

CONTENTS

Units	Page No.
1. Introduction of Supply Chain	1-51
2. Logistics Management	52-126
3. Inventory Management	127-148
4. Recent Trends in SCM	149-178

SYLLABUS

M-234

SUPPLY CHAIN MANAGEMENT

UNIT I

Introduction: Basic Concept and Philosophy of Supply Chain Management; Essential features, Various flows (cash, value and information), Key Issues in SCM, benefits and case examples.

UNIT II

Logistics Management: Logistics as part of SCM, Logistics costs, different models, logistics sub-system, inbound and outbound logistics, bullwhip effect in logistics, Distribution and warehousing management.

Purchasing & Vendor Management: Centralized and Decentralized purchasing, functions of purchase department and purchase policies. Use of mathematical model for vendor rating/evaluation, single vendor concept, management of stores, accounting for materials.

UNIT III

Inventory Management: Concept, various costs associated with inventory, various EOQ models, buffer stock (trade off between stock out / working capital cost), lead time reduction, re-order level fixation, exercises – numerical problem solving, ABC, SDE / VED Analysis, Just-In-Time and Kanban System of Inventory management.

UNIT IV

Recent Issues in SCM : Role of Computer / IT in Supply Chain Management, CRM Vs SCM, Benchmarking-concept, Features and Implementation, Outsourcing-basic concept, Value Addition in SCM-concept of demand chain management.

UNIT 1 INTRODUCTION OF SUPPLY CHAIN

NOTES

★ STRUCTURE ★

- 1.0 Learning Objectives
- 1.1 Introduction
- 1.2 Definitions: Basic Concept and Philosophy
- 1.3 Physical Manifestation of a Supply Chain
- 1.4 Elements of a Supply Chain Model: Essential Features
- 1.5 Various Flows in Execution of SCM
- 1.6 Overview of the Supply Chain Landscape
- 1.7 Supply Chain Planning
- 1.8 Logistics Capacity Planning
- 1.9 Demand Planning
- 1.10 Demand Forecasting
- 1.11 Supply Planning
- 1.12 Inventory Planning
- 1.13 Logistics Capacity Planning
- 1.14 Transportation Capacity Planning
- 1.15 Transportation Capacity Procurement
- 1.16 Warehouse Capacity Planning
- 1.17 Supply Chain Execution
- 1.18 Transportation Management
- 1.19 Fleet Management
- 1.20 Warehouse Management
- 1.21 Reverse Logistics Management
- 1.22 Returns Disposition Determination
 - Summary
 - Review Questions
 - Further Readings

1.0 LEARNING OBJECTIVES

After going through this unit, you will be able to:

- discuss about basic concept and philosophy of supply chain management.
- describe what is essential features of supply chain?
- difference between benefits and case examples.
- what is logistics capacity planning?

NOTES

1.1 INTRODUCTION

Various definitions abound for supply chain. These definitions change with the industry vertical and the context. We will stick to a generic definition that defines supply chain as the flow and management of resources across the enterprise for the purpose of maintaining the business operations profitably. This really is an extremely generic definition, and therefore may be fuzzy at first, but we will examine the components of the definition, and a picture of a supply chain will soon emerge.

1.2 DEFINITIONS: BASIC CONCEPT AND PHILOSOPHY

Resources in this definition can be materials, people, information, money, or any other such resources that must be managed for profitable business operations. Materials can be raw materials, Work-in-Progress (WIP), or finished products. In the context of retail industries, it is the merchandise that the retailers sell. It costs to buy this merchandise, store it, and distribute it. If a store is out of merchandise, it loses the sale, thus affecting revenue; if it is overstocked, it increases the inventory, affecting operating cash flow negatively. Some of this merchandise may be seasonal, and therefore must be planned based on seasonal patterns. It may be local (e.g., folding portable chairs with your favorite team's logo on the back), may depend on weather (e.g., snow boots and jackets), or may need to be custom ordered (e.g., purple carpet). All these factors make the merchandise a resource to be managed. This illustrates the "right-time, right-place, right-quantity" mantra that you may have heard in relation to supply chain management. People can also become constraints that must be managed for profitable operations. In a supply chain context for retailers, think of the distribution center associates that must be available to receive and ship all the planned merchandise from a warehouse in a given day. For manufacturers, this relates to the direct labor.

