A World Class Warehouse Management System[1]

ระบบการจัดการโกดังสินค้าระดับโลก

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บทคัดย่อ

วิทยาการเกี่ยวกับการจัดการโกดังสินค้ามิใช่เรื่องใหม่ แต่ในปัจจุบัน การจัดการโกดังสินค้าแตกต่างไปจากอดีต ประการแรกธุรกิจสมัยใหม่มีขนาดใหญ่กว่าในอดีต ประการที่สอง สินค้ามีความหลากหลายซับซ้อนกว่า ประการที่สาม ค่าแรงงานเพิ่มสูงขึ้นมากในหลายปีที่ผ่านมา ประการที่สี่ เศรษฐกิจในปัจจุบันประสบภาวะวิกฤต และประการสุดท้าย ปัจจุบันการแข่งขันสูงมาก สิ่งเหล่านั้นทำให้ต้องควบคุมทั้งการลงทุนและค่าแรงเพื่อการอยู่รอด ต้องคำนึงถึงคุณภาพของสินค้าในราคาที่เหมาะสม และส่งมอบสินค้าตรงเวลา บทความนี้จึงใคร่นำเสนอลักษณะสำคัญของระบบการจัดการโกดังสินค้าระดับโลก (WMS) ซึ่งสามารถสะท้อนให้เห็นปัญหาหลายประการในโลกธุรกิจสมัยใหม่

Abstract

The science of warehouse management is not new, but modern day warehouse management is different: First, modern day businesses are much bigger; second, products are more complex; third, labor costs have risen dramatically over the last few millennia; fourth the current economics is in crisis; and finally, competition has arrived. That is, we now have to control both investment and labor costs to survive, provide a quality product at competitive prices, and deliver when the customer needs it. Thus, this paper is to present major characteristics of worldclass warehouse management systems (WMS), which can address the problems of the modern day businesses.

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Introduction

Responsiveness, reduced lead time and elimination of non-value add activities are the keys to world class performance [1-8]. Consequently, more and more companies need to enhance customer service and distribution efficiencies with worldclass warehousing and improved logistics support. So, we need application functions that are comprehensive throughout our organization as well as across the links and partnerships of our supply chain. These requirements and challenges are reflected in the business system model embedded in [3].

The layers or functional areas of this business model are [3]:

1. Customer service and demand management, from forecasting and sales operations to field equipment and warranty service.

2. Financial, accounting and administrative applications.

3. Manufacturing resource planning (MRP II), covering the full suite of MRP II applications.

4. The execution and control of purchasing and manufacturing activity, with plant and supply chain interfaces.

5. Advanced Planning and Scheduling (APS) to synchronize both resources and materials, with constraint management capability.

6. Logistics and distribution management, including advanced warehousing and traffic management applications.

7. Decision support and implementation enabling tools with appropriate ISO 9000 Assistance, to ensure effective use in timely and economic fashion.

Each corporation and each plant has its own identity, and a corporation has the same number as a company. Within the hierarchy of the organization, the system allows us to have three types of warehouse, dependent on whether or not we are using Distribution Requirements Planning (DRP). In the more comprehensive situation, when DRP is being used, there are three levels of warehouse [3]:

1. Distribution Center warehouses are not associated with a particular plant.

2. Shipment warehouses are at a corporate level for finished goods and viewed in Master Production Scheduling (MPS) and MRP.

3. Plant warehouses are also seen in MPS and MRP but are associated with production facilities.

In most organizations there is opportunity for improvement in warehouse operations, from the viewpoint of reduced turnaround time and increased service to the customer. This is particularly the case when the organization has a significant finished goods or service parts operation. Better asset utilization, responsiveness and balanced customer service are vital to the competitiveness of a company [3].

