Corporate Office

2809 Millbrook Road
Raleigh, NC 27616
(919) 876-3667
FAX (919) 872-9666
www.tompkinsinc.com

Tompkins Offices

Allentown, Pennsylvania
Atlanta, Georgia
Chicago, Illinois
Dallas, Texas
Irvine, California
Raleigh, North Carolina

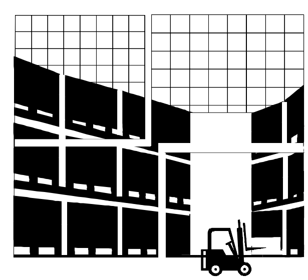
Tompkins Associates International Limited
Cambridge, United Kingdom

Tompkins Associates of Canada Limited
Toronto, Canada

International Associates

Buenos Aires, Argentina
New Delhi, India
San Juan, Puerto Rico
Sao Paulo, Brazil
Sydney, Australia

Tompkins
ASSOCIATES



Inventory: The Unwanted Asset

M-34

TABLE OF CONTENTS

1.0 Introduction 1

2.0 Culture 2

3.0 Manufacturing 3

4.0 Distribution 5

5.0 Warehousing 12

6.0 Partnerships 15
- 6.1 Partnership Definition 16
- 6.2 Identifying Potential Partners 16

7.0 Information Technology Systems 18
- 7.1 Manufacturing Resource Planning (MRP II) 19
- 7.2 Distribution Resource Planning (DRP) 20
- 7.3 Warehouse Management Systems (WMS) 22
- 7.4 Electronic Data Interchange (EDI) 25
- 7.5 Communication Methods 26

8.0 Conclusion 27

1.0 INTRODUCTION

In today’s dynamic business environment, organizations that cannot adapt to change will no longer be in business. Today's customers demand higher quality, more variety, lower prices, and delivery in smaller quantities more frequently. The common denominator that holds these demands together is inventory.

Re-engineering your Inventory Management System requires more than simply installing an MRP II or DRP system, although both are key components to the success. True inventory improvements, those that significantly reduce inventory and have a positive impact on customer service, can only be achieved through a re-engineering effort of the company culture, manufacturing, distribution, relationships, and information technology. Without significant improvements in these areas, your organization will not be performing at its true potential.

Thus, inventory reduction must be centrally focused to be effective. It is necessary to implement an Inventory Management System that minimizes inventories and maximizes customer service. The six key components that make up this global Inventory Management System include:

1. A company culture dedicated to accelerated growth and customer service.
2. Manufacturing focused on reducing customer lead times.
3. A cost-effective distribution network that is highly responsive to customer requests.
4. Efficient warehousing operations that are able to respond to ever- increasing customer requirements.
5. Relationships with customers and suppliers built for mutual benefit and growth.
6. Information technology systems that allow for accurate forecasting and planning.

With inventories drastically reduced, resources can be re-allocated to other functions that better serve the customer. With response time reduced to days or hours, customers can rely on you for quick, on-time delivery. Finally, with the aid of business partnerships to improve customer service, your competition will be unable to match your service levels.

Because change is a constant factor in today's business environment, our organizations must continuously improve to remain competitive and alive. In the past years, our organizations have made significant improvements in quality, manufacturing costs, and customer service. For many organizations, it is becoming increasingly difficult to identify additional improvement initiatives that significantly impact the organization. Improvement in inventory management is the next step. This monograph will provide an understanding of the impact inventory has on our overall competitiveness and the importance of a strategic plan for success.

2.0 CULTURE

The first required component for a successful Inventory Management System is a company culture that is conducive to change. Since the company culture is defined by top management, it is management's responsibility to instill the necessary culture that allows for continuous improvement. Without continuous improvement and employees who are adaptable to change, any type of change in the inventory system will be met with resistance and may never achieve the expected results. In addition, as employees face change head-on, inventory management will have what it takes to succeed.

When top management sets the proper tone for company culture, it effectively tells the organization that it believes that its employees are its number one resource. Inherent to this policy is the belief that the employees have the necessary knowledge and skills to provide ideas and make decisions that are beneficial to the organization. When a company takes this belief one step further and implements a team-based approach to continuous improvement, many successes can be realized, including a successful inventory management system. To instill this company culture, top management must first understand the difference between leading and managing.

Leadership is interested in the long-term gains and vision of the future, while management makes short-term decisions and focuses on day-to-day activities. When the company leaders make the conscious decision to believe in their employees and lead the organization through a period of change, employees maintain confidence that the organization will provide an opportunity for them to contribute constructively.

Defining where your Inventory Management System is going is essential for it to be successful. This definition will be a part of your organization's Model of Success. This Model of Success contains the ideas and information that will guide the organization into the future and includes:

- Vision - A description of where you are going
- Mission - How you are going to get there
- Requirements of Success - What it takes to get there
- Guiding Principles - The values you practice as you pursue your vision
- Evidence of Success - To determine if you are going in the right direction

With this Model of Success in place, teams, including the inventory reduction team, will have the necessary tools to focus their decision making in the direction that the organization is heading.

In most organizations the inventory management team is made up of warehouse employees. For this team to be successful, all barriers between the organizational silos must be removed. Therefore, team members will need to represent all functions of the organization that are responsible for inventory (sales, marketing, engineering, manufacturing, warehousing, distribution, and in some cases vendors and customers). Combined with the knowledge and understanding of how each function contributes to inventory management, the use of teams can achieve realistic and significant improvements.

With the proper culture in place, the organization is ready to take on many of the challenges that await. One of the first challenges is to produce the product cost effectively while improving customer service. At this point your organization can re-engineer its manufacturing system.

3.0 MANUFACTURING

Over the last several years, national and international efforts have taken place to reduce manufacturing costs in order to remain competitive in the global marketplace. Great strides have been made in reducing manufacturing costs. A portion of those costs can be attributed to inventory reduction.

There are basically three types of inventory: raw materials, work-in-process (WIP), and finished goods. The method of manufacturing directly impacts the levels of inventory required and the levels of customer service that can be attained. The single manufacturing component that is responsible for lead times, customer service, and the creation of inventory is the production lot size. There is a direct connection between production lot sizes, lead teams and WIP inventory.

Some of the biggest discussions in trade magazines, newspapers, and business conferences revolve around the issues of Quick Response (QR), Fluid Distribution, Efficient Consumer Response (ECR), and Just-in-Time (JIT). The main objective of these issues is to reduce the lead time from raw material vendors to end user by integrating the supply chain.

In traditional cost accounting principles, the production lot size is determined by the lowest total cost, taking into account set-up costs, inventory carrying costs, unit costs, and the forecasted demand for the product. To reduce production lot sizes, the equation suggests that unit or carrying costs must increase or annual demand or set-up costs must be reduced. The only valid scenario is to reduce set-up costs. This has traditionally been interpreted as a limited number of set-ups and longer production runs. The concept sounds valid: the lower the number of set-ups, the more product that can be produced. However, this concept does not take into consideration the customer's requirements. As customers demand more choices at lower costs, organizations must produce more variety in smaller quantities.

Any type of lead-time reduction requires many factors for success, including customer/supplier partnerships, discussed later. It is impossible to reduce cycle times without a decrease in inventory. In fact, manufacturing lead times are directly related to the amount of WIP inventory (measured in hours, days, weeks) present on the factory floor. Therefore, lead time reductions must be coupled with a WIP reduction.

Consider the analogy of WIP as the water level in a river. When a dam releases water downstream, the water is at a higher level than the rocks; a rafter can navigate the river with greater ease. As the water level decreases, the larger rocks surface and the river is more difficult to navigate safely without damaging the raft. Thus, as you reduce your WIP, obstacles will present themselves. At first, the obstacles will appear severe. It is our job as managers to either remove these rocks from the river, or skillfully navigate around them. As the water level continues to lower, additional obstacles will arise and additional skills will be required to successfully navigate the river. This is continuous improvement.