Management of the flow of *information* is equally important to smooth operations. Extending the distribution center example, if the information on inbound shipments to the warehouse is not visible to the warehouse manager, it can create problems for labor scheduling as well as downstream fulfillment planning for the store orders. In fact, visibility across supply chain functions that can provide a consolidated view of demand, inventories, and orders has emerged as one of the most important and valued functions in most companies.

Money is another resource. Often, the objective of a lot of supply chain planning and execution initiatives is to minimize the cost of doing business (or maximize the profitability).

Other resources can be physical assets such as buildings and machinery. Manufacturers routinely plan operations for their factories with the intent of maximizing the utilization of most critical assets. Retailers can sometimes find themselves in a fix when the number of trailers they manage falls short of the shipments they need to send to their stores, or when the warehouse capacity is too small for the inventory they must hold for ramping up to the holiday season.

Flow and management of these resources is key to supply chain management. Some of the resources actually flow through the supply chain, such as merchandise. It flows from the suppliers' warehouses to the retailer's warehouses, then to their stores or customers. Others help the flow of this merchandise, such as workers in the distribution center. Recall that the objective of a well-managed supply chain is to plan and execute the *flow and management* of the *resources* for the purpose of maintaining the business operations profitably. Recall also that the *resources* are generally scarce and cost money. Putting these two together, the emphasis on *profitability* becomes clear. If your supply chain can achieve this better than your competitor's, you are in good shape. If not, supply chain improvements can help.

Across the enterprise refers to the extended footprint of supply chain operations as it straddles the planning and execution processes across several functions. These processes cover planning processes like demand and supply planning, and then continue with the execution processes of purchasing, manufacturing, stocking, and distribution of inventory through a network of warehouses and transportation resources.

The final words in our definition refer to the *profitability*. Supply chain processes directly affect the costs of planning and operations, and therefore provide extraordinary opportunities to reduce the Cost of Goods Sold (COGS) and improve asset turnover, thereby enhancing profitability of a corporation.

NOTES

1.3 PHYSICAL MANIFESTATION OF A SUPPLY CHAIN

Now that the definition in theory is behind us, let us look at the physical manifestation of supply chains. This is easier to understand with an example. We will look at a typical retailer with stores and

NOTES

warehouses; though some retailers, such as grocers, may also have manufacturing facilities as part of their supply chains. All retail supply chains have distribution-intensive operations irrespective of the specific retail segment they represent. Examples of these retail segments are soft-line retailers like apparel chains, hard-line retailers like home-improvement chains, or department stores.

Most retailers have brick-and-mortar stores where the merchandise is presented for the customers to buy. Some of the new-breed retailers (such as Amazon.com) may not have physical stores, but they do provide an environment where the merchandise and customers can interact. Physical or not, the stores fulfill the same function—they bring the merchandise and the customers together and provide an environment conducive to sales. The merchandise arrives in the stores from the retailer's own warehouses, or directly from the supplier's warehouse. All of these (namely the store, retailer's warehouse, and the supplier's warehouse) together represent the physical supply chain.

As shown in figure 1.1, if the *store* is in New Jersey, and the supplying *warehouse* in Florida, then the *merchandise* may be carried on a *truck* along *I-95*. The elements in italics represent respectively the *demand location*, *supplying location*, *product*, *transport resource*, and *route*. Together, all of these constitute elements of the supply chain that must be managed by the retailer to smoothly serve the customer. When customers buy, the stores need to replenish the merchandise. This merchandise is typically replenished from the warehouses. But the warehouses themselves need to be replenished with merchandise from the vendors. That brings us to the *purchase orders* against which such merchandise is supplied by the vendors.

Before any purchases can be made, we need to establish the total customer demand, existing supplies, and remaining demand that must be fulfilled from new purchases. The purchase orders are therefore planned through a process that computes the demand for merchandise at each of the locations and predicts how much should be bought, where, and when. As these purchases must be made in advance of actual demand, the demand planning processes help in establishing the projected (forecast) demand, and merchandise planning processes establish assortments to decide what will be sold where.