The world-class WMS can improve your distribution operations by [1-8]:

- ✧ Reduced turnaround time
- ✧ Lower inventories
- ✧ Enhanced customer service
- ✧ Improved warehouse space utilization
- ✧ Higher worker productivity
- ✧ Better inventory accuracy

In summary, world-class WMS allows us to do much more within our logistics operations with much less effort and cost. It can be an easily justifiable extension of our business operation into a very customer sensitive area of the business. World-class WMS covers all our storage operations, such as receiving, locating, putaway, order management, picking, and shipping. Adaptability to individual business needs is achieved by rule based procedures, such as those for wave picking and cross docking. World-class WMS supports activity based locating, bar code and directed RF, automatic replenishment, and lot tracking. These features ensure that our customers will get what they want, when they want it, with the fastest response [1-8].

WMS Functionality

Modern, on-line WMSs receive most of their input from and direct most of their output to the hourly workforce. These systems control and direct a significant number of people, representing a significant labor cost. Therefore, to be successful, they must be designed to achieve high levels of productivity along with high levels of accuracy. The details of the products being stocked, the layout of the facility, the material handling methods used, and other factors thus become important design consideratios.

However, WMSs differ from industry to industry, from business to business, and even from department to department within a business. The functional similarities among industries are [6, 8]:

- ✧ receiving,
- ✧ quality control,
- ✧ put away,
- ✧ replenishment,
- ✧ cycle counting,
- ✧ rewarehousing,
- ✧ miscellaneous items,
- ✧ order management,
- ✧ picking, and
- ✧ shipping.

On the other hand, the functional differences between industries are [6, 8]:

- ✧ cross-docking,
- ✧ work-in-process,
- ✧ serial number and lot tracking,
- ✧ bills-of-material and assembly operations,
- ✧ multiple stockrooms,
- ✧ check-out, check-in,
- ✧ material handling methods.

World-class WMSs should include both types of functionality.

WMS Opportunity Identification

Challenges most frequently cited as the basis for WMS investment include [6]:

- ✧ Receiving, picking and shipping errors

✧ Long search times due to misplaced or lost stock

✧ Manual transaction recording

✧ High direct and indirect labor cost as measured by cost per dollar shipped

✧ Inventory accuracy below 99%

✧ Low inventory turn

✧ Shrinkage

✧ Lot tracking and shelf life management issues

✧ Lengthy order cycle times, low fill rates and related customer service problems

✧ Poor space utilization, increasing use of outside storage and related shuttle costs

✧ Performance measurement issues

✧ Customer demands

✧ Internal/external survey feedback.

The Needs for Accuracy

Most businesses require a contionous flow of materials and supplies. They make an effort to keep track of the amounts of each item on hand, so that they can avoid disruption of that flow. In small businesses with small amounts of inventory, it is often sufficient for a human to remember approximate inventory records. When warehouse manager thinks that supplies may be getting low, he can walk to the warehouse and check. However, as the amount of inventory increases and as the rate of material flow into and out of warehouse increases, it becomes more and more difficult for a human to remember even approximate inventory balances. Some form of recordkeeping is needed to supplement the human memory.

When everything goes right, manual inventory records can be an efficient way for businesses to assure that they have the materials they need. Unfortunately, this method of keeping inventory records, can encounter a long list of possible problems: Some examples are [8]:

1. Material handlers can accidentally move the wrong material.

2. The right material can be moved, but it can be moved to the wrong location. In large warehouses, meterial in the wrong location is effectively lost because the time required to find it is prohibitive.

3. The quantity of parts moved can be wrong.

4. If the quantity of part moved is right, it can be recorded incorrectly, or either the part identity or the new location of the parts can be recorded incorrectly.

5. The clerk who copies the transaction record onto the file cards can select the wrong card.

6. The numbers can be copied *incorrectly*.

7. The arithmetic can be done *incorrectly*.

8. The results can be recorded *incorrectly*.

The importance of inventory accuracy has long been *underestimated*. The cost to business of inaccurate inventory records can be immense. It is far more than just the cost of finding the inventory errors and correcting them. In fact, it involves virtually every aspect of every department.

