goods, although improved but has not yet reached the standard time frame. The reason is to pick work , shift work lies not only in the search of goods, stacking, but also related to the size of goods and the work time of forklift. The number of bulky goods is constantly increasing in the warehouse, so even we have a digital library recommendation and the assistant of the optimal path, the goods themselves extraction inconvenience greatly affect the efficiency of the pick the goods and the time of the shift work. But, owing that the system is busy, the time efficiency of the whole process of access to library still meet the standard.

(2) in the digital library utilization, we can clearly see the shelf utilization is significantly improved. Because the warehouse shelves to use a variety of different specifications include adjustable shelves, the cargo volume does can’t put into the shelf will not happen. This can greatly

improve the utilization of space.

4.7 Summary

Though the optimization of different issues, I would like to introduce what we need to do actually in the following aspect:

(1).output work

First of all, through increasing the measurement of goods such as length, width, high data when the goods put into the library, and re-enter data when passing over a certain range in the system, the method can reduce embarrassment of the goods can’t be booking, reduce re-booking costs and improve efficiency.

Secondly, through the further optimization of the SAP and WMS systems can help the forklift operator pick goods in the minimum distance and shortest time to complete tasks, which also speed up the operational efficiency of the warehouse operations of the library.

(2).Warehouse storage operations

The most important thing is by using system optimization, route optimization, adding more to consider conditions such as the rate on the circulation of goods, goods classification method to shorten the operating time, which greatly improves the efficiency of library stock alert features, also greatly increases the warehouse space utilization.

(3).Inventory aspect

With the help of the model to determine the best order of the optimal order quantity, and the optimal cost and other important information, inventory reaches a satisfactory level of customer service.

(4).Staffing aspect

The determine number of staff working arrangements achieve optimal results. Especially the method of one person with two cars can greatly improve the efficiency of artificial.

(5) Handling facilities

According to prediction of future shipment number, we can obtain the optimal number of machines, at the same time make use of the lateral forklift to increase warehouse space utilization, but still need to consider the cost.

Chapter 5 Conclusion

For modern logistics nowadays, the requirements of time and efficiency are much higher. Firstly, in order to improve the competitiveness of the warehousing industry, warehousing companies must improve operational efficiency and space utilization. What's more, focusing on the use of modern management to change the traditional storage business philosophy is needed so that to achieve optimal coordination and cooperation. Thirdly, Strengthening the IT level of the warehouse, trying to make all reasonable and efficient warehouse factors coordinate.

Under the premise of ensuring the basic functions of storage, efficient warehousing operation is to take effort to reduce the cost of inputs to achieve the optimal allocation of resources, thereby enhancing the competitive advantage of enterprises, and ultimately maximize its benefits.

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