NOTES

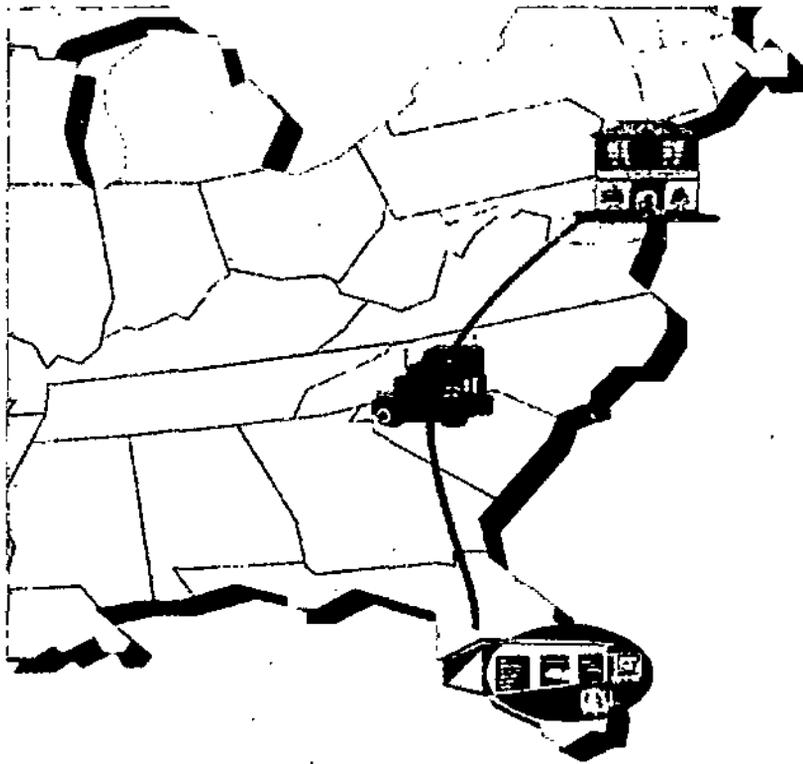


Figure 1.1. Basic Elements of a Supply Chain

1.4 ELEMENTS OF A SUPPLY CHAIN MODEL: ESSENTIAL FEATURES

Now that we have a fairly good idea about the physical components of a supply chain, let us look at how a typical supply chain is modeled to support the business processes. Supply chains have two ends: the demand end and the supply end. The demand end of the supply chain models elements of the supply chain where the demand originates. Examples of the demand end are stores, a Web-storefront, or customers. Business requirements determine whether individual customers in a supply chain are modeled. For most retail operations catering to individuals, this may not be required; but think of a manufacturer with a wholesale operation and you might want to model the customers as well. Whether one models the stores at this end, or the end-customers, depends on the level at which a consistent demand pattern exists, which also can be easily modeled. For example, for a large retailer with thousands of stores and individual cash-and-carry customers, stores may be very well suited to model demand. However, for a consumer goods manufacturer like Procter and Gamble, large individual customers like WalMart or Target will be better suited to model demand. We will also call this

NOTES

end of the supply chain the *downstream*. Figure 1.2 shows the demand and supply ends of a supply chain. The supply end of a supply chain represents the sources of supply, such as suppliers' warehouses or a factory. These represent the supply chain elements that provide supplies to address the demand generated at the other end of the supply chain. We will call this end of the supply chain the *upstream*.

Thinking of the supply chain in terms of *demand end* and a *supply end* also helps in understanding one of the core problems that supply chains solve—that of balancing supplies against demand. Demand flows from downstream nodes to the upstream nodes in a supply chain network, while the supplies flow from the upstream nodes to the downstream nodes.

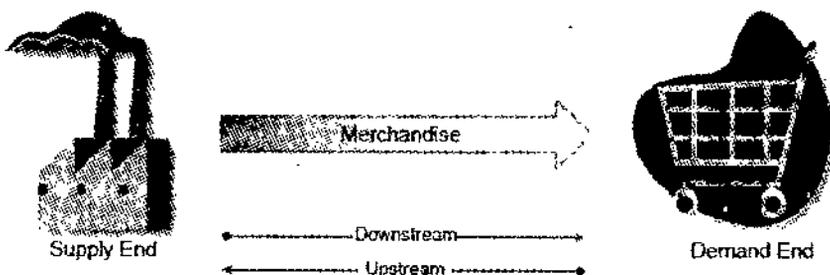


Figure 1.2. Demand and Supply Ends of a Supply Chain

Between the supply and demand ends of a supply chain are modeled other elements that constitute the *distribution network*. Examples of these elements are warehouses, cross-docking facilities, transshipment points, processing facilities, assembly plants, and so on.

