

Crossdocking: Just-In-Time for Distribution

Kevin R. Gue

Graduate School of Business & Public Policy

Naval Postgraduate School

Monterey, CA 93943

`kevin.gue@nps.navy.mil`

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Warehousing without inventory

Of the four major functions of warehousing — receiving, storage, order picking, and shipping — the middle two are typically the most costly: storage because of inventory holding costs, and order picking because it is labor-intensive. Crossdocking is a logistics technique that eliminates the storage and order picking functions of a warehouse while still allowing it to serve its receiving and shipping functions. The idea is to transfer shipments directly from incoming to outgoing trailers without storage in between. Shipments typically spend less than 24 hours in a crossdock, sometimes less than an hour.

Crossdocks are essentially transshipment facilities to which trucks arrive with goods that must be sorted, consolidated with other products, and loaded onto outbound trucks. Outbound trucks may be headed for a manufacturing site, a retail outlet, or another crossdock, depending on the application.

What makes crossdocking different than traditional warehousing? In a traditional model, the warehouse maintains stock until a customer orders, then the product is picked, packed, and shipped. When replenishments arrive at the warehouse, they are stored until a customer is identified. In a crossdocking model, the customer is known *before* the product gets to the warehouse and there is no need to move it to storage.

Does that mean that in the crossdocking model the customer (a retail outlet, for example) has to wait some additional time for inbound transportation to the warehouse? Well, yes, but often the added certainty of strictly scheduled deliveries offsets any uncertainty associated with longer lead times (more on this later), and there is no loss to the system. On the contrary, crossdocking, when properly executed, enables firms to eliminate inventory costs and reduce transportation costs, often at the same time.

Motivation

Crossdocking is attractive for two main reasons. In some cases, retailers identify waste associated with holding inventory for sku's with stable, high demand, and see crossdocking as a way to reduce inventory holding costs. The retailer essentially replaces inventory with information and coordination.

For other retailers, and for less-than-truckload (LTL) and small package carriers, crossdocking is a way to reduce transportation costs. For example, individual retail outlets might receive shipments directly from vendors using LTL or small package carriers, leading to excessive inbound transportation costs. Crossdocking is a way to consolidate those shipments to achieve truckload quantities. In one case that we know of, a retailer consolidated orders from more than 100 retail outlets to each of about 100 vendors and had the vendors ship truckload quantities to a crossdock operated by a third-party, rather than sending LTL shipments directly to the outlets. Crossdocking reduced inbound transportation costs and simplified receiving at the retail outlets.

Types of crossdocking

The term “crossdocking” has been used to describe different types of operations, all of which involve the rapid consolidation and shipment of products. Napolitano (2000) proposes the following classification scheme:

Manufacturing crossdocking — receiving and consolidating inbound supplies to support Just-In-Time manufacturing. For example, a manufacturer might lease a warehouse close to its plant, and use it to prep subassemblies or consolidate kits of parts. Because demand for the parts is known, say from the output of an MRP system, there is no need to maintain stock.

Distributor crossdocking — consolidating inbound products from different vendors into a multi-sku pallet, which is delivered as soon as the last product is received. For example, computer distributors often source components from different manufacturers and consolidate them into one shipment in *merge-in-transit* centers, before delivering them to the customer.

Transportation crossdocking — consolidating shipments from different shippers in the LTL and small package industries to gain economies of scale. For small package carriers, material movement in the crossdock is by a network of conveyors and sorters; for LTL carriers it is mostly by manual handling and forklifts.

Retail crossdocking — receiving product from multiple vendors and sorting onto outbound trucks for different stores. Crossdocking has been cited as a major reason Wal-Mart surpassed KMart in retail sales in the 1980's (Stalk et al., 1992).

Opportunistic crossdocking — in any warehouse, transferring an item directly from the receiving dock to the shipping dock to meet a known demand.

The common elements to all of these operations are consolidation and extremely short cycle times, usually less than a day. The short cycle time is possible because the destination for an item is known before or determined upon receipt.

