A Case Study:

Reducing the Cost Per Order and Improving Productivity within a Chemicals Distribution Center—Part 2

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In the first article we described the concern that a manufacturer and distributor of chemical products had because of an increasing number of complaints from customers. These complaints focused primarily on quality and service issues related to the distribution function. In addition to the complaints from customers, management was concerned with a trend of increasing cost per order.

In order to identify the reasons for rising order costs and the causes of quality problems, the company decided to benchmark their distribution centers. Each distribution center was benchmarked against the others and against the distribution centers of competitors. The benchmarks included metric and process criteria.

The results of the metric benchmarking showed that all of the company distribution centers had order costs that were higher than the competitive average. These costs ranged from 1.1 to 11.6 times the industry average. One of the benchmarks—warehouse space utilization—was less than half of the industry average. The primary cause of the poor utilization was due to the inventory being stored in floor locations that did not utilize the height of the warehouse effectively. This caused the inventory to be spread over a much larger footprint. The larger footprint caused long travel distances for order pickers, replenishment operators, and material receivers. This in turn caused poor productivity and high order costs.

The process benchmarking showed that there were no systemic issues that would explain the low productivity and higher costs. However, they did discover that the warehouses were only using 10% of the capabilities of the warehouse management system.

In this article we describe how the reduced order costs and improved quality by improving the warehouse layout and by using the full capabilities of the warehouse management system.

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DETERMINING THE PROBLEMS TO BE SOLVED

There is a saying, "Without the facts you are just another person with an opinion." Before the benchmarking results were available, management, supervision, and operators all had their own ideas of the causes of high costs and poor quality. A team was formed to identify the real problems that contributed to high order costs and to develop and implement solutions to those problems. The team used the facts from the benchmarking data to focus their attention on the real problems that needed to be solved. These were:

- Reducing high order costs by eliminating travel time during order picking, replenishment, and product put away operations;
- Improving order accuracy by using the full capabilities of the warehouse management system.

DEVELOPING SOLUTIONS

The team agreed that major changes in layout and product placement within the warehouse were necessary to improve the warehouse operations. The team agreed that the changes that would have the most positive effect were reducing the footprint of the warehouse, developing a product slotting system that ensured that frequently picked products were located close to shipping areas, and fully utilizing the capabilities of the warehouse management system.

Before beginning to design the new warehouse layout, the team needed to understand the constraints of the building, company policies regarding warehousing practices, and applicable government regulations. The team identified the people within the company that had the necessary expertise and experience. The experts were used as a resource by the team members when needed.

Before the warehouse layout could be optimized, information about the business was needed. The information required included:

- Number of SKUs that would have to be stored including additions and deletions;
- Annual volumes by SKU;
- Number of units of an SKU on an order;
- Pick frequency by SKU;
- Product characteristics that might affect storage area or method. This included characteristics such as hazardous or flammability rating, the weight of the product package, and the dimensions;
- Seasonality of orders;
- Number of shipments and receipts each day;
- Order size including number of units, number of lines, and number of pallets;
- The current build strategy for pallets.

The team also needed to understand the required level of inventory to support the business. Too much inventory would waste financial resources and too little inventory would cause them to disappoint customers. They eventually reached a compromise and agreed to design the warehouse to hold a maximum of 30 days of supply. This would mean that the average inventory would be approximately 15 days of supply.

WAREHOUSE LAYOUT

After analyzing the data, it became clear that the best approach for maximizing the use of the warehouse cube was to divide the warehouse into zones. Products with similar characteristics would be placed in the

Figure 1—Determination of the number of zones.