All the elements we have mentioned here are different *types* of locations. We will call them *nodes*. The relationships among these nodes are also modeled in a supply chain to establish the valid paths along which goods/ services can travel. We will call these paths *flow-paths*. As depicted in Figure 1.3, the network of nodes and flow-paths in the supply chain model creates the supply chain *network*. Though it may not be identical, the supply chain *network model* closely mirrors the physical supply chain for a retailer.

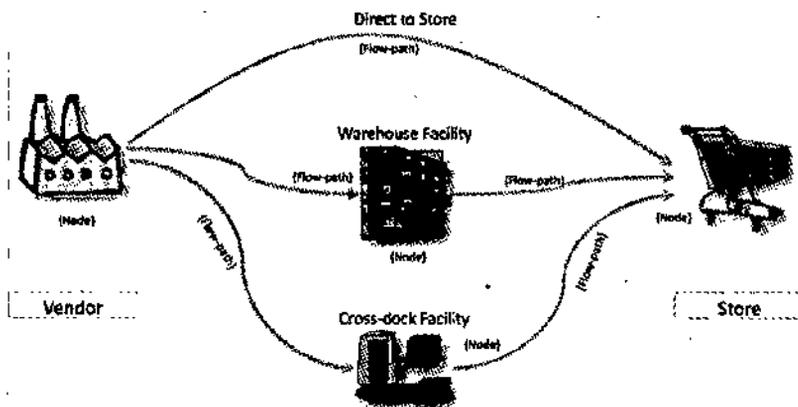


Figure 1.3. Supply Chain Nodes and Flow-paths

A node in a supply chain model generally represents a type of location along with its inventory, operations, resources, skills, and any other attributes relevant to supply chain operations. Nodes add value to the material flowing through the supply chain. Figure 1.4 shows a supply chain node and the typical elements that can be defined at a node.

NOTES

Nodes typically model locations. Locations can be used to represent a manufacturing location (such as a factory), distribution location (such as a warehouse), selling location (such as a store), or a supplying location (such as a vendor/warehouse). Locations can have multiple purposes as well. For example, a factory may also serve as a warehouse.

Inventory is consumed, produced, or distributed through these nodes. For example, inventory is consumed at the stores as customers buy the merchandise. Raw material is consumed at factories, and finished goods are produced in turn. A warehouse distributes the goods.

Operations are performed at these nodes. These operations can vary from manufacturing activities such as machining and assembly in a factory, to distribution activities such as receiving and shipping in a warehouse. Only certain types of operations can be performed at a certain location. For example, a pure cross-docking warehouse location may not stock inventory; therefore it can serve only those inbound shipments that are immediately used for fulfillment of outbound shipments. In another example, a factory may only have resources for machining operations while the final assembly of the product may be produced in a separate factory. This restricts the feasible paths for materials flowing through the supply chain network.

Resources are consumed by the operations at the node. However, resources have a limited capacity. For example, if it takes one hour to assemble a car on an assembly line, then you can produce only eight cars in an eight-hour workshift. This can constrain the flow of goods and services through that node in the network. This is called *throughput*. *Constraint-based planning* is one of the key differentiators of supply chain planning when compared to its predecessor MRP (master resource planning) processes, which assumed infinite materials and resources. We will cover this in more detail later. Resources have *skills*, and therefore all resources may not be able to do all operations. For example, a receiving clerk in the warehouse may not be able to process shipments that require driving a forklift. This can further constrain the flow through a node. Enforcing these constraints during planning ensures that the

Core Supply Chain Functions

NOTES

The core functions of the supply chain relate to activities that are limited to within the four walls of the corporation. These are the processes that are typically covered within what is called the *Supply Chain Management (SCM) space*.