With regard to information, there are two types of crossdocking, sometimes called *pre-distribution* and *post-distribution*. In pre-distribution operations, the vendor prepares the product for direct transfer in the distributor's crossdock. For example, they might price items or attach bar codes. At a minimum, they label the incoming pallets so workers in the crossdock can put them directly into outbound trucks, without staging them. Pre-distribution is good for the distributor because operating costs are lower, due to not having to touch the product, but it is very difficult to orchestrate because the distributor's vendors (and there might be hundreds of them!) must know how much of each sku goes to which final customer, and they must label the product accordingly. Post-distribution operations alleviate this burden, but the crossdock must label items on receipt, meaning higher labor costs to the distributor.

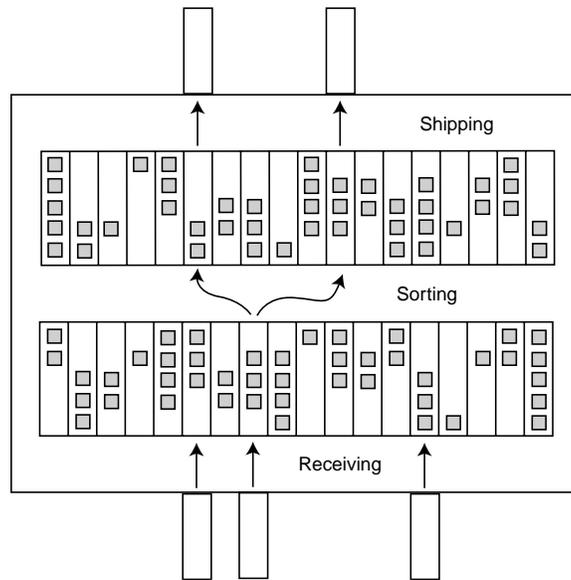


Figure 1: Representation of a two-stage crossdock. Workers put pallets in lanes corresponding to the receiving doors; a second team of workers sorts pallets into shipping lanes, from which a final team loads them onto outbound trailers.

Figure 1 illustrates a retail crossdock in a post-distribution operation. A two-stage system has the advantage of allowing workers in shipping to pick from among several pallets in a shipping queue (which results in more tightly packed loads), while still allowing value-added processing by workers in receiving. The disadvantage, of course, is that pallets are handled an additional time, and the crossdock must be wide enough to accommodate two queues, resulting in additional labor cost due to travel. Were the distributor able to arrange pre-distribution with its vendors, they could eliminate one of the queues and handling costs would go down significantly (Bartholdi et al., 2001).

Product selection

Generally speaking, a product is a good candidate for crossdocking when its demand meets two criteria: low enough variance and high enough volume. In this sense, crossdocking is very much like Just-In-Time manufacturing, which

is most viable when demand has low variance and there is high enough volume to justify frequent setups (or alternatively, setups are inexpensive). In fact, Napolitano (2000) calls crossdocking “JIT in the distribution arena.”

In the extreme case that demand for a product is constant, the warehouse can arrange to receive the right quantity on the right day, and simply move the product to the shipping dock. If demand is uncertain, crossdocking is difficult because matching supply and demand is difficult. In addition to having low variance, demand for the product must be sufficient to warrant frequent shipments. If demand is too low, frequent shipments lead to excessive inbound transportation costs, and the warehouse would be better off holding stock rather than crossdocking.

One strategy that retailers use is to have centralized buyers determine what gets shipped to stores, instead of the stores themselves; that is, it is strictly a push distribution system and there is no need to carry safety stock. The buyers have effectively taken *all* variance out of the demand (from the retail outlets, not from the customer). Retailers like Wal-Mart and Ross Stores use this technique.

A good product for crossdocking is also relatively easy to handle. For example, Home Depot chooses which products go through its crossdocks after carefully analyzing current inbound transportation costs and ease of handling. Items such as lumber and awkward industrial supplies are all taken directly to the stores, rather than being run through the crossdock, because any savings in transportation costs would be offset by excessive handling costs.

Supply chain relationships

From a management perspective, crossdocking is a complex enterprise, involving extensive coordination between the distributor and its suppliers and customers (Schaffer, 1997).