So, the goal is to reduce WIP. How can we reduce WIP without fatally disrupting operations? Reducing production lot sizes, the concept behind cellular manufacturing, is the first step. To illustrate the coupling of lead time, WIP, and lot size reduction, we will use an example. In this example, we are going to manufacture the world's most beloved product; the widget. As everybody knows, the basic widget requires only three operations to transform raw materials into finished goods. One manufacturer of widgets informs us that the first operation requires one minute, the second operation requires five minutes, and the final operation requires three minutes. Figure 3.1 illustrates the dynamics of a 1,000 unit order performed in a single batch and Figure 3.2 shows the impact of performing the same order in five batches.

In Figure 3.1, processing the order requires nearly four weeks (9,000 minutes) to complete. In addition, we must provide queuing space for all 1,000 units in WIP. In contrast, Figure 3.2 shows that the same order requires less than two and a half weeks (5,800 minutes) to complete and, at the same time, only 400 units are on the floor at any given time. The reduction in lead time becomes even more significant when lot sizes are further reduced, operations are more closely balanced, and additional operations are required. Reduction of WIP and batch sizes also improves other competitive measures of product pricing and higher quality products.

Product pricing can be addressed in two ways. We can either have higher margins through reduced product costs or increased sales using lead-time reduction to increase our competitiveness. To illustrate, let's assume that the industry lead time for widgets is three weeks. If we operate as in Figure 3.1, it would normally take four weeks to complete. To maintain market share, we must either begin the order a week before we get it (based on a sales forecast), or use overtime and premium freight to effectively make a four-week process fit within three weeks. These scenarios negatively impact our profit margins. On the other hand, using Figure 3.2, the process could essentially begin with a firm order and still be completed within the given lead time. In instances where operations are closely balanced and the numbers of operations are higher, the reduction of lot sizes may result in lead times that are significantly lower than the industry standard. In these cases, your customers may actually be willing to pay a premium for the items to acquire them in significantly less time, all without adding costs to the manufacturing process.

Quality will improve with the reduced lot size approach. If product defects are found after the manufacturing process is completed, Figure 3.1 suggests that all 1,000 units will be scrapped or reworked, adding to the already excessive lead time. In Figure 3.2, however,

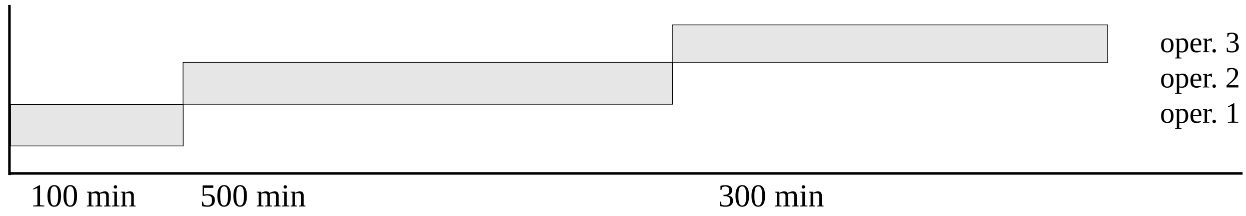


Figure 3.1

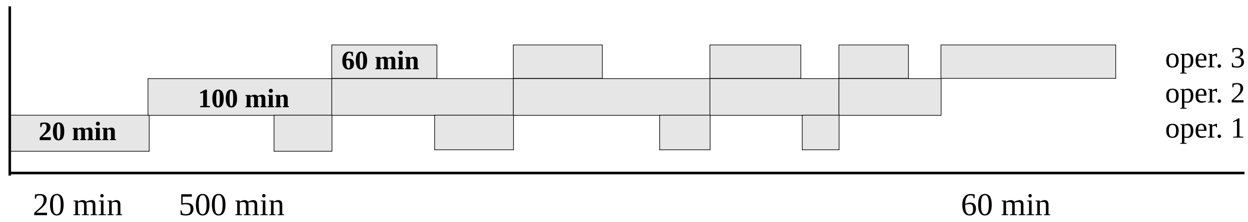


Figure 3.2

even if the defect was realized after the first batch was completed, only 400 of the 1,000 units would have been processed. If the defect was found after the first batch, the number is reduced to 200 units, whereas in the one-batch process, the entire 1,000 units are still affected.

Reducing the lot size means that additional set-ups will be required. To economically achieve lot size reduction using cost accounting principles, additional set-ups must correspond to a reduction in set-up times. Manufacturing 101 tells us that we want to keep our machines utilized to their greatest extent. Additional set-ups suggest that our machine utilization is going to be lower than it was previously. In this example, in order to achieve machine utilization like before, we may have to do five set-ups in the time it takes for one. Although this may be desirable, in nearly all cases this is unnecessary. Due to the nature of manufacturing, there are only a handful of operations that limit throughput. All others have excess capacity that either increases WIP or remains idle. It is the bottleneck, or near-bottleneck workstations that will require resources to reduce setup time.

For example, Toyota Motor Company has developed a series of objectives and techniques that can effectively allow you to reduce set-up times. Table 3.1 identifies the four objectives and six techniques to achieve set-up reduction.

A thorough understanding of the relationship between lead-time WIP inventory and lot sizes is essential to reduce inventory within the manufacturing environment. It is equally important to understand the impact on your organization's overall competitive measure of success. These changes within the manufacturing arena will impact the distribution arena.

4.0 DISTRIBUTION

After years of focusing efforts in the manufacturing arena by improving productivity and quality, executive management is now looking at distribution as the new frontier for customer service and cost control. In addition, customers are no longer satisfied with just quality products. They are now demanding quality service and increased value.

To truly understand the significant role distribution plays in an organization's competitiveness, it is necessary to understand the three utilities of a product: form, time, and place. The form of the product is a function of the design, functionality, and quality. This utility is dictated by engineering and manufacturing. The time and place utilities define customer service, having the right product in the right place at the right time, and are controlled by distribution. This is where distribution has the opportunity to significantly improve the competitive nature of the organization. The definition of distribution is nothing more than the management of the inventory while in motion (transportation) and at rest (warehousing). Therefore, distribution is basically the management of inventory to achieve customer service.

It was once believed that to improve customer service, it was necessary to maintain high levels of finished goods inventory to prevent stock-outs. Although customer service levels may have been met, the actual competitiveness of an organization might have actually deteriorated due to higher inventory levels, resulting in increased carrying costs and decreased cash flows. Arbitrarily reducing inventories, as many organizations have attempted, can be equally damaging by reducing customer service levels. The challenge we all face is determining the right inventory levels that balance customer service with inventory investment. Another challenge is the combination of marketing and its impact on SKU proliferation, and manufacturing and its

Table 3.1 Objectives and Techniques to Achieve Set-up Reduction

1. **Separate the internal set-up from the external set-up**. Internal set-ups are activities that must occur inside a machine and require that it not be in operation. External set-ups are activities that occur outside the machine and can take place while the machine is in operation. The key is to be certain that all external set-up operations are completed before the machine is taken out of production. Only internal set-up activities should be performed when a machine is out of operation.
2. **Convert as much of the internal set-up as possible to external set-up**. Thus, by altering the machine or the set-up activities, the total set-up time can be minimized.
3. **Eliminate the adjustment process**. A significant percentage of all internal set-ups is time for adjustments. By altering the machines or the set-up, a standard setting or an automatic setting can be established that eliminates the need for adjustment.
4. **Abolish the set-up**. One way to eliminate set-ups is by standardizing parts and thus eliminating the need for a set-up. Another approach is to have parallel operations performing different operations and, by a switching mechanism, use only the operations that apply to each product.