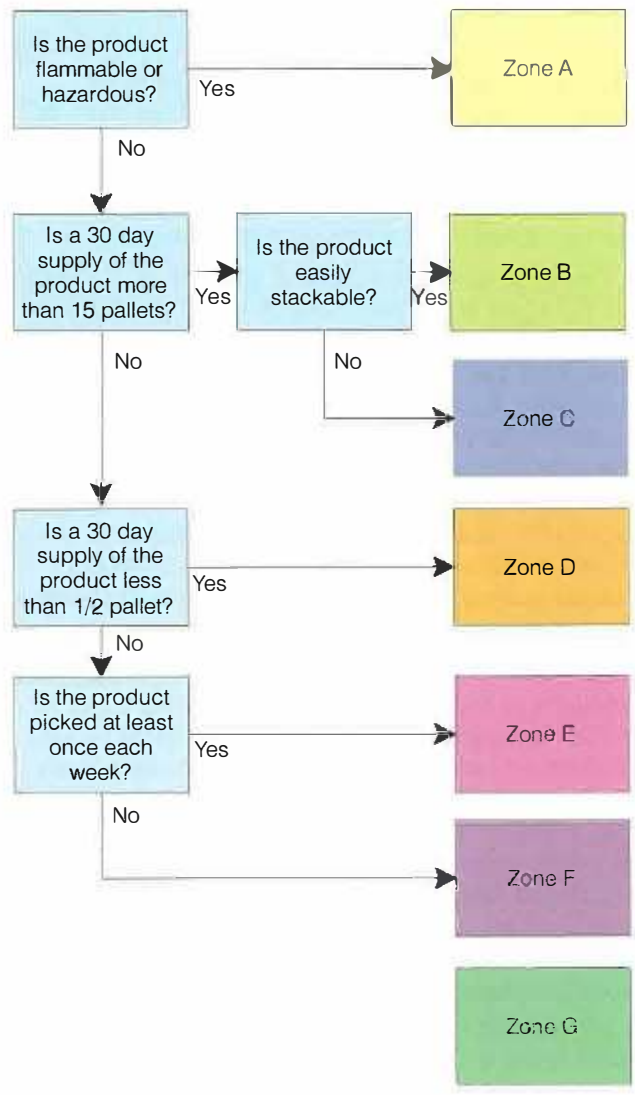


Figure 2—Zone storage method.

Zone	Zone Description	Storage Method
Zone A	Flammable or hazardous products	Flammable storage
Zone B	Large movements and easily stackable	Floor storage
Zone C	Large movements and not easily stackable	Floor storage
Zone D	Very small product movement	Shelves
Zone E	Frequently picked products	5 high pallet racks
Zone F	Infrequently picked products	5 high pallet racks
Zone G	Overflow area	Floor stage

same zone. The characteristics that were used to determine in which zone a product was located included the number of pallets represented by a 30-day supply, frequency of picking, average order quantity, and whether the product was classified as being hazardous or flammable. The flow chart in *Figure* 1 shows the decision process used to determine in which zone a product was assigned.

The decision chart showed that the warehouse should be divided into six zones. A seventh zone was added to hold overflow product. This was needed to store excess inventory caused by inventory buildup prior to the busy season. This was necessary due to the manufacturing plants not being able to produce enough during the busy season to meet customer demands. From the list of zones, and the characteristics of the products in each zone, the most efficient storage method was determined. *Figure* 2 describes the zones and the storage method selected for each zone.

Once the zones were defined, the strategy for laying out the zones in the warehouse for high productivity, and low cost was straightforward. Products that were considered hazardous or flammable were assigned to the existing flammable rooms. Zones with fast moving products were place in a zone located close to the shipping area to minimize travel time when picking orders and re-stocking pick locations. Products that moved frequently but in smaller quantities were placed in racks as close to the shipping area as possible. Products picked less frequently were placed in racks further from the shipping area.

Each zone was laid out using a simple strategy. Each product was assigned a fixed picking location and an overflow storage area. Products were assigned picking locations within a zone based on how frequently the product was picked. Products were assigned pick location in descending order of pick frequency. The most frequently picked item was assigned the storage location closest to the shipping area. The next most frequently picked item was placed next to it. This would minimize travel time because the most frequently picked products were located in the same aisle.

We checked whether this layout would achieve the results using a computer simulation model. The model used current customer orders to determine travel distance using the new layout. The simulation showed that overall travel time would be reduced by 50%. The model also showed that 90% of the line items on those orders were located in the first two aisles of each zone, meaning that for most orders, only a very small part of each zone would be traversed during the picking process. The team agreed that the new layout would significantly improve cost per order by reducing travel time and decided to implement the changes.

IMPROVE ORDER ACCURACY

To get the best results from the re-layout of the warehouse, the team needed the full sophistication of a Warehouse Management System (WMS). The team discussed the functionality they needed from the WMS with the information systems (IS) department and were informed that the current WMS did not support the functionality the team needed. This was a critical setback to the project. After further investigation, the team determined that while the company owned the WMS module, it had never been fully implemented. To support warehouse operations the IS department had written a warehouse locator system that simply recorded the location where a product was placed and retrieved that location for printing on the pick ticket.