Examples of these functions are demand planning, supply planning, manufacturing, warehousing, transportation, supply chain visibility, and supply chain network optimization. These functions differ from those in the extended supply chain in that they are typically managed completely within the four walls of the corporations. While partner collaboration is desirable for these operations, it is not critical to their central intent. The data required for these functions is usually generated within the corporation and available without any constraints or privacy concerns. The changes to this data are governed by corporate policies and are therefore predictable. While these functions generate data and transactions that can enable collaboration with partners, such partnering is typically beyond the scope of conventional SCM processes. The core supply chain functions as described here remain the main focus of the current discussion.

Extended Supply Chain Functions

The extended functions of the supply chain extend the processes at either end of the corporate Supply chain, and create the extended supply chains representing the partners and enabling collaboration where relevant.

On the supply end, *Supplier Relationship Management (SRM)* complements the SCM core processes. The SRM processes add the capability for bidding, bid analysis and awards, strategic sourcing, collaboration, supplier performance management, supplier compliance, and supplier score-carding. Most of the SRM processes are extremely relevant to the SCM discussion. While we may not go into as much detail on SRM functions, we will touch on these where relevant to provide the context.

On the demand end, *Customer Relationship Management (CRM)* complements the SCM core processes. The CRM processes add the capability for quote and opportunity management, customer order and fulfillment management, returns and exchanges, customer collaboration, customer segmentation, profiling, and other customer analytics such as lifetime value and demographics, market-basket analysis, and so on. CRM processes may further support marketing functions like pricing, promotions, targeted marketing campaigns, and customer support functions through call centers. Different industries require different functions from the CRM landscape depending on their target customer, channels, type of merchandise, and maturity. CRM processes cover a large functional landscape and are largely beyond the scope of the current discussion, though we may briefly touch on them where relevant.

Figure 1.6 shows this relationship between the core and extended supply chain functions. The dotted line in this figure depicts the general scope of the supply chain functions that are covered in this book.

NOTES

1.5 VARIOUS FLOWS IN EXECUTION OF SCM

A few words on supply chain planning and execution are in order as the rest of the book is organized along these lines. *Supply chain planning* typically consists of functions that produce a relatively longer-term picture for future operations. These processes are designed to provide decision-support tools for supply chain managers. They typically have a longer planning horizon, and are modeled at an abstract level and at a higher granularity than the physical assets of a supply chain. The planning processes provide the ability to create multiple scenarios and evaluate them for specific metrics to determine the optimal plans.

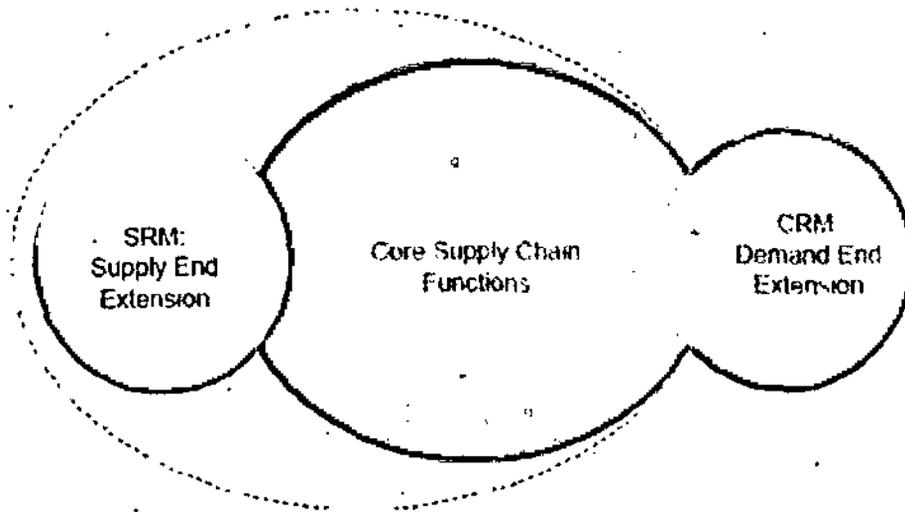


Figure 1.6. Core and Extended Supply Chain Functions

They are generally modeled through complex mathematical models and solved for optimizing one of the overriding objectives. The output of these planning processes is adopted by the execution processes for action.