Table 3.1 continued

The six Toyota techniques for applying these concepts are:
1. Standardize the external set-up actions. By standardizing the methodology for preparing dies, tools, and materials, the set-up operations become less of a craftsman task and more of a routine production task.
2. Standardize the machines. The portions of the machines that affect set-up methodology should be standardized. Standardize all functions that will result in a more routine set-up operation.
3. Use quick fasteners. Time-consuming nut-and-bolt fastening should be replaced with quick-release, quick-fastening devices.
4. Use a supplementary tool. Instead of mounting a tool into a machine, it is often quicker to preset the tool into a supplementary tool and then have a quick insert of the supplementary tool into the machine.
5. Consider multi-person set-up crews. Significant portions of the set-up can be done simultaneously by different people.
6. Automate the set-up process. The set-up of some machines can be done at the touch of a button.

desire to maintain long production runs. This combination can easily hinder all attempts to improve the distribution function. The final challenge lies in meeting management's desire to have the lowest cost distribution network with maximum customer service and high inventory turns. Individually, these three desires are advantageous. A combination, however, will prove that they actually defeat one another. For example, maximum customer service for an organization might require a network of 10 distribution centers fed by three supply sources. This network will invariably require greater inventory levels and greater costs to operate than a network of three distribution centers. The real goals in distribution are to establish a level of customer service that meets or exceeds the customer's expectations and to minimize inventories and reduce costs.

Once the customer service levels have been set, an organization must then re-think the distribution philosophy: push system vs. pull system. Each philosophy has its merits and its downfalls, but they have at least one thing in common; it takes discipline for the systems to work. Regardless of the distribution philosophy, any multiple location distribution system must balance inventory levels between the points of origin and the points of distribution. The primary goal of such distribution systems is to provide the customer with an accurate and quick response to their orders at the lowest possible cost. This is accomplished by operating the system with the minimum inventory necessary to meet demand, and minimizing transportation and space costs.

At the foundation of defining inventory levels is the accurate sales forecast. Since a forecast is management's best guess of the future, the reliability of the forecast is suspect. This creates the need for "safety stock" inventory in order to prevent stock outs that diminish customer service. Furthermore, distribution centers (DCs) generally are not designed to handle the peak inventory level, except when sales are consistent throughout the year. So, during peak inventory periods, the product is either backed up at the plant or stored in a temporary off-site location. These two factors, the need for safety stock and the inability to handle peak inventory levels, greatly impact the choice of a distribution system.

The first approach is to push all the products from the plants to the DCs based on projected sales within a DC's region. The second approach is for the DCs to pull products from the plants based on actual customer demand. In a push system (see Figure 4.1), because all of the product is deployed based on the sales forecast for each region, an inaccurate sales forecast incurs several severe penalties, including:

- Increased safety stock
- Larger DCs
- High stock transfer costs

The pre-order deployment of product directly increases safety stock as more DCs are added to the system. Each location must have enough safety stock to not only cover systemwide forecast inaccuracies, but also to handle the individual regional sales fluctuations. This increase in safety stock then necessitates the need for larger DCs to handle the increase in product inventory. When large regional sales fluctuations occur, products must be shipped between DCs to accommodate customer order demands. These fluctuations increase the transportation cost systemwide and incurs additional handling and shipping costs are due to an increase in material handling, shipping, product loss, and damage. The more points of distribution in the system, the greater the penalties incurred for unpredicted order fluctuations.

Using the push distribution philosophy, the penalties of higher safety stock, larger DCs, and increased safety stock are not the only penalties that the system may incur. By building large inventories at each DC, product rotation and the ability to utilize crossdocking are greatly reduced. Without crossdocking abilities, all products must be unloaded, staged, taken to a storage location, stored, pulled from a storage location, staged, and loaded for shipment. In a crossdocking mode, the products are only unloaded, staged, and loaded for shipment. The crossdocking approach allows for the elimination of much of the material handling of the product.

A push system does present several positive and cost-effective benefits including the following:

- Smaller manufacturing plant warehouses
- High customer service level
- Full truckload plant to DC shipments

The only warehousing activity needed at the plant is the area required for dock staging. This allows the plant to utilize its space for production and eliminate the need for a full warehouse staff. By deploying the product to the regional DCs, it enables the plants to build

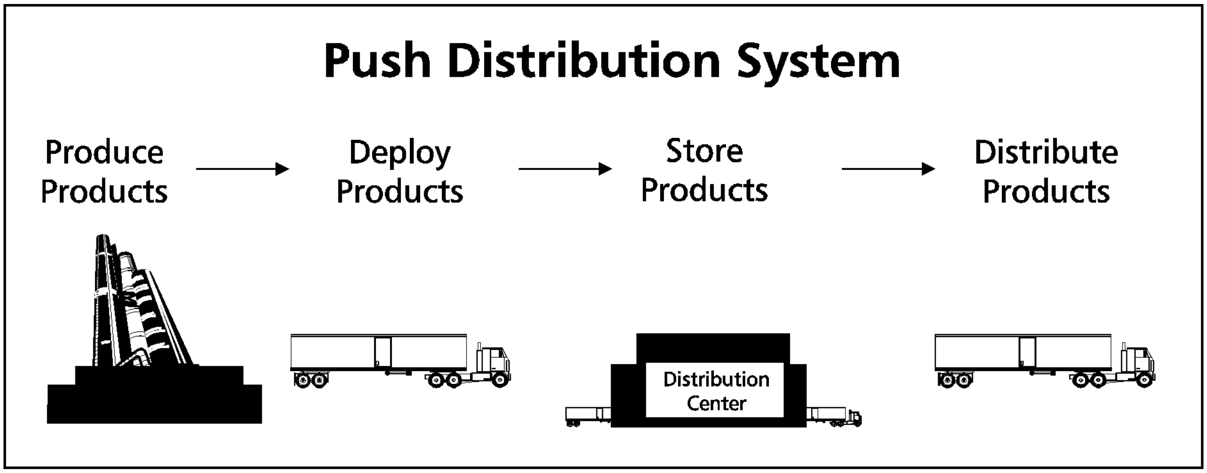


Figure 4.1 Push Distribution System

full truckload quantities and reduce systemwide transportation costs. A push system functions most effectively when sales patterns are consistent and accurately forecasted or there are a limited number of SKUs and DCs.

In a pull distribution system (see Figure 4.2), an inaccurate sales forecast has a less significant impact on the distribution system for two reasons. First, the forecast is not required within a regional area, only at the global level. Actual customer demands at the DC level trigger replenishment activity from the plant. Second, all fluctuations in demand are corrected by changing the production schedule at the production source, not at the regional DCs. In a pull environment, an order from a customer generates an order from the DC, which then leads to a production run to replenish the plant warehouse. In an ideal pull production environment, the facility would produce the product(s) at the time an order is received. When the order is complete, the product would immediately be shipped. However, this type of production operation would be extremely expensive to build and operate. Realistically the plants will stock a "buffer" inventory and pull products from this buffer to ship to the DCs. The DCs then have the ability to crossdock incoming receipts to fulfill customer orders.

A pull distribution may experience significant potential problems including the following:

- Large on-site plant warehouses
- Slow order fill time (lower customer service level)
- Increase in less-than-truckload shipments

The larger on-site plant warehouses occur as a result of inventory being stored at the point of origin rather than at the point of distribution, as in a push system. These on-site plant warehouses increase the size of the plant, the plant warehouse staff, and may also reduce the plant's ability to expand production areas in the future. One way to reduce the size of the on-site warehouse is to shorten the production runs. In general, the investment in production equipment to increase capacity, improve efficiency, reduce maintenance, and reduce changeover time is better than investing in warehouse space. A slower