For example, production planning systems like Material Requirements Planning (MRP) and MRP II are affected. An iventory error that *understates* inventory will cause orders to be placed too soon. The consequent result is *excess inventory, shortages of storage space,* and *unnecessary costs and investment.* When inventory errors overstate the quantity on hand, the result is often delayed reorders, shortages, expediting, and late deliveries to customers. Late deliveries and other forms of poor customer service tend to drive customers away, of course. Lost opportunity costs can be significant, sometimes driving a company out of business. DRP, like MRP and MRP II, assumes that the inventory data used is correct and its tolerance for error is nearly zero [8].

This impact is not limited to planning systems. Financial systems, for instance, are affected when iventory errors occur. Since inventory is an asset, general ledger software usually reflects the on-hand balances in the company's books. When the on-hands are wrong, the ledger is wrong and the company's profit is misstated [8].

Location-Based Inventory

Most companies need computer based WMSs and computerization should be considered a prerequisite for inventory accuracy and productivity. Although computerization does not, itself, provide accurate inventory records, the machines do arithmetic flawlessly, eliminate other problems such as illegible handwriting, and make possible the sheer volume of calculations necessary without degradation in internal accuracy [8].

In the early days of computer-based inventory, many systems kept only a four-wall inventory. Four-wall inventories are those which record only the on-hand balance within a building or in a department or within the four walls. For several reasons, four-wall inventories simply do not work. When, for instance, a cycle counter is instructed to count and verify the inventory of a part, he or she must be able to locate the parts to count. If the inventory is four wall, the cycle counter has a big job, just to find the parts to count. On the other hand, if the cycle count is to take within a single bin, finding the material is easy [8].

Therefore, not only is a computer-based WMS a prerequisite to accuracy and productivity, it must be one that keeps track of the quantity on hand and its actual, physical location in the plant. Physical locations must be tracked in enough detail so that material can be found with reasonable ease. This location-based inventory is one of major characteristics of the world-class WMS.

Problems with Paper-Driven WMS

Paper-driven computerized WMSs have been very widely used. However, paper-driven systems have major problems. Most of these problems related directly to the number of hands through which information flows and the number of times that information must be copied, keyed, printed, read, and understood.

There is, of course, a cost incurred every time the information is handled, and there is a probability that errors can be introduced. Even if the chance of error is small, when thousands of transactions are performed each day and millions each year, the laws of probability make it clear that errors will occur. Since errors tend to accumulate in inventory systems, the eventual result is inaccurate inventories [8].

To illustrate the above errors, let us take an example from [8]. Imagine a factory that employs 10 full-time material handlers, and that each material handler creates an inventory transaction (a put-away, withdrawal, or a move) every 30 seconds, 8 hours a day, 5 days a week. This implies 48,000 transactions each week. If the material handlers are 98 percent accurate in the following instructions and reporting results to the system, 960 errors are generated each week, and another 960 locations go bad each week because inventories are perpetual. If there are 20,000 storage locations in the factory and if a physical inventory is performed only once a year, the physical inventory will find about 18,200 locations, or 91 percent of the inventories, to be incorrect.

The key to accuracy, therefore, is a matter of locating sources of error and eliminating or minimizing them. Studies performed estimate typical manual data entry error rates at about 1 in every 400 characters [8]. Even if a transaction is only 25 characters long, the job of achieving 99.92 percent accuracy in a paper-driven system is clearly impossible. Error rates for bar-code entry, on the other hand, are often quoted at 1 per 3 million characters, which translates to accuracies in excess of 99.999 percent for 25 character records. Bar codes are not the total answer, but they can be an important part of the solution.