Having the functionality provided by the WMS was such an integral part of the team's strategy for improving warehouse operations that they met with senior management to make the case for fully implementing the WMS. After much discussion everyone agreed that to meet the goals that the team had set, the WMS module would need to be fully implemented. The warehouse management system provides the following functionality:

- Assigns operators tasks through the RF devices;
- Splits orders between operators to minimize travel time;
- Improves order accuracy by requiring operators to scan the location and product bar codes;
- Assigns operators to replenish pick locations when they were located close to replenishment stock;
- Interleaves tasks to reduce non-value-added travel time;
- Identifies bottlenecks to management as tasks back up.

It was decided to use an outside computer firm with WMS experience to assist in getting the full WMS up and running.

Figure 3—Cost per order.

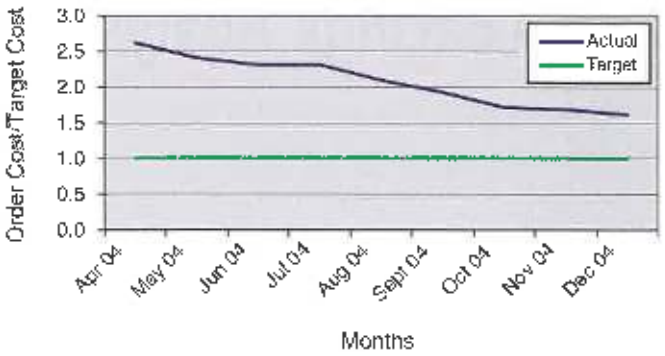
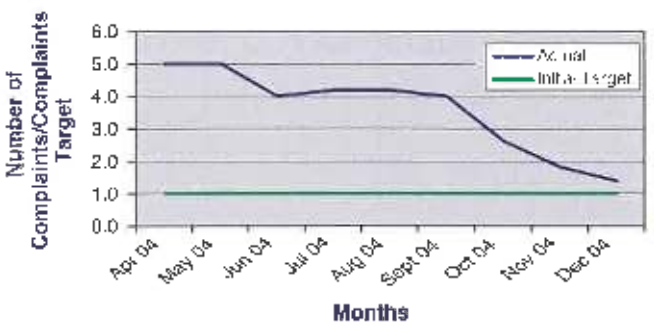


Figure 4—Customer complaints.



IMPLEMENTATION

Making major changes is never easy and this project was no exception. Problems began to appear almost as soon as the project started. Many of the products stored in the warehouse were very heavy and racks had to be designed to accommodate this weight. The rack supplier was unable to supply these racks from stock and had to build them. Unfortunately, there was a worldwide shortage of steel that delayed manufacturing of the racks for two months. This delay meant that the delivery of the racks would not occur until the peak busy season.

The team's next challenge occurred when the lines were painted to designate the floor locations. These disappeared after two short weeks because the paint did not adhere to the floor. To improve adherence, the floor was chemically etched, the lines repainted, and the floor was then re-sealed. This produced crisp bright paint lines that are adhering well. Unfortunately, this caused a month's delay in the schedule.

When the racks eventually arrived the installation went well. Populating the racks with the correct product was more of a challenge. This warehouse had always operated on a 100% random storage system. Now we were requiring not only that the correct product go in a location, but the correct batch number as well. Despite the steep learning curve, the entire inventory eventually was put in the correct locations.

The challenges continued when the team discovered that many products had more than a 30-day supply. In fact, some products had more than a year's supply. The short-term solution was to use the overflow zone.

RESULTS OF THE PROJECT

Figure 3 shows the drop in cost per order expressed as a percentage of target cost. To date they have achieved 50% of the goal and they are confident that when the warehouse management system comes fully online, they will achieve the goal of having costs lower than the industry average.

The second goal of the project was to reduce the number of customer complaints due to warehousing issues. Customer complaints have been reduced by 70%. This reduction in complaints can be directly traced to using bar coded locations and the automatic checking functionality of the WMS. *Figure* 4 shows the reduction in customer complaints. The steep decline in the number of complaints did not occur until the warehouse management system was implemented.

Using benchmarking, this company identified opportunities to reduce order costs and improve order accuracy. The simple strategies to correct the problems have allowed them to improve cost per order and inventory accuracy and to reduce customer complaints due to shipping errors.