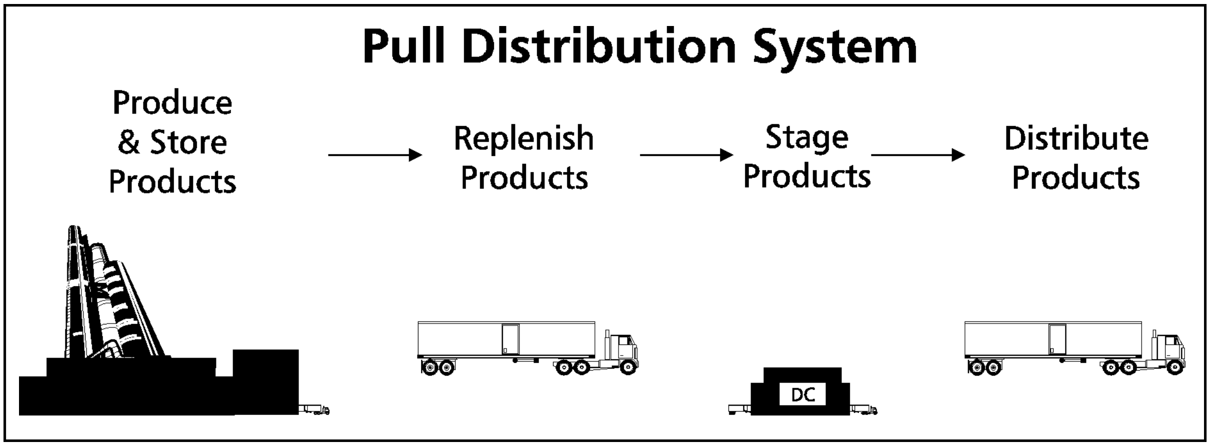


Figure 4.2 Pull Distribution System

order fill time reduces the customer service level. As orders take longer to reach the customer, the future sales growth may slow or even decrease. Balancing the lead time for customer orders, inventory to fill those orders, and manufacturing lot sizes becomes extremely critical to limit the potential for lost sales.

The final potential penalty occurs when customer orders are placed. The combined demand for orders in a region generally does not equal full truckload (FTL) quantities. To increase the number of FTLs, additional orders need to be batched, which will further reduce response times. When orders cannot be combined to create FTL quantities to a DC, the transportation cost of an order increases significantly. This additional cost may be offset by eliminating stock transfers between DCs as occurs in a push system.

Now that sales forecast inaccuracies have less impact on a pull system, the following benefits can be realized:

- No stock transfers between DCs
- Lower safety stock
- Lower overall system inventory
- Direct plant to customer shipment opportunities

The buffer inventory maintained at the plants, serves as the system inventory and handles the reallocation of products to the DCs when sales fluctuations occur. This eliminates any DC to DC stock transfers. In addition, by storing all the inventory at the plants, the safety stock is reduced, because only systemwide sales fluctuations, rather than regional and systemwide sales fluctuations, affect product inventory. This in turn reduces the overall system inventory and the required warehouse space. The final benefit of a pull system comes from the opportunity for shipments to be made directly from the plant to the customer. For large customer orders from one plant, that plant can ship the order directly to the customer. This reduces costs of transportation and handling, reduces DC traffic, and improves response time and customer service. A pull distribution system functions most effectively in an environment with a variety of production and distribution points and a large number of SKUs in the system.

There are significant benefits in both push and pull systems as well as potential problems. For many organizations, a hybrid approach that utilizes the gains of both systems is often best (see Figure 4.3). This hybrid approach utilizes the benefits of a push system for the more popular SKUs and a pull system for the slower moving SKUs. This results in a smaller warehouse at the plant to store the slower moving items, while pushing FTL to the DCs for the popular items. This hybrid of push and pull is the system that offers the most benefits including:

- Reduction or elimination stock transfers between DCs
- Utilization of FTL shipments between plants and DCs
- Reduction of overall system safety stock
- Improvements in opportunities cross-docking at the DCs
- Direct plant-to-customer shipments
- High customer service level

In order to determine the type of distribution system that best fits each individual operating environment, it is first necessary to identify both the present and the projected influences on distribution including:

- Transportation costs and methods
- Inventory carrying costs
- Product storage and rotational requirements
- Damage costs
- Expansion needs and costs
- Projected growth
- Production capacity
- Production cycles
- Customer demands and needs

Analysis of this data will provide the necessary conformation to determine the proper approach. If this discussion of push vs. pull distribution has brought on more questions than answers, perhaps it is necessary to pursue Third Party Logistics firms. For many organizations today, distribution, as we have already suggested, has become an area in which to gain a competitive advantage. Unfortunately, some organizations do not have

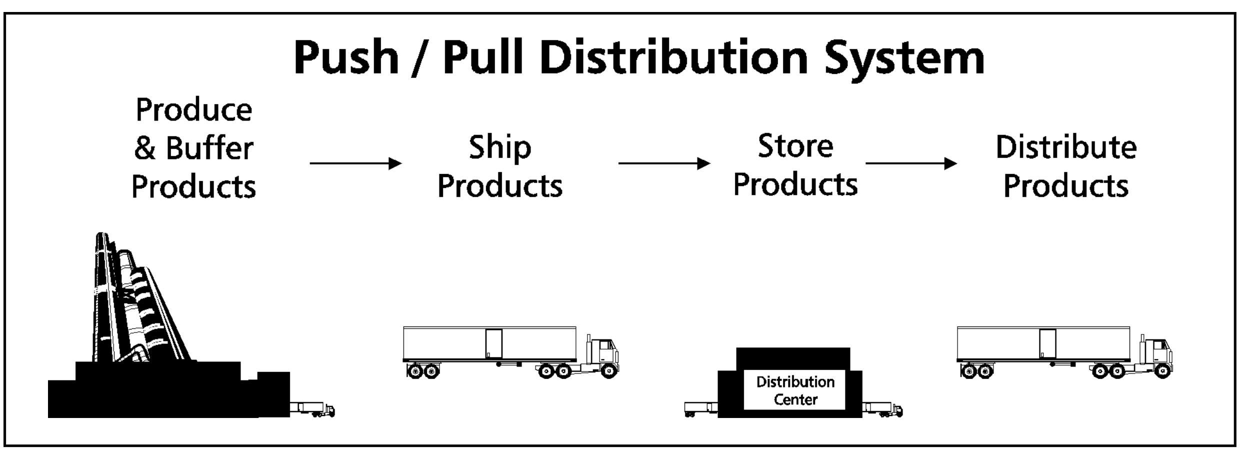


Figure 4.3 Push/Pull Distribution System

the necessary resources to improve their distribution function. These organizations need to pursue Third Party Logistics. Third Party Logistics firms have proven systems and can spread the cost of innovative and state-of-the-art technology over multiple client organizations. Third Party Logistics firms have been around for many years, but have recently become invaluable to many organizations in their quest for competitiveness. In addition, these firms provide a wide range of services that can be tailored to your needs. Table 4.1 lists a sample of services provided by Third Party Logistics firms.

In the final analysis of any distribution system, one will find that no two systems function alike, and over time, any one distribution system must adapt to various external and internal influences in order to operate efficiently. The real questions are how efficient is your distribution system and how efficient can it be?

Table 4.1 Third Party Logistics Services

Freight Payments	Warehousing
Customer Clearance	Returns
Carrier Selection	Display Building
Rate Negotiation	Subassembly
Vehicle Leasing	Packaging
Claims Processing	Kitting
Hazardous Materials	Labeling
Freight Tracking	Order Processing
Fleet Management	Customer Service
Vehicle Maintenance	EDI
Driver Leasing	Information Systems
Insurance	Data Processing
Multimodal Coordination	Inventory Control
Financing	Documentation
Consolidating/Pool	Sort/Segregate

5.0 WAREHOUSING

Warehousing is the portion of distribution responsible for managing inventory at rest. “Warehousing” is the word that first comes to mind to many when thinking about inventory. This is where the majority of inventory is housed. This is also the group that routinely receives executive orders to cut inventory. Unless warehousing is under the materials management function, much of the waste and excess inventory found in the warehouse will remain in the warehouse and contribute to inflated inventories. The focus here is to identify the areas where the warehouse manages inventory that will serve to reduce costs and improve customer service. Again, before we go slashing inventories, we must remember that arbitrary reductions of inventory can, and often does result in unsuspected lower fill rates due to inventory stockouts. With this in mind, what can warehousing do to facilitate inventory reduction, reduce costs without sacrificing customer service and possibly improve customer service? What we find is an interdependency that must be recognized.