Another important problem is delay. Imagine when transactions are delayed, inventory records get out of date and are, in fact, wrong. This would not be a significant problem if the paperwork were eventually to catch up. But, in most businesses, there is a continuous stream of delayed transactions. Thus, the inventories, and the balances used by MRP and DRP, are continuously wrong. For most purposes, in most companies, delays are as bad as errors. To address this problem, RF terminals with bar code reader need to be used [8].

Bar Coding-Automatic Identification Technology

WMSs require the frequency identification of things to the computer. For example, to record the movement of a pallet of material from one location to another, three identifications must be made: (i) the material being moved, (ii) its source or origin, and (iii) its destination. In large warehouses and distribution centers, tens of thousands of identifications can be needed each day.

Inventory accuracy, as mentioned earlier, requires achieving extremely high levels of transaction accuracy. Many businesses have found that mechanizing the identification of

things such as products and locations to the system helps substantially in the achievement of the necessary levels of accuracy. Machines, particularly electronic ones, are capable of the accuracy and reliability required. Humans are not, at least with expensive checking and double-checking. Automatic identification, therefore, is important to inventory accuracy and productivity. In addition to achieving accuracy, automatic identification is often justified by labor cost savings. Under some circumstances (e.g., scanners beside conveyors), automatic identification can happen without labor cost.

Bar coding is the most widely used and applied automatic identification technologies. Bar code technology is very well developed, the equipment required to print and read bar codes is inexpensive, and the resulting reliability and accuracy are extremely high. Bar code labeling must be a part of world-class WMSs.

Slotting

Proper slotting plays a crucial and exciting role in warehouse operations If done right, it can save companies upward of 20% in terms of productivity gains [10]. Order picking, in direct correlation with slotting makes up about 50% of warehouse costs: it is a highly labor-intensive task, and most mistakes made in the warehouse are made in order picking [10]. Thus, the question becomes how to eliminate the travelling and searching associated with order picking so as to cut down on costs. While some of this activity can be eliminated through the use of machines and information systems, human labor is still an important part of order picking. Human cannot be entirely replaced as they bring value to the activity by extracting small items, counting and adding value-added service [10].

Therefore, the primary objectives behind proper slotting are to improve selector productivity, make better use of warehouse space and comply with demanding ergonomics standards. The proper slot setting can be achieved through the support of world-class WMS.

Just-In Time

Just-in-Time (often abbreviated JIT) is an approach to business operations that has the objective of eliminating waste by having material arrive just in time to be used. Close synchronization of all material flow is necessary to achieve this goal. The result, particularly in manufacturing organizations, can be a drastic reduction in inventories and a corresponding increase in productivity.

While JIT reduces inventory, it does not reduce the need to control inventory that remains nor does it reduce the need to have accurate inventory records. In fact, close synchronization of operations requires even higher levels of accuracy than does the traditional job shop. Unplanned shortages, should they occur, will affect more than just one work center and more than just one operation. In short order, the entire plant could

be shut down. World-class WMSs are applicable to both the JIT shop and the traditional shop [8].

Conclusions

Effective warehouse management is an age-old problem. The challenge of warehouse management has not changed at all. You still need to know where items are, and how much of them you have. A more recent twist to traditional warehouse management dilemmas, however, is the ever-increasing speed with which inventory must move. Customers want their products and they want them now, and they do not want to keep any on-site inventory. That means you need to know what products you have and where they are, so that you can ensure that customers get what they need faster than ever before [9].

Key to accomplishing this is to use today's enabling technology-bar coding, RF, WMS and sophisticated material handling equipment-which lets you put your finger on the location of your warehouse and get it out the door as soon as possible.

Warehouse management systems also provide a bridge between enterprise-level purchasing, manufacturing planning, manufacturing execution and customer service systems and the warehouse or distribution center. With real-time visibility of available inventory, the world-class WMS marshals people, space and equipment to efficiently receive, store, pick and ship components and raw materials to production and finished goods to wholesalers, distributors and end customers. As a consequence, it seems clear that all warehouses could benefit from some form of WMS.

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