

# Effective Supply Chain Management

by Michael Donovan

The complexities of getting material ordered, manufactured and delivered overload most supply chain management (SCM) systems. The fact is, most systems are just not up to handling all the variables up and down the supply chain.

For years, it was thought that it was enough for manufacturers to have an MRP or ERP system that could help answer fundamental questions such as: What are we going to make? What do we need to make the products? What do we have now? What materials do we need, and when? What resources/capacity do we need and when?

Manufacturers need to know a lot more today to have a truly effective supply chain. There are a number of fundamental weaknesses in the old system logic. Many planning and scheduling systems in use today assume that lead times are fixed, queues do not change, queues must exist, capacity is infinite and backward scheduling logic will produce valid load profiles and good shop floor schedules. These assumptions are totally illogical, and following them causes many schedule compliance problems. An effective fix is first to streamline operations and then to apply predictive, preventive forms of advanced planning and scheduling.

SCM involves two flows. Information flow signals the need to start the flow of material. In a supply chain, the fast flow of high-quality information and material is inextricably linked and of paramount importance to SCM success. Untimely or low-quality information virtually guarantees poor performance.

Manufacturers need to develop flexible supply chain processes that can adapt to the needs of various customer segments. They must also develop supply chain strategy, processes and supporting systems that conform to current and future requirements.

Generally, an effective SCM approach must focus on:

- Flexible supply and production processes that can very quickly respond to changing customer demand
- A short-cycle, demand-driven order-to-delivery process
- Accurate, relevant information that is available on demand throughout the supply chain

Throughout the supply chain, there are some absolutely critical and predictive questions your system should accurately and quickly answer:

- When *will* specific orders *really* ship?
- Which orders *will* be late?
- Why *will* these orders be late?
- What are the specific problems that *are* delaying the schedule?
- What are the *future* schedule problems and *when* will they occur?
- What *is* the best schedule that can be executed now?

If management can answer predictive questions, its decisions will greatly improve. Preventive actions can offset what were once unforeseen problems. The supply chain will be managed more effectively and improve chances of gaining a competitive advantage.

In the early 1980s, with the introduction of just-in-time production to the United States, many were convinced that pull signals (kanbans) and instant material deliveries would eradicate the need for MRP. The announcement of MRP's death was premature, except for firms with simple products and absolute control of supplier deliveries. Those with more complex products requiring more supply sources for more parts discovered that longer lead times and demand and supply variability were still issues to be dealt with.

Simply put, the more diverse your product line and the more complex your products, the more valuable MRP is for planning raw material needs. This is not to say pull logic is not use-

ful for raw material planning, because it is. Yet for most, it is not necessary (or desirable) to put every part number from every supplier on a pull system.

Scheduling production with MRP push logic, however, is like pushing a rope. You don't know what direction it will go. Pull systems will eventually dominate the entire supply chain—to customers and from suppliers, as well as internal material movement. Yet, MRP can, and must, coexist with pull scheduling.

Cycle time compression should be the first objective in the order-to-delivery process. Midrange manufacturers often have limited clout with suppliers, making across-the-board mandatory lead-time reductions unlikely. While there are many ways to work out mutually beneficial and necessary improvements with suppliers, the real enemy is time. The alternative is to work selectively on supply improvements while using a rationalized inventory deployment strategy to support the first objective—reducing order-to-delivery cycle time.

Good collaborative forecasting, good planning and realistic replenishment scheduling are essential to effective SCM. Further improvements come from redesigning supplier links to make them firm, fast and flexible for the benefit of the entire supply chain. During the transformation, companies have learned the value of minimizing cycle time and having predictable schedules, especially with mass customization. Both are necessary for effective supply chain performance. ♦



R. Michael Donovan is a management consultant based in Framingham, Mass. He can be reached at (508) 788-1100. Other educational material is

available at [www.rmdonovan.com](http://www.rmdonovan.com)

# Cross Docking

The desire to decrease logistics costs has led organizations to investigate more profitable approaches to supply chain management. Three proven, yet not fully integrated, supply chain levers are:

1. Distribution network optimization
2. Shipment consolidation, and
3. Cross-docking

The first, with the largest literature, finds the number and best locations for facilities. The second may be overlooked, but shipment consolidation gives a proven payback whereby less than truck-load (LTL) shipments are combined into truck-load (TL) moves. Shipment consolidation enabled Nabisco Inc. to cut transportation costs in half, reduce inventory levels, and improve on-time delivery.

Now consider the third, cross-docking. **Cross-docking** is a practice in logistics of unloading materials from an incoming vehicle and loading these materials in outbound trailers or rail cars, with little or no storage in between. To say in another way : Cross-docking is the practice of receiving goods and quickly processing them for reshipment (minimum handling, no storage). This may be done to change type of conveyance, or to sort material intended for different destinations, or to combine material from different origins.