To improve customer service, we need to focus on two issues: reducing the order fulfillment cycle and increasing the order fill rate (ready, available, and undamaged). This is accomplished through inventory accuracy and the reduction of inefficiencies. Cost reductions naturally follow. Let’s look at the initiatives individually.

One of the initiatives to reduce costs is to reduce dependence on the warehouse as much as possible. In a manufacturing environment where the warehouse stores raw materials, organizations should investigate point-of-use storage. According to this concept, receipt of goods is made at the point-of-use (read on the manufacturing floor) and completely bypasses the warehouse (with the possible exception of safety stock). This serves to reduce the amount of storage space required in the warehouse, which in turn reduces the carrying costs assessed against the warehouse.

For point-of-use storage to work, an organization must adopt some discipline and alter the purchasing mentality. Point-of-use works when raw materials, tagged for point-of-use, are ordered more frequently in smaller quantities. Therefore, only those SKUs supplied by reliable vendors can be a candidate for point-of-use. After the potential SKUs have been selected, the next set of criteria should be employed. To get the most for our money, we then want to focus on the SKUs that either require a significant investment or require a great deal of warehousing space. This will result in the greatest reduction in inventory carrying costs.

Another significant area for improvement that allows for reduced inventory and improved customer service is an increase in inventory accuracy on a SKU or location basis. Because accuracy rates in the warehouse are typically bad, organizations are rarely certain that the computer inventory actually represents what is physically in the warehouse.

What happens is that the computer says there is inventory available, but when we go to pick the inventory for an order, there is none available. After frequent occurrences, materials management artificially inflates the inventory to prevent future stock out. The inflated inventories place an unnecessary strain on the warehouse and take up additional space. To reduce inventories and the space to store it, we must be certain that the actual inventory matches the computer inventory. The only true way for high inventory accuracy to occur is through cycle counting.

Cycle counting is nothing more than auditing inventory records throughout the year versus performing the annual physical. This audit, giving more weight to SKUs with higher throughput, provides the opportunity to discover causes of errors and to implement changes to prevent them from occurring in the future. Identifying causes of errors without preventing future occurrences defeats the purpose of cycle counting.

Another way to reduce the space requirements for warehousing is to eliminate excessive inventory due to shrinkage. Shrinkage is made up of three components: obsolescence, damage, and loss. The first two actually tie up valuable space, the third impacts customer service in that inventory you thought was there somehow made its way out of the warehouse. To prevent obsolescence, the warehouse needs an inventory management policy that will reduce inventory. Due to the ever decreasing life cycles of products, obsolescence will continue to grow unless efforts are made to increase inventory turns. The larger your company's inventory position, the greater the risk of obsolescence.

Damage exists in two forms: internal and external. Internal damage is caused within the warehouse and external damage is caused outside the warehouse, typically in transit. External damage can be reduced through improved packaging. Internal damage can be reduced through awareness of value and conscientious material handling. In either case, damaged product somehow manages to work itself in the back corner of the warehouse and grows until the warehouse is full. When full, the warehouse manager will typically request more warehouse space.

Damaged and obsolete inventory should be removed from the warehouse by returning the inventory to vendors, contributing it to charity or a third-party clearing house, or by straight write-off on the books. This accumulating inventory will cause excessive material handling and sets a tone for the warehouse workers that is counter to an efficiently run warehouse.

Control of inventory that reduces or eliminates loss due to pilferage is mandatory to improve the fill rate of customer orders. When product is missing from the location and customer orders are allocated against the inventory, stock outs will occur. A wide variety of tools are available to increase security. Loss due to pilferage can be reduced by implementing a policy that allows only warehouse workers in the warehouse.

After determining inventory levels and reducing obsolete and damaged inventory, it is time to begin evaluating the effectiveness of storing inventory to improve customer service and reduce costs. Two issues need to be considered: equipment storage and handling, and product slotting. The intent of the warehouse is to allocate as much space as possible to storage rather than to aisles. To do this, we need to either reduce the number of aisles in the warehouse or reduce the width of the aisles. Economically, any new equipment needs to be justified against existing methods. To reduce the number of aisles, deeper storage is required. It is important to note that where deeper storage is used, selectivity of product decreases. The storage profile of the individual SKUs must match the depth of storage to reduce the effects of honeycombing. Storage equipment used for deeper storage include double-deep racks, push back racks, pallet flow racks, and drive-in/drive-through racks. To reduce the width of aisles, the material handling equipment must be reviewed, including narrow-aisle reach trucks, turret trucks, and order picker trucks. As space utilization improves, inventory carrying costs reduce.

Product slotting has an impact on customer service which can allow the order picking cycle to be reduced. By slotting the warehouse using an ABC approach, or locating items that typically ship together near each other, the time to pick customer orders can be reduced, eventually to the point of real-time order picking.

Removing inefficiencies from the warehouse improves customer service. Many of the inefficiencies are related to the following:

- Information lag time
- Dead-heading (material handling equipment operating without a load)
- Incorrectly stored material
- Excessive paperwork
- Long travel distances

These inefficiencies are addressed through the implementation of a Warehouse Management System, discussed later.

6.0 PARTNERSHIPS

The term Partnerships is becoming the most overused and misused term to describe the relationship between customers and suppliers today. The intent of partnerships is to increase the competitiveness of the partnering organizations. This translates into:

- Reduced lead times
- Reduced inventory levels (both parties)
- Greater responsiveness
- Increased trust
- Increased margins
- Increased sales
- Improved customer service
- Increased product quality

As the partnership evolves, the purchasing department spends less time hammering and leveraging suppliers and more time addressing the issues above; increasing competitiveness. This is far from the traditional purchasing function.

Consider the traditional characteristics used by purchasing:

1. The best way to cut costs is to maximize competition.
2. Suppliers are interchangeable.
3. Multiple sourcing allows us to maximize our supplier leverage.
4. Share only the required information to address the contract on the table and be sure to hold confidential information on product designs and production schedules.
5. Maintain arm's-length relationships.
6. Pursue short-term contracts to keep the suppliers on their toes and to maximize your flexibility.
7. Evaluate all contracts for cost and play suppliers off one another.

Interestingly, many of the above practices have been implemented while pursuing strategic alliances. It is not surprising that several studies have reported the failure of strategic alliances. What is needed is a shift to partnerships. For this shift from customer/ supplier to partners to take place, we must begin with a true understanding of the word "trust."

Why is trust so important in establishing partnerships? It is because from trust, relationships grow and prosper. It is from trust, that respect develops. From respect comes a willingness to really listen to what others are saying. Listening grows understanding, concern, participation, and then open communications. It is open communications that lead us to positive results, which act as a positive reinforcement for even greater trust. Therefore, without trust there is no partnership and no evolution of mutual objectives, strategies, rewards, and sharing of risk that is required to build partnerships. Trust does not occur between companies, but between people. As a result, partnerships do not occur between companies but between people. Thus, partnerships require a fundamental shift in relationships that occur over time as the trust between people evolves.

6.1 PARTNERSHIP DEFINITION

Just as a relationship between a man and a woman goes through the phases of dating, going steady, being engaged, and marriage, so too a partnership evolves. The equivalent of dating for a couple is to a partnership the "customer-driven" organization. In these traditional relationships, there is little commitment to one another. The partnership equivalent of going steady is invincible customer service and although this is an important step in the evolution of a trusting relationship, it is just the beginning. To move beyond this stage of the relationship, each of the parties must increase their commitment to one another. The partnership equivalent to being engaged is a cooperative relationship where significant planning for partnership (marriage) occurs. The ultimate commitment, of course, is the marriage, or partnership. Unfortunately, when the commitment ceases and communication breaks down, just like in marriages, partnerships sometimes result in divorce.

Obviously, many organizations do not understand that just as it takes two to be married, it takes two to create a partnership. Therefore, in each relationship we must have a supplier and a customer who are both ready for partnership. An important thing to reflect on here is that every organization is the customer to some organizations and the supplier to others. As a result, each organization has first-hand experience in playing on both sides of many potential partnership relationships.