Implementing a crossdocking operation often means that channel partners will experience increased costs, or at least a few headaches along the way. On the supply side, the vendor may be asked to deliver smaller shipments more frequently, or to attach price tags or bar codes. On the demand side, a customer may be asked to order only on certain days, or to allow a few more days lead time for delivery. All of these requirements lead to extra costs and coordination for channel partners, and the distributor should expect to pay

for these services. Of course, the savings associated with crossdocking must overcome these extra costs for the system to be viable.

There is also an increased requirement for quality in receiving. Because the goal of crossdocking is to immediately transfer products to outbound trucks, there is no time to inspect quality on the receiving dock. Ideally, this would eliminate counting as well, although this level of confidence is rare.

Increased communications between channel partners is another requirement, and often a big obstacle. The distributor must know what is on each inbound truck before it arrives, the carrier must know the required delivery window, and so on. The most common way to handle these needs is through Electronic Data Interchange (EDI) systems.

Case studies

Home Depot

Home Depot operates a crossdock in Philadelphia that serves more than 100 stores in the Northeast. Home Depot's culture allows store managers a great deal of autonomy with regard to product selection, inventory levels, and so on. In the past, each store ordered from vendors separately, and orders were sent in LTL shipments directly to the stores. Home Depot now uses crossdocking to reduce costs from the vendor by consolidating orders among its stores and ordering in truckload quantities from vendors.

Here is how the new system works: Each of the 100+ stores orders from each vendor on a specific day of the week. The vendor consolidates all orders and sends truckloads of product to the crossdock in Philadelphia. There, workers transfer products to trailers bound for individual stores, so that outgoing trailers contain products for a single store from many vendors. Transportation costs are lower because shipments into and out of the crossdock are in truckload quantities.

Wal-Mart

Wal-Mart distributes two types of products from its distribution centers: *staple stock* and *direct freight*. Staple stock includes items that Wal-Mart customers expect to find in the same place at every Wal-Mart, such as toothpaste and shampoo. Direct freight is stock that Wal-Mart's central buyers

procure in large quantities and push out to stores. This is stock that may be “here today and gone tomorrow.”

In the distribution center, there is an inventory of staple stock items. When they are requested by stores, workers pick the orders and ship them. Direct freight items are handled much differently. They arrive on pallets and are put immediately into flow racks, from which workers pick cases on the other side. Wal-Mart’s central inventory system predetermines how many of each sku each outlet will receive, and workers pick to those quantities. Direct freight is in the warehouse for less than 48 hours, so Wal-Mart essentially eliminates all inventory holding costs. At one distribution center in California, direct freight accounts for a whopping 60% of all items shipped.

Costco

The “warehouse concept” made famous by Costco is all about reducing logistics costs, and crossdocking is at the center of the strategy. Because the outlet (itself a warehouse) displays pallet quantities, crossdocks in the Costco system receive and ship pallet quantities. At one distribution center in California, 85% of all pallets move across the dock in tact; the remaining pallets are broken down and sorted by case in a lay down area. By not breaking most pallets at the distribution center, Costco saves labor costs that other retailers have to pay for order picking, packing, and shipping.

Costco currently uses a post-distribution system, meaning that they attach labels to pallets after receiving them. In the future, they hope to have their vendors attaching those labels for them, so they can avoid all touch labor in the warehouse.

FedEx Freight

FedEx Freight is the new name for American Freightways and Viking Freight, both inter-regional LTL carriers that were merged under their parent FedEx name. Pickup and delivery drivers are out during the day delivering shipments and gathering freight that must be transported that night. In the evening, drivers return to a crossdock, where workers unload freight, sort it, and load it onto outbound trucks. Those trucks travel during the night to their destinations, where the freight is unloaded and sorted onto delivery trucks the next morning. Crossdocking gives the LTL carrier economies of

scale that allow cost-effective transportation to areas with relatively little freight flow.

Questions

1. Describe a retail environment that is *not* amenable to crossdocking.
2. Imagine a firm that distributes to large urban retailers as well as small rural ones. If the firm were to use a crossdocking model, would you expect service to the two types of retailers to differ? Why or why not?
3. For a firm that uses crossdocking to reduce inventory holding costs, aren't they simply pushing the inventory (and the safety stock) further up the supply chain? Is there net gain then?
4. What operational advantages do you see to establishing pre-distribution operations? What types of objections might a vendor raise? How would you negotiate in light of those objections?

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