In purest form this is done directly, with minimal or no warehousing. In practice many "cross-docking" operations require large staging areas where inbound materials are sorted, consolidated, and stored until the outbound shipment is complete and ready to ship. If the staging takes hours or a day the operation is usually referred to as a "cross-dock" distribution center. If it takes several days or even weeks the operation is usually considered a warehouse. This was first pioneered by Wal-Mart.

Cross-docking aims to decrease costs and improve customer service through continuous flow of items from origin to destination. It is well accepted by the supply chain industry that these operational benefits are achievable, but logistics managers directly involved still must specify the detailed workings of any cross-dock system. Thus, the first part of our paper introduces several approaches to cross-docking and how each is used.

There are at many methods of cross-docking, such as – 1) Manufacturing cross docking, 2) Distribution Center cross docking, 3) Terminal cross docking, 4) Retailer cross docking, etc. Out of all these, two important ones are described below:

1. **Manufacturing cross-docking:** "Current" (finished goods move right off production line to a waiting truck) or "future" (items produced are staged for later shipment) are the categories.
2. **Distribution center cross-docking:** We distinguish between "current/active," "current/same day," and "future." In the first, items are loaded immediately on a vehicle; current/same day products are staged on a conveyor for release later that day. Future cross-docking involves the holding of items until they become current/same day.

Since most shipments spend less than 24 hours there, the best candidates for cross-docking are fast-moving items with fairly constant demand. Napaolitano (2000) and Jue (2001) describe cross-docking as "just-in-time for distribution systems."

## Chapter 15

### Sourcing Decisions in a Supply Chain

---

#### ● SUPPLIER SCORING AND ASSESSMENT

Selecting a supplier requires a two-step solution :

1. Performance analysis of each vendor,
2. Vendor rating and selection

However, selection of a supplier from a list of many suppliers can also be done through a Multi Criteria Decision Making (MCDM) technique, such as Analytic Hierarchy Process (AHP).

#### Performance analysis

When comparing suppliers, many firms make the fundamental mistake of focusing only on quoted price, because many other factors affect the procurement decision. While evaluating suppliers, the following factors need to be considered:

1. Purchase price (quoted price)
2. Pricing terms
3. Replenishment lead time
4. On-time delivery
5. Supply flexibility
6. Delivery frequency / minimum lot size
7. Supply quality
8. Inbound transportation cost
9. Information coordination capability
10. Exchange rates and tariffs
11. Supplier viability, etc.

#### Supplier selection based on cost only (page 472)

Suppliers should be evaluated based on several costs : material cost, cycle inventory holding cost, safety inventory holding cost and transportation cost (or ordering cost).

Here is an example which compares two suppliers based on three costs: material cost and holding cost (cycle inventory holding cost, safety inventory holding cost).

$\sigma_D$  = Standard deviation of demand = 300 pieces

Average demand  $D$  = 1000 pieces/week

Lead time  $L$  = 6 weeks

Standard deviation of lead time  $S_L$  = 4 weeks

$$\begin{aligned}\text{So, standard deviation of demand during lead time } \sigma_L &= \sqrt{L\sigma_D^2 + D^2S_L^2} \\ &= \sqrt{6 \times 300^2 + 1000^2 \times 4^2} \\ &= 4066.94 \text{ pieces}\end{aligned}$$

Safety stock = 1.645 standard deviation units (Z standard deviation units)  
=  $1.645 \times 4066.94 = 6690$  pieces.

Price of safety stock =  $6690 \times 0.97$  \$

So, safety stock holding cost =  $6690 \times 0.97 \times 0.25 = 1622$  \$/year. (6)

$$\begin{aligned}\text{Total inventory cost} &= \text{Material cost} + \text{cycle inventory holding cost} + \text{safety inventory} \\ &\quad \text{holding cost} \\ &= (4) + (5) + (6) \\ &= 50,440 + 970 + 1622 = 53,032 \text{ $ /year}\end{aligned}$$

#### Final decision:

It is found that the total inventory cost for the existing supplier (52,696.75 \$) is less than the total inventory cost for the new supplier (53,032 \$). Thus, the decision should be to continue with the existing supplier.

#### **Supplier selection based on many factors (Vendor rating)**

(Source: Tony J. R. Arnold, "Introduction to Materials Management, Prentice Hall, USA, 1991, pp. 118).

