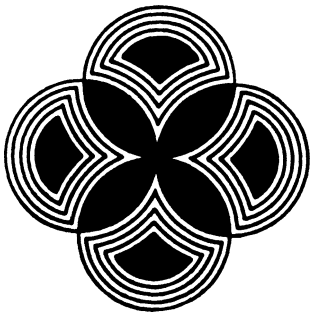
M O D U L E

VI

Distribution Inventory Planning and Control



Learning Objectives

After completing this module, you will be able to

- Complete a DRP/MRP problem
- Describe and compare the types of Distribution Inventory Systems
- Discuss the impact of Just-in-Time (JIT) on distribution

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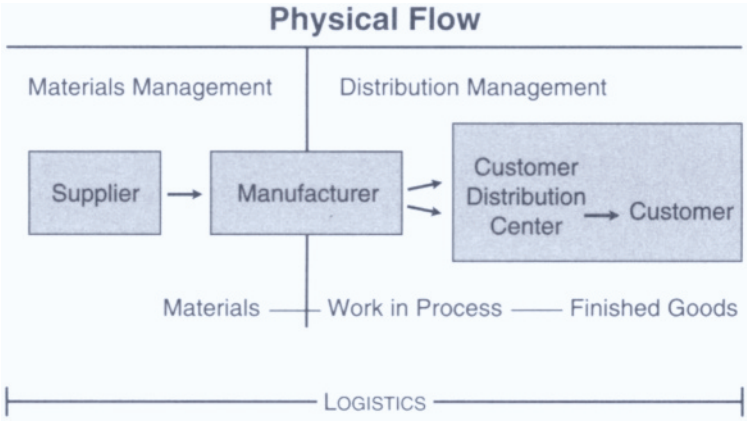
DELIVERING PRODUCTS

The physical distribution of products flows through a variety of geographically placed distribution points. The distribution points could include the manufacturing facilities, distribution centers, wholesalers and retailers, or the distribution of goods may flow directly to the customer or through various levels as shown below. Inventory is carried at each location based on criteria such as cost, desired customer-satisfaction level, and efficiency of the distribution operation.

The physical distribution of products must be considered in all types of manufacturing environments (build-to-stock, build-to-order, and assemble-to-order) as well as in wholesale and retail environments.

Following is a diagram that shows how physical distribution and material management fit together to make up the logical flow of goods.



LOGISTICS

Logistics includes the activities of acquiring material (procurement), moving material through the manufacturing environment (manufacturing of products), and distribution (getting the products to, or close to, the final customer).

- ✓ **Distribution requirements planning** involves meeting customer requirements and receiving and storing goods at the lowest cost possible. In most cases distribution encompasses the process of customer order entry through delivery of the product to the customer.

- ✓ **Distribution resource planning (DRP)** extends distribution requirements planning into the planning of key resources contained in a distribution system: warehouse space, workforce, money, trucks, freight cars and so on.

- ✓ **Distribution inventory** includes all inventory anywhere in the distribution system. In most cases, it is finished goods inventory; however, in some cases parts, subassemblies and assemblies can be part of distribution inventory. In all cases this inventory is very expensive; the objective is to manage it by moving it through the distribution system as quickly as possible.

TYPES OF DISTRIBUTION SYSTEMS

Distribution systems are loosely classified as either a push or a pull system.

- **PULL SYSTEMS—**In a pull system decisions for replenishment of the inventory are made at the field warehouse. This is in contrast to the centralized decision making in the push systems. The advantage of a pull system is that control is placed with the field management team. The potential disadvantage is the lack of visibility between warehouses, which could result in excess inventory.

- **PUSH SYSTEMS—**This pushes the inventory from a central factory out to the warehouse. *Replenishment decisions are made at the manufacturing site.* The advantage to the push system is the economies of scale provided by a central source such as the factory. The disadvantage is the lack of flexibility in responding to local customer requirements.

  The most common push system is distribution requirements planning (DRP). This is an MRP-like process using time-phased order point techniques to reflect the demands and planned future orders for all levels of the distribution system.

  Forecasting of independent demand, together with actual sales data is exploded through the various levels of distribution. The point of connection between the manufacturing system and the distribution system is the master production schedule (MPS).