6.2 IDENTIFYING POTENTIAL PARTNERS

Identification of potential partners can be done by the customer looking at their suppliers or by the suppliers looking at their customers. In either case, the identification of potential partners should not be based upon the sales volume in the past or projected for the future. The identification of potential partners should be based upon the opportunity for additional contribution to profit over a five-year planning horizon. Contribution to profit may be obtained by either increasing revenues or reducing costs. Factors involved in a potential partner's ability to contribute to additional profits include:

1. Quality of leadership
2. Understanding of partnerships
3. Focus on quality
4. Level of innovativeness
5. Understanding of time compression

Table 6.1 Relationship Evolution

Between A Man And A Woman	Between People Within Two Organizations
Dating	Customer-Driven Organization
Going Steady	Invincible Customer Service
Being Engaged	Cooperative Relationship Planning for Partnership
Marriage	Partnership

6. Volume of present and potential business
7. Acceptance of change
8. Technical competence and creativity
9. Level of information systems
10. Geographical location/responsiveness
11. Honesty, ethics, and trust
12. Organizational consistency
13. Level of distribution expertise
14. Openness of communications
15. A win/win mindset
16. Flexibility
17. Acceptance of continuous improvement
18. Focus on value
19. Profitability
20. Attitudes toward growth
21. Performance track record
22. Willingness to experiment/take risks
23. History of organizational learning
24. Cultural fit
25. Quality and accuracy of cost information
26. Industry reputation

These factors should be evaluated and a preliminary list of potential partners should be generated. The list of potential partners should be further refined by conducting an on-site visit with the potential partner. This visit should be positioned with the potential partner as a time to better understand the relationship and to review future opportunities. This visit should not be positioned as the first step toward partnering. Many visits will result in a decision not to pursue a partnership and thus, not labeling the partnership concept will minimize the disruption with suppliers where it is best to retain a traditional relationship. Additionally, announcing initially the potential for the creation of a partnership may very well scare off potential partners much in the same way that a young man would scare off a young lady if on the first date he began talking about marriage.

The on-site visit should include a plant tour, some relationship building, and a lot of discussion on the following issues:

1. What are the keys to your success?
2. Why do customers select your product?
3. What changes do you see in your business?
4. What do you see in the future that will change your business?
5. What are you doing now to prepare for the future?
6. What are the greatest opportunities for improvement?
7. What is the one thing that you would like to change if you could?
8. What can we do to help you?
9. What can we do to make our relationship easier?
10. What can we do together to reduce costs?
11. What are the cost drivers?
12. What can we do together to increase revenues?
13. What can we do for one another to increase profits?

The results of some of these on-site meetings will be joint projects. The on-site meetings that do not net joint projects should not be forced to the next level of the relationship. Allow these relationships to evolve at a comfortable pace. The on-site meetings that do result in some joint projects should still be considered as potentials for partnership. Every effort should be made to pursue the joint efforts while demonstrating trust, openness, and a win-win mindset. Many successful meetings, interactions, and continuous improvement projects will need to take place before a relationship evolves into a partnership. Especially early in the process, the focus should be on building trust, communicating clearly, and pursuing continuous improvements, eventually leading to partnerships.

7.0 INFORMATION TECHNOLOGY SYSTEMS

Information Technology Systems will be the necessary tools for reduced inventory and improved customer service. In fact, information is replacing inventory. The quality of information will determine the level of reduced inventory. The four primary information technology systems for organizational improvements are Manufacturing Resource Planning (MRP II), Distribution Resource Planning (DRP), Warehouse Management System (WMS), and Electronic Data Interchange (EDI). As presented in Figure 7.1, these systems lead to quality information and zero information lead times. From here, many improvements are available.

Quality information is the foundation for successful operations. Without quality information, we cannot make quality decisions. Many organizations believe that the justification for these tools are reduced costs and inventory. The justification alone, however, can be made on the basis of increased information accuracy. Without a high level of information accuracy, we cannot expect to begin to reduce labor or inventory. If we try to reduce labor without first obtaining high levels of information accuracy, we can almost guarantee that other areas of our operations will suffer.

Once we have obtained high information accuracy, it is then time to compress the information lead times. This is a critical step because the value of quality information deteriorates over time. It does not benefit manufacturing to know customer requirements one week after starting production. It does not benefit the warehouse to know that the cycle count was 99 percent accurate one month after the actual cycle count was taken. The faster we have the information, the more valuable that piece of information. When information lead times approach zero and the quality of information is extremely high, then we have the opportunity to begin to reduce costs and improve quality.

Quality information and zero information lead times make significant contributions to the improvement of customer service and productivity. These are the keys to reducing costs and improving quality.

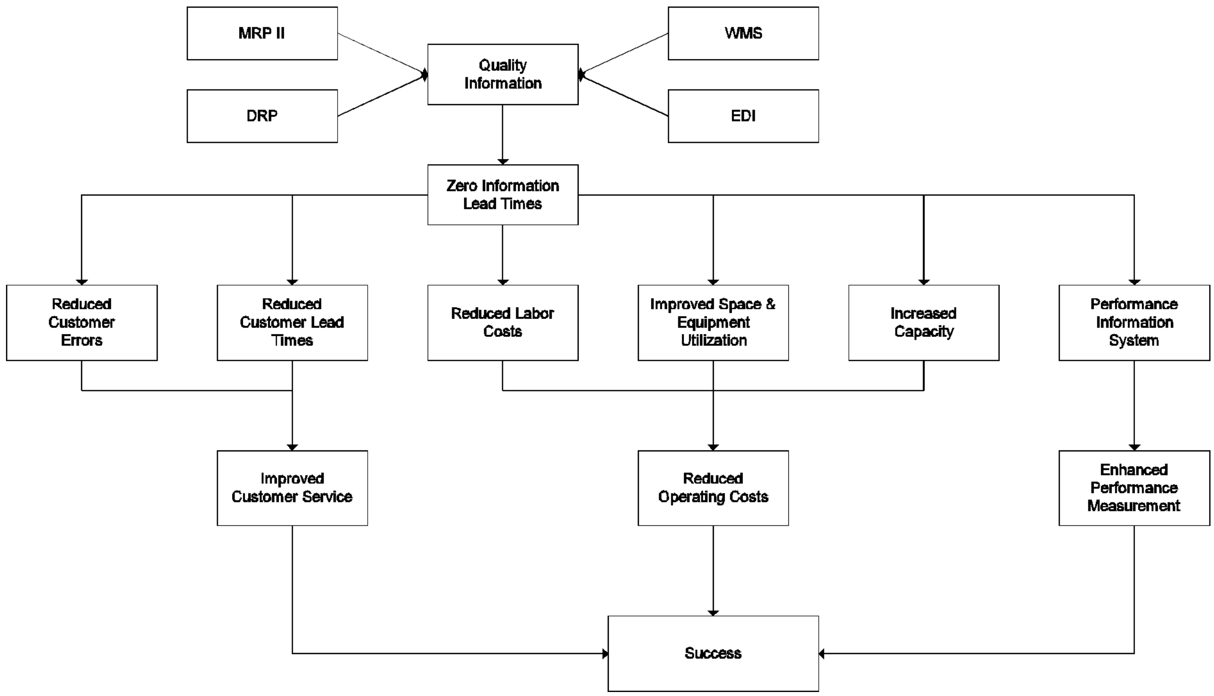


Figure 7.1 Warehouse Information Systems

7.1 MANUFACTURING RESOURCE PLANNING (MRP II)

Despite recent negative publicity surrounding MRP II in trade journals and publications, MRP II is alive and well. In fact, there is really no other way to support a manufacturing environment. Consider the following global questions:

- What are we going to make?
- What is required to make what we need?
- What do we have available?
- What do we have to get?

These four questions are the basis for MRP II. By introducing capacity planning, shop floor control, financial planning, and simulation to this baseline model that all use the same database, we now have MRP II.