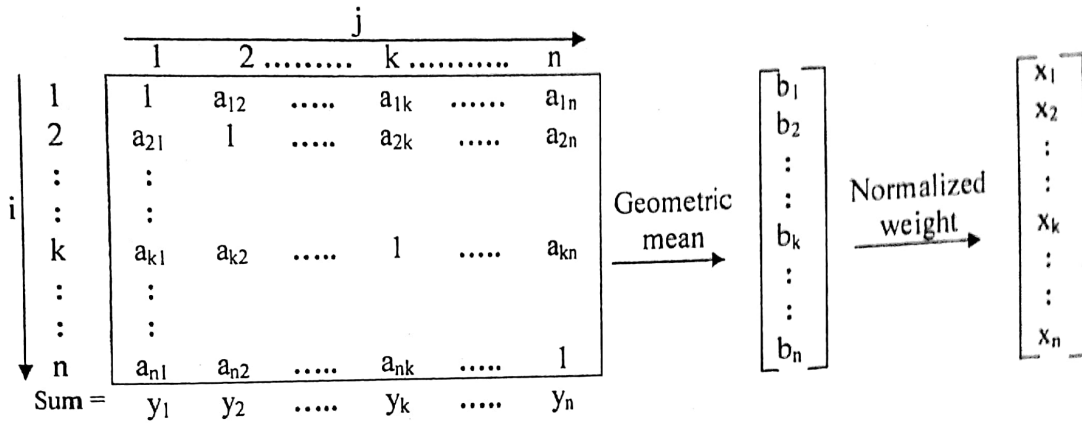
Vendor rating schemes are designed to assist the purchasing department to select the most appropriate supplier. Basically, all schemes require that some quantitative data is obtained for each supplier on some performance factors, explained earlier. For instance, let's assume the following performance analysis factors:

- Quality
- Delivery
- Cost
- Service and reliability

The importance of each of the above is not necessarily the same. In such a situation, weightages can be assigned to each factor, an example being given below:

This method can be used in a wide range of problems, like supplier selection, machine or equipment or method selection, marketing options, etc. The main advantage of using AHP method is its ability to handle a complex problem in a simple way.

It compares different alternatives (i) against different attributes (j) through an  $n \times n$  judgment matrix as follows:



Where, i and j are alternatives or attributes to be compared, and  $a_{ij}$  is a value which represents comparison between alternatives / attributes i & j.

In the matrix,  $y_k = \sum_{i=1}^n a_{ij}$ , where  $k = 1, 2, \dots, n$  and  $j = 1, 2, \dots, n$  (1)

Geometric mean is calculated from the elements of rows as follows:

$$b_k = [(a_{k1})(a_{k2}) \dots (a_{kn})]^{1/n} \quad (2)$$

Normalized weights are calculated as follows:

$$x_k = \frac{b_k}{\sum_{k=1}^n b_k} \quad (3)$$

Saaty's measure of consistency is done in terms of Consistency Index (C.I.), as follows:

$$C.I. = \frac{\lambda_{max} - n}{n - 1}, \text{ where } \lambda_{max} = y_1 x_1 + y_2 x_2 + \dots + y_n x_n = \sum_{k=1}^n y_k x_k \quad (4)$$

Some randomly generated consistency index (R.I.) values (proposed by Saaty) are:

n	1	2	3	4	5	6	7	8	9	10
R.I.	0	0	0.58	0.9	1.12	1.24	1.32	1.41	1.45	1.49

Acceptability of alternative or attribute is measured in terms of Consistency Ratio (C.R.):

Evaluation at level 1:

Attributes	Reputation	Quality	Technical know-how	Cost	Delivery flexibility
Reputation	1	1/3	1	1/3	1/3
Quality	3	1	2	1	1
Technical know-how	1	1/2	1	1/2	1/2
Cost	3	1	2	1	1
Delivery flexibility	3	1	2	1	1

For the assignments in the above judgment matrix,

$n = 5$

$C.I. = 0.003675$

$C.R. = 0.00328 = 0.328\% < 10\%$ , so acceptable.

Similarly, matrices are evaluated at other levels.

Evaluation at level 2: for attributes

Reputation

	Vendor 1	Vendor 2	Vendor 3
Vendor 1	1	3	3
Vendor 2	1/3	1	1
Vendor 3	1/3	1	1

$n = 3$

$C.I. = 0.001$

$C.R. = 0.00172 = 0.172\% < 10\%$

So, acceptable.

Quality

	Vendor 1	Vendor 2	Vendor 3
Vendor 1	1	1/1.5	1/1.3
Vendor 2	1.5	1	1.2
Vendor 3	1.3	1/1.2	1

$n = 3$

$C.I. = 0.0$

$C.R. = 0\% < 10\%$

So, acceptable.

Technical know-how

	Vendor 1	Vendor 2	Vendor 3
Vendor 1	1	1/2	1/3
Vendor 2	2	1	1/2
Vendor 3	3	2	1

$n = 3$

$C.I. = 0.00366$

$C.R. = 0.00631 = 0.631\% < 10\%$

So, acceptable.

Cost

	Vendor 1	Vendor 2	Vendor 3
Vendor 1	1	1/2	1/1.5
Vendor 2	2	1	1.5
Vendor 3	1.5	1/1.5	1

$n = 3$

$C.I. = 0.00196$

$C.R. = 0.00338 = 0.3380\% < 10\%$

So, acceptable.

Delivery flexibility

	Vendor 1	Vendor 2	Vendor 3
Vendor 1	1	5	3
Vendor 2	1/5	1	1/3
Vendor 3	1/3	3	1