  In a push system of distribution inventory planning and control, a central control point such as a factory establishes the amount of inventory each distribution center will receive.

  This centralized push system is mainly used in situations where the distribution center and the manufacturing center are owned by the same company.

  The decision of how much and when to send products is made by the central decision-making department, based on forecasted demand. The subject of forecasting, forecast errors and their impact on inventory, was discussed in Module III.

FORECASTING STOCKKEEPING UNIT (SKU) REQUIREMENTS

The forecast for SKU requirements in a distribution system usually falls into two types: forecast based on aggregate (total) demand and forecast based on allocations.

1. Aggregate forecasts are completed for each distribution center and then summed, to determine the total forecasted demand. This forecasted demand would include the required safety stock to buffer against demand fluctuations.

2. Forecasting by allocation starts with a forecasted total and then allocates a portion of this total to each distribution center.

Irrespective of which forecasting method is used, the impact of change to the original forecast must also be considered. A sample of these changes includes changes in customer and in product demand, lead times, material availability, and unplanned interruptions in the work flow, such as strikes.

As a result of these changes, safety stock must be maintained at a level to ensure that inventory is available when the customers want it. In addition, safety lead time may be used to buffer against fluctuation in demand. This simply involves the expansion of quoted lead time.

Equal Run-Out/Fair Share Quantity Logic

Regardless of how carefully the planning process is carried out, sometimes there is not enough product to be distributed. When this occurs a technique called "fair share" or "equal run-out allocation" may be employed. This method simply attempts to allocate material or parts fairly to each location.

This is a method of allocating scarce products/inventory with the purpose of keeping as many customers happy as possible.

This method is used in a centralized push distribution system to provide inventory to as many distribution centers as possible. The importance of the customer, size of order, and contractual obligations are also considered when determining the equal run-out or fair share quantities.

INTEGRATING DISTRIBUTION AND MANUFACTURING SYSTEMS

The following figure shows a simplified sequence that the distribution system and the master production schedule (MPS) would follow in order to integrate the distribution and manufacturing system.