If we look again at the four fundamental questions, you would begin to see the impact of real-time, quality information. In most companies, “What are we going to make?” is typically a sales forecast, which continually proves to be inaccurate. “What is required?” is the Bill of Materials (BOM), which is usually outdated and therefore inaccurate. “What do we have available?” is based on our inventory records with typical accuracy between 50 to 75 percent on a SKU by SKU basis for companies not using cycle counting.

Without accurate and timely inputs, the information provided by MRP II will be flawed and the decisions made based on this information will also be flawed. The resources required to address these three inputs are not minimal and certainly not comprehensive. In fact, additional resources will eventually be required to approach world- class status and reach the next level of MRP II success. To reach this level it will be necessary to:

- Develop customer/supplier partnerships
- Simplify the manufacturing process

If you are not currently involved in actively building partnerships with your customers and suppliers, critical information required by MRP II will be severely inadequate, leaving the planners to supplement the information with estimates and guesses. The second issue is to simplify your operations. The idea is to reduce the levels of assembly stated in your BOM. This is critical to MRP II efficiency. To streamline your BOM, you will invariably need to re-layout your manufacturing operation to more closely resemble cellular manufacturing. This is one area that is usually left out in capital budgeting for MRP II implementation. In fact, this is one way to stall your MRP II implementation. If you want successful implementation, avoid these mistakes:

1. Let someone from MIS head the implementation. Since MRP II is a computer system, or so some think, let someone with computer knowledge be the champion, rather than someone with intimate knowledge of the manufacturing process.

2. Forget about spending any money on training and layout improvements. MRP II costs enough, so cut corners in these two areas.

3. Continue to allow your forecasts, BOM, and inventory records to be inaccurate. There is too much effort required to maintain accurate records; approximation will eventually even out.

4. Implement MRP II “cold turkey.” Operate one way on Friday, throw out the old system, and begin MRP II on Monday.

Successful MRP II implementation is difficult. If anyone has told you otherwise, you have been misled. The gains, however, can be tremendous and with proper implementation the following benefits are achievable:

- Inventory reduction of 30 percent of raw materials and finished goods
- Less inventory shrinkage
- Purchasing department with less paperwork and expediting allowing time to work with suppliers resulting in reducing purchasing costs by five percent
- Utilization of equipment by producing items that are needed rather than items that have reached a reorder point and are thought to be needed

If you look at any of the other alternatives, you will find that MRP II is the preferred approach in industry.

7.2 DISTRIBUTION RESOURCE PLANNING (DRP)

As discussed earlier, distribution is playing a key role in the reduction of inventory throughout the supply chain. Traditionally, the amount of inventory kept at each of the distribution centers followed an approach of a safety stock level plus a given period's average worth of stock. Since this does not take into account actual customer demand, excessive inventories result in non-peak periods and stock outs result during peak periods. Even with the awareness of peaks and valleys, without a system built around customer demand, averages and shortages will exist. The problem is that inventories stay stagnant prior to the peak season, rather than building up for the peak season. When the peak season hits, inventories are wiped out and production goes into full force toward the end of the season to satisfy back orders and replenish stock. This causes inventories to build up going into the slow season, resulting in excess inventories in the DCs. By utilizing an inventory management system, such as DRP, the above situation would be dramatically diminished. The major difference between traditional order point theory and DRP theory is that order point determines need based on predefined levels and DRP theory is based on product demand. By knowing when a product is needed, an organization can better prepare the DCs peaks and valleys of demand.

Many variables play a role in disrupting the DCs. Stock build-ups and depletions are normal occurrences in a distribution environment. The most common reasons result from plant shutdowns, installation of new equipment, or potential manufacturing labor problems. Space distribution typically operates during manufacturing shutdowns, and a build-up of inventory is required to fulfill customer orders during the shut down. If properly planned, customer service levels will drop due to stock outs. If new equipment is being installed, build-up of inventory is required during the transition period of bringing down the old equipment and starting up with the new. If operating in a union environment, there may be a period of shutdown during new labor contracts, also requiring a buildup.

DRP can effectively handle these situations by setting up a temporary supply source within DRP and begin building inventory based on the demands from the distribution centers. The forecasts to build this inventory would be similar to that of anticipating peak seasons, with the master production schedule set at zero during shutdown. The depletion will occur normally, first by depleting the temporary location then by manufacturing when the shutdown is over.

Adding or deleting distribution centers also has a significant impact on customer service. If done improperly, again, stockouts will occur. Adding or removing a distribution center in DRP is as simple as changing the bill of distribution and revising the planning information in the new distribution centers. Remember, that by adding or removing a distribution center in the Bill of Distribution, the forecasted demand of the remaining distribution centers will also be affected.

Controlling obsolescence is another key area of control within DRP. Obsolescence is typically identified after it's too late to do anything about it. DRP can be set up such that if planned orders for an item do not occur within a user-defined time frame, DRP will issue an action item. This action item will allow management to decide whether to transfer inventory to a new location or to begin a promotion to reduce inventory, all while manufacturing discontinues production of the item. These common distribution problems are minimized by the ability to look forward and address the possibilities of what might happen if changes are not implemented today. By taking DRP one step further with the use of partnerships and setting up DRP with your customers, the quality and lead time of information are improved. You then have the knowledge of:

- How much your customer is selling
- When your customer will place an order
- What marketplace shifts will affect which products
- If you will meet your forecast
- When you will go on backorder
- When your customer will go on backorder

7.3 WAREHOUSE MANAGEMENT SYSTEMS (WMS)

Customer service is the first area of improvement that an Information Technology (IT) system affects. Without IT systems, many companies experience a deficient due date performance, a higher external error rate, or have to install costly manual procedures to expedite orders and keep errors to a minimum. A WMS, by providing zero information errors, reduces a high external error rate or eliminates the need for manual checking procedures. This is accomplished due to the self-checking, system-directed nature of a WMS. All activities performed are done so in real-time and confirmed by the WMS. All activities are directed by the WMS as opposed to being operator selected or directed. This method ensures that the proper quantities and items are shipped to the proper person and that customer service will improve. A WMS also contributes to reducing customer service lead times. This is possible because the WMS eliminates paperwork and thus eliminates the lead times associated with paperwork. Due to the near instantaneous nature of the information exchange, the warehouse is also able to ship orders closer to their time of placement.

Three operational areas are impacted by a WMS: labor productivity, space and equipment utilization, and warehousing capacity. The first operational area of improvement to be discussed is labor productivity. A WMS will have a significant impact on labor productivity. Labor productivity increases of 15 to 30 percent are not uncommon with a WMS. Labor productivity increases occur primarily due to the following:

- System-directed operations: A reduction in driver search time
- A reduction in deadheading
- Optimization of the pick path
- An ABC supported storage philosophy
- Increased storage density

System-directed operations directly contribute to the labor savings areas stated above.

The underlying theory behind system-directed operations is task management. In fact, task management is the most valuable tool a WMS can have to manage labor. The five factors that must be considered to support task management are:

1. Operator location
2. Equipment availability
3. Activity type (picking, put-away, receiving, shipping, cycle counting, etc.)
4. Queue times
5. Task criticality

Task management is the ability to optimize labor and equipment assignments based on queued labor tasks. Labor task management refers to the fact that the WMS must have the ability to select the next labor task from a queue of all pending activities, and not just from one module, labor subgroup, or customer order. A lift truck operator is no longer solely a put-away operator. The lift truck operator now can perform any warehousing task the lift truck operator is qualified to perform. If an operator has just completed a put-away, the operator does not have to travel back to receiving to pick up another load for put-away. That operator can perform a cycle count near the location of put-away, then perform a pick nearby to be delivered back to the dock. After the pick, the operator can then do a put-away as it is the closest pending activity. Task management expands the pool of tasks available to an operator, thus minimizing travel distance. The WMS looks for the best available task to complete in all activity types, rather than within one activity type. Minimizing travel distances results in a direct increase in labor productivity.