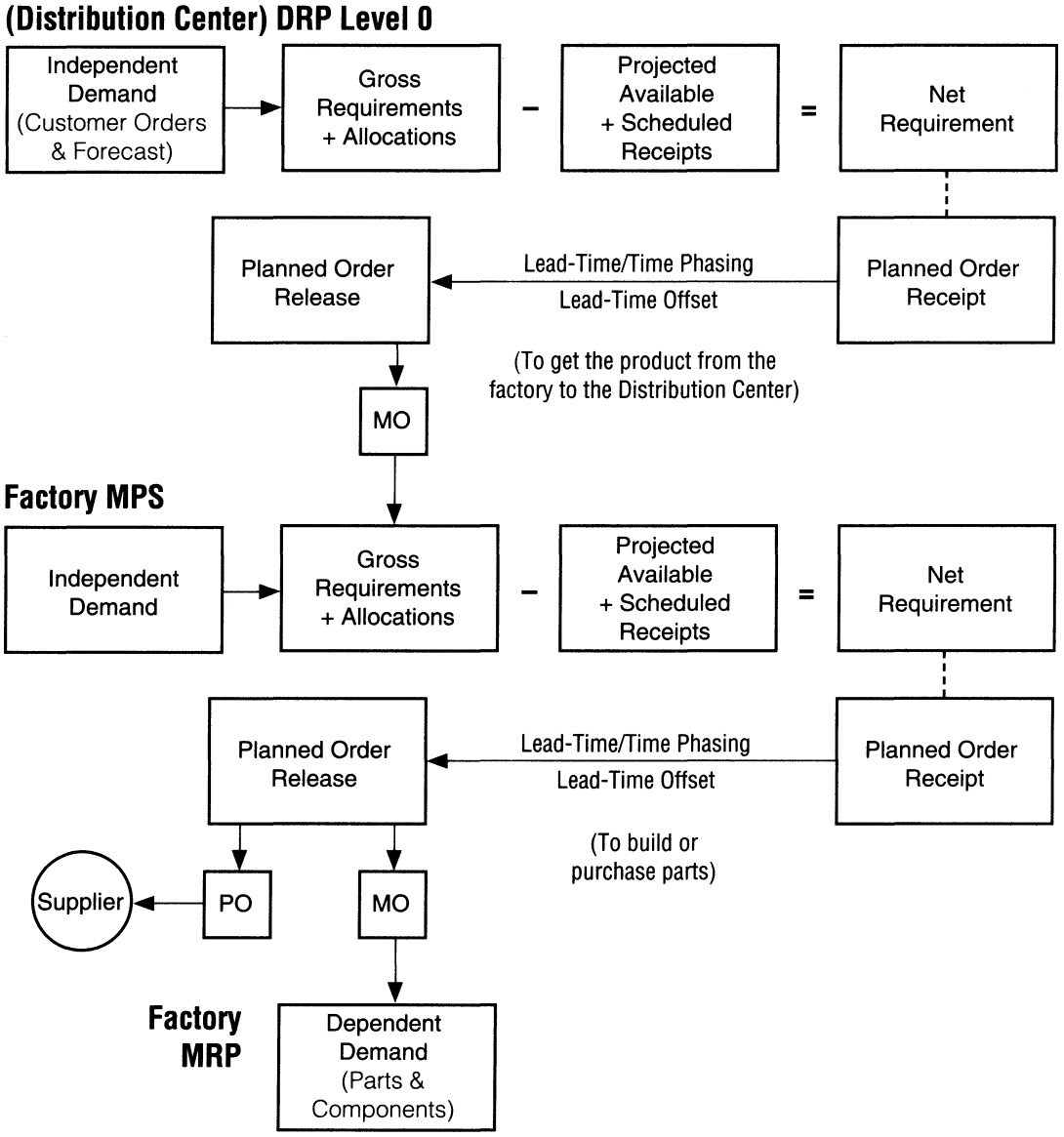
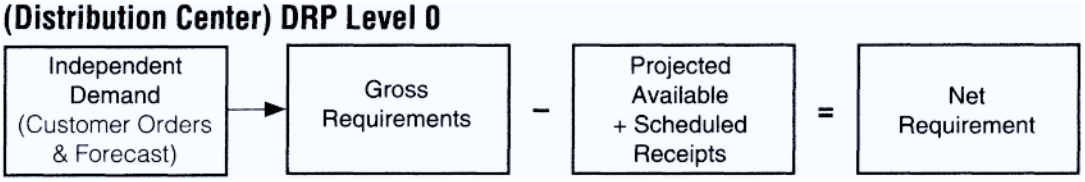


Figure 6.1: Process for Determining Gross-to-Net Requirements

The MPS section of Figure 6.1 is discussed in the following pages.

Time-Phased Order Point (TPOP)

TPOP is used in a distribution system to schedule the right item at the right time at the right place and in the right amount. The logic used in the MRP system in used here, as well.



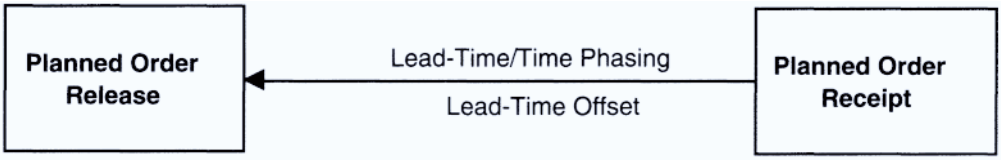
- **Independent Demand:** Independent demand comes from sources such as the forecasts, customer orders for end items, as well as repair parts. Independent demand is demand for an end item or service part that is unrelated to the demand for other items. The DRP and MPS contain only independent demand.

- **Gross Requirements:** Gross requirements are the total dependent and/or independent requirements for a product or part prior to accounting for the item currently on hand or scheduled to be received.

- **Projected Available On-hand Inventory:** On-hand inventory is the quantity that is physically located in stock, and shown in the inventory records as being physically in stock. Periodically, this on-hand inventory is reconciled to the financial inventory (book inventory).

- **Scheduled Receipts:** Scheduled receipts are orders already released (opened) either to the distribution center (customer order), manufacturing (production, manufacturing, or shop orders), or to suppliers (purchase orders). Orders released in a prior planning horizon are scheduled to arrive during the current planning horizon.

- **Net Requirements:** The net requirements are order amounts that remain after on-hand and scheduled receipts are subtracted from gross requirements.

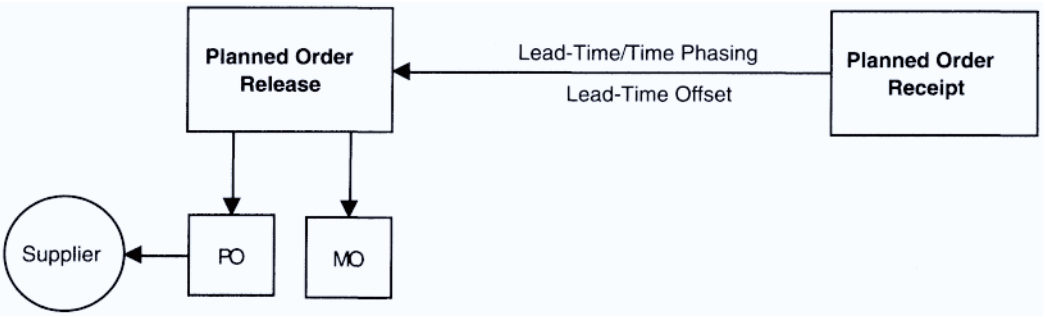


- **Planned Order Receipt:** When there is a net requirement, you must plan to receive an order to satisfy it. If you do not, a material shortage will result. A planned order receipt is the quantity you plan to receive at a future date. Planned order receipts differ from scheduled receipts in that they may change during subsequent planning periods. Scheduled receipts, on the other hand, have been built or are in the process of being built, either by suppliers or internally. Changes to the scheduled receipts are very costly.

- **Lead-Time:** In order to receive an order into the distribution center, you need to determine the amount of time it takes to receive the order from your manufacturing floor or from the supplier. This length of time is called lead-time.

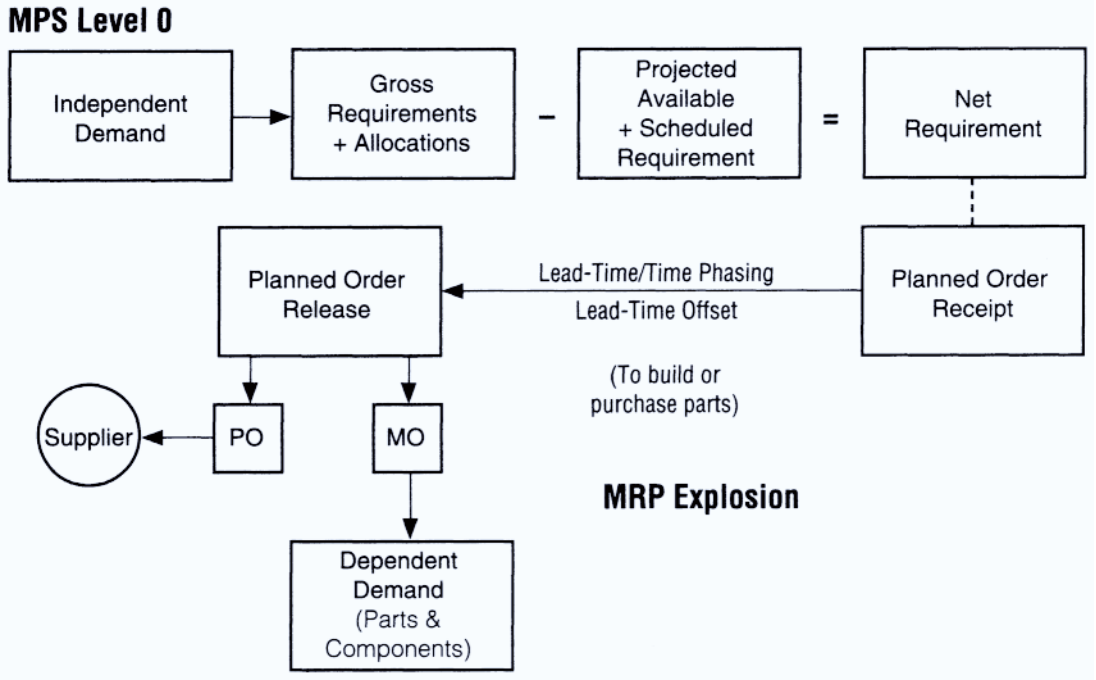
- **Time Phasing/Lead-Time Offsetting:** Time phasing enables you to look into the future in order to plan.