Labor productivity increases are not the only goals of task management. Task management must also support the high levels of customer service. The WMS must time stamp and manage task times in the queue and operate in a real-time manner. The WMS must be able to designate an order as critical and have the WMS prioritize the tasks associated with that order to guarantee superior customer responsiveness. This WMS prioritization may require that multiple operators work on the same order at the same time to meet customer service requirements.

The WMS must also manage non-critical orders in the queue and ensure that non-critical orders do not sit for an indefinite time. Pick tasks should be completed before cycle counting or re-warehousing tasks, however, these lower priority tasks should not be forgotten. A WMS must be able to re-prioritize low priority tasks to a higher priority if the low priority task sits in the queue for too long.

In addition to directing labor, the WMS must also provide labor planning feedback to management. Considering the expected order loads, the WMS should provide an estimate of personnel hours to complete the day's expected activities. With this estimate, management can then make planning decisions to meet the needs of its customers. For example, if the WMS projects that it will take 40 personnel hours to complete the day's receiving, but only 36 hours are available, management must make a decision regarding how to handle the shortfall. It may involve re-assigning labor or putting off some receiving until the next day. In either case, management has been notified and management can make a decision that minimizes the impact on its customers.

The second area of operational improvement is increased space utilization. Space utilization is improved because the WMS tells an operator where to put an item and the WMS attempts to maximize the utilization of each slot. Many warehouses, especially pallet rack warehouses, have less than optimal space utilization due to the fact that the actual storage slots are not full. This situation occurs because either the existing systems do not support consolidation of product or there are no variable rack height openings. In the instance of slot consolidation, the use of the computer is necessary if we are to effectively manage this operation. A paper-based attempt at consolidation is labor intensive and time-consuming. In the instance of variable height openings, a greater variety of rack openings allows increased ability to select a storage location that best fits the product. The challenge with this opportunity in a paper-based system is that it is difficult to manage a variety of different storage location sizes. A WMS makes this activity very easy to perform.

In addition to improved space utilization, a WMS also improves equipment utilization. Because warehouse employees are more effective in a WMS environment, the pieces of equipment that these employees use are better utilized. Additionally, fewer pieces of equipment are necessary because of the improvements in labor productivity.

In many instances, the use of a WMS will result in the unjustification of the automated pieces of equipment. A WMS allows a company to make its manual operations more effective. Once the manual operations become more efficient, then the incremental savings associated with automation are reduced. The incremental savings originally associated with automation become so small that the automation is no longer justified.

The final area of operational improvement is improved capacity. As a company grows, there are two ways to increase capacity: by increasing the size of the distribution center or by moving goods faster through the distribution center. Obviously, the second option is the preferred option. Moving goods through the distribution center more quickly requires no capital investments and yet still allows a company to meet its growing needs.

Increasing the flow of goods through the distribution center increases the inventory turns. The faster inventory turns, the greater the shipping capacity of a distribution center. The inventory turn is affected by two factors: purchasing and inventory accuracy. Purchasing affects the turn rates because we must balance inventory carrying costs with the cost to purchase an item. If a company purchases an item every day, the inventory carrying cost becomes very low, yet the cost associated with purchasing that item becomes very high. Therefore, a certain amount of inventory is associated with purchasing policy. This cost of goods can be reduced through partnership agreements with your vendors.

The second portion of the inventory turn is associated with information timeliness and accuracy. Companies carry safety stock and active surplus inventory because the existing inventory information is either inaccurate or untimely. Because the basic premise behind a WMS is quality information and zero information lead times, a WMS will allow a company to reduce inventory levels and thus increase the inventory turn rate. This increase in turn rates will ultimately allow a company to reduce inventory and to also increase the dollar value of goods processed per square foot of warehouse space.

7.4 ELECTRONIC DATA INTERCHAGE (EDI)

The impact of EDI on a business is far from simple, which can make its financial effects difficult to quantify. Most organizations, whether commercial or governmental, rely on three things in order to function effectively. These three things are:

1. The flow of products or services from the organizations to customers (and also from their suppliers to themselves)
2. The flow of cash into and out of the organization
3. The flow of information

While the need for products and cash flow are immediately obvious, the necessity of the flow of information will become obvious with a little reflection. In the modern organization, information is the glue that holds the organization together. The availability, distribution, and use of timely, accurate, and appropriate information is the key factor for running efficient organizations. The WMS is the mechanism for capturing and using a substantial amount of important information in the area of physical distribution. EDI is a key transport mechanism for information. Figure 7.1 on page 19 shows the central part that EDI plays in enhancing the competitive advantage, and is the primary mechanism for incorporating external data into the operations and planning systems.

Many operations systems and planning systems also rely on accurate and timely data from one another, which may also be indirectly attributable to EDI transactions. An example is the MRP II system, which requires an accurate inventory status report from the WMS. If inventory is kept at remote sites, or the organization manages inventory at its customers' sites, the inventory status information may be collected using EDI.

An on-line Order Processing System will accept EDI purchase orders to reduce the order lead time and ensure order entry accuracy. The Order Processing System will also rely on accurate on-hand inventory data from the WMS.

The ability to acquire accurate and timely information will yield significant advantages to an organization. This will enhance its competitive edge through reduced costs and improved customer service. The systems enable the organization to make and distribute the right products at the right time by doing effective planning based on accurate information acquired by on-line systems. If the organization is producing the right products at the right time, waste is eliminated and costs are reduced.

7.5 COMMUNICATION METHODS

Currently, there are three communication methods used to implement EDI:

1. Direct Link: A connection is established between two trading partners over the public telephone system. In this case, one organization dials the other at a specified time to establish a link to transfer data. The drawbacks of direct link occur when the number of trading partners increases - establishing the link consumes more and more resources, computer and human, as the number of trading partners increases. Additional problems occur when trading partners are using different and incompatible computer systems.
2. WAN: A Wide Area Network (WAN) is used to transfer the data. This technique is used infrequently, and then only for data transfer between remote sites of the same organization.
3. VAN: A third-party communications service known as a Value Added Network (VAN) is used. VANs are simply computers with large communications capability. They provide "mailbox" and other services. In this case, one trading partner downloads data by modem to the VAN. The VAN will then sort the transaction data for the other trading partner to pick up in their mailbox. For most organizations, the use of a VAN is the most appropriate method.

In between receiving the data and storing it in the outgoing mailbox, most VANs can provide additional value-added services. An example of these services would be the translation of the data from ASCII to EBCDIC (different types of character representation codes), so that for instance, a PC can communicate with an IBM mainframe. Therefore, using a VAN, trading partners do not need to have the same kind of computer hardware or software to communicate through EDI. Many VAN services can also translate between EDI transaction set standards.

We have seen how EDI can reduce administrative costs by eliminating data entry, and we have also seen how EDI can affect conventional manufacturing and warehouse operations. Using EDI, and with a little help from bar coding, we have a system for accurately tracking inventory and efficiently distributing inventory information. Such a system is an unparalleled tool for effective planning and maximizing customer service while minimizing costs. It is also the basis of supply chain integration.

Supply chain integration initiatives such as Quick Response, Efficient Consumer Response and Just-In-Time all benefit from the use of EDI. Each of these initiatives is engaged in re-engineering the process of supplying the product to the end user, treating the costs of the end product as directly attributed to all the steps involved between raw materials and the finished product.

8.0 CONCLUSION

We are coming to a crossroads where our organizations must decide which path to follow: to continue down the same path or to choose a new path, one with inventory reduction that reduces costs while improving customer service. The information presented here will allow your organization to achieve the results which, until now, management has only envisioned. This will be accomplished through the following:

- A company culture dedicated to accelerated growth
- Manufacturing insisting upon significant reductions in lead time
- A distribution network that is highly responsive to customer requests
- Warehousing operations that respond quickly and accurately to ever-changing customer requirements
- Building partnerships with customers and suppliers
- Quality information systems that allow for zero reformation lead times

Without these components in place, your organization will not be in a position to significantly improve your competitiveness.