  (This is better than psychic friends.) This lead-time offset is established by determining when the item is needed to satisfy a requirement. This allows the MRP system to schedule a planned order receipt in one time period and the planned order release in an earlier time period. The difference between these two dates is the required lead time to make, buy, and/or deliver.



- **Planned Order Release:** A planned order release suggests an order be created, including quantity, release date and due date. It suggests that a purchase order (PO) or manufacturing order (MO) is to be created. Planned orders exist only within the MRP system, and may be changed or deleted by the computer during subsequent MRP processing if conditions change.

  The planned order release results in purchase orders, which are given to suppliers, and manufacturing orders, which are sent to the shop floor. In the case of an MO, a planned order release at one level creates a gross requirement at the next level.



► **Dependent Demand:** Dependent demand is the demand for all the components required to satisfy the independent demand.

Dependent demand is directly related to or derived from the bill of material (BOM) structure for other items or end products. These demands are calculated, not forecasted. Independent demand is forecasted, and any given item may have both dependent and independent demand. For example, a part may be the component of an assembly and may also be sold as a service part. The MRP represents dependent demand.

EXERCISE 1: Calculations

In this exercise you will build on what you've learned by doing a complete DRP/MPS/MRP calculation for Product F. The gross requirements have been entered for Product F at the Western and Eastern Region Distribution Centers. Lot sizes, lead times, and projected on-hand balances have been entered. For the following situation, determine the planned order releases. *See page 119 in the back of the book for the correct answers.*

Product F—Distribution Center (Western Region)

		Week 1	2	3	4	5	6
Lot size = 250 Lead-time offset = 3 weeks	Gross Requirements	100	50	200	200	200	200
	Scheduled Receipts			250			
	Projected on-hand = 250						
	Net Requirements						
	Planned order receipt						
	Planned order release						

Product F—Distribution Center (Eastern Region)

		Week 1	2	3	4	5	6
Lot size = 300 Lead-time offset = 2 weeks	Gross Requirements	120	120	140	140	160	
	Scheduled Receipts						
	Projected on-hand = 300						
	Net Requirements						
	Planned order receipt						
	Planned order release						

Product F—Factory Finished Goods—MPS

		Week 1	2	3	4	5	6
Lot size = 400 Lead-time offset = 1 week	Gross Requirements						
	Scheduled Receipts						
	Projected on-hand = 750						
	Net Requirements						
	Planned order receipt						
	Planned order release						

JUST-IN-TIME IN A DISTRIBUTION ENVIRONMENT

Just-in-Time (JIT) manufacturing evolved from work done in the area of quality control from the early 1950s through the 1980s. JIT programs were influenced by continual process improvements. From a broad view, just-in-time is a philosophy. From a very narrow view, just-in-time means scheduling the right part, at the right place, at the right time.

Total quality control and total quality management have been the driving forces behind the evolution toward JIT.

Just-in-Time is a philosophy that is just as applicable in the distribution and transportation areas as it is in the manufacturing facilities.

In addition to the cost reduction, Just-In-Time principles aid in cost reduction by

- **Improving Housekeeping:** Housekeeping revolves around removing all items that are not really essential to performing the operation or the job, for example, excess parts, personal items, tools that are not being utilized and defective material. The first step, then, is to clean up the work area, organize the distribution center and terminal, and define who is responsible for keeping that work area clean. The result is better organization and improved visibility and work efficiency.

- **Reducing Inventory:** By minimizing the amount of inventory in the distribution channel, the overall level of inventory and the related cost to carry the inventory can be reduced. This inventory reduction also reduces lead time and contributes to faster time-to-market. Physical inventories at the distribution center are faster, easier, and more accurate.

- **Reducing Lead Time:** The reduction in overall distribution lead-time in turn allows for faster deliveries to customers.

- **Improving Material Handling:** Improved material handling and the subsequent reduction in unplanned downtime also reduce lead-times.

- **Simplifying Processes:** Provides a smooth flow from supplier to customer: Once processes are documented, waste (such as excess inventory, effort, etc.) can be eliminated. This elimination of waste simplifies the process, which in turn allows the product to flow through these processes faster. As products are ordered from the customer, the order can be pulled through the entire supplier/manu-facturer/ distribution system faster.

  Stocking points can be reduced at some of the intermediate locations—not only for the supplier but to the customer, as well.

  By using local suppliers, small quantities with faster deliveries can be achieved. Many shippers are using standard-sized reusable containers to cut cost and reduce delivery times. This also makes cycle counts easier and faster. In some cases, the return to the supplier of an empty container is a signal to deliver.

- **Promoting Organizationwide Involvement:** For the types of changes that have been discussed to take place, all functional groups must be involved. JIT is an organizationwide concept, not just a manufacturing responsibility. It is impossible to do JIT supplying if your customers are not doing JIT.

CASE STUDY, PART 3; JADE Inc.

In the last part of the work you did for JADE Inc., you prepared a list of qualitative and quantitative factors the company should consider when locating a new warehouse. The company has now asked you to expand your work. They would like you to prepare a list of cost elements they should include when determining the overall cost of a new distribution system. Note: In your answer, expand on the items covered in this book aaid include items based on your experience.

Part 2: After considering the total cost of transportation and storage, the percentage of the cost of goods sold, for each item, needs to be considered. However, all costs are still an expense, and any reduction in them has a potential positive impact on profit, assuming customer satisfaction is not jeopardized.

Now list some of the ways distribution costs may be reduced:

- _____
- _____
- _____

See page 120 in the back of the book for suggested answers.

CASE STUDY, PART 4: JADE Inc.

In your last presentation to the executives of JADE Inc., you recommended that your contract be extended in order to do a study on the various types of transportation methods they should use in their new distribution system.

They accepted your proposal, and asked you to list the advantages and disadvantages of each method using the following chart. Note: In your answer, expand on the items covered in this book and include items based on your experience.

Method of Transportation	Advantages	Disadvantages
Air		
Water		
Railroad		
Pipeline		
Road vehicle		

See page 121 in the back of the book for suggested answers.

EXERCISE 2: Choose the Correct Answer

Answer the following questions. See page 119 in the back of the book for the correct answers.

1. List the types of Distribution Inventory Systems.

_____

_____

2. Which of the following statements best describes Distribution Resource Planning?

I. Same as Distribution Requirement Planning
II. Uses TPOP
III. In addition to product distribution, deals with facilities, people, trucks, etc.

A. I and II
B. III only
C. II and III

3. Which of the following statements best describes Distribution Requirements Planning?

I. Uses TPOP
II. Uses MRP Logic
III. Is the same as CRP

A. III only
B. II and III
C. I and II
D. All of the above

4. Which of the following statements describes a push system?

I. A system of replenishing field warehouse inventories
II. Uses decentralized decision making
III. Is included in EOQ

A. I only
B. II and III
C. All of the above

5. In allocating inventories to warehouses, the equal run-out method accomplishes the following:

A. An equal supply at each location
B. The accuracy of the cycle count
C. Minimized inventory investment
D. Maximum production efficiency

NOTE TO THE READER

In this book we've explored the competitive issues facing business today, and you've been introduced to the theory, tools and techniques that can make inventory management possible. We've discussed the objectives and policies, inventory systems, tools and techniques, physical inventory control, and you've had an opportunity to practice using many tools. At this point you have the knowledge and skills necessary to launch and/or support your own continual improvement process. Now, what can you do each day to increase your net worth and make yourself more marketable in the manufacturing arena?

As the future unfolds in front of us and we bring new products to market faster and faster, I'm convinced that the manufacturing formulas presented in this book will play a major role. But the most important role will be played by the portion of the formula that focuses on improving the forecasting process and the subsequent reduction in the forecast error. It is my hope that you will use this formula and the other tools successfully on the job, that you will teach others, and that as a result we will reach the critical mass required to manufacture on an environmentally safe, global basis. Forecasting and Scheduling is the topic of my next book.

Good Luck.