One such process is inventory planning. This process typically determines inventory stocking levels, ordering frequency, and order quantities at all locations that need inventory. A typical inventory planning process is modeled at warehouse or store level, and needs demand and supply information in weekly or monthly buckets as the main input. Based on the user defined target service level, this process can generate multiple scenarios for inventory deployment for minimizing inventory costs. Finally, the output of the inventory planning process is adopted as an

NOTES

input to the replenishment planning process that provides the purchase suggestions for execution. *Supply chain execution* typically consists of functions for relatively short-term duration and for immediate execution of operations. These processes are designed to create an execution schedule for the target business function such as shipping to stores, or production schedules for a factory.

They typically have a short execution horizon, and are modeled to closely reflect the physical assets of a supply chain. They may create multiple scenarios, though these scenarios are typically internal to the system for generating the best feasible solution. They can also leverage complex mathematical models or simple rules to create feasible execution schedules.

Depending on the process, optimization may or may not be an overriding factor for execution processes. The output of these execution processes is activities that may create transactions for the host/ERP systems. As an example of a supply chain execution process, let us consider inbound operations at a warehouse. These operations are typically planned for the next few days. They are planned based on the inbound purchase orders, or Advance Shipment Notices (ASN). The output of the inbound planning process for a warehouse typically is the schedule of receiving and disposition activities for the warehouse. The process needs to model the warehouse assets to the lowest possible granularity, reflecting the physical assets like dock doors, forklifts, receiving associates, zones, aisles, and locations for creating a feasible execution schedule. The process in this example works fine with a set of decision rules to schedule receiving and for determining the disposition for the inbound inventory. Once executed, the process generates the inventory transactions that are sent to the host/ERP system.

A contrasting example of a supply chain execution process will be shipment planning for the inbound orders. This process also models all the relevant physical assets such as lanes, routes, transportation equipment, and modes, but typically leverages complex mathematical models to create the shipping plans. The overriding objective of this solution is to create a shipment plan that minimizes transportation cost and transports all the orders as required. The output of this process creates shipments that are executed by the carriers, suppliers, and receiving location (warehouse) associates. Once these shipments are executed, it may create carrier transactions for payments that are then integrated back into the resident host/ERP system for settlement.

Figure 1.7 shows an example of the planning and execution functions for a retail supply chain. At a high level, the retail supply chains cater to the three basic processes of buying, distributing the merchandise, and selling.

Within the context of these high-level processes, the supply chain functions provide the capabilities for planning and execution. The figure shows that the buying process is supported by sourcing, replenishment planning, and vendor management functions in the planning tier, and by purchase order management in the execution tier. Together these functions will provide all core capabilities required to operate a retail supply chain's buying process.

NOTES

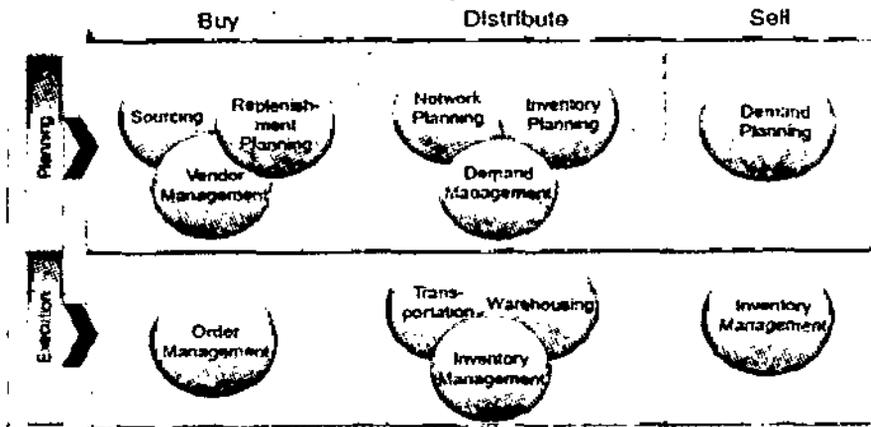


Figure 1.7. Examples of Retail Supply Chain Planning and Execution Functions

1.6 OVERVIEW OF THE SUPPLY CHAIN LANDSCAPE

Before heading off into individual functions, we present the overview of the supply chain landscape that is the subject of current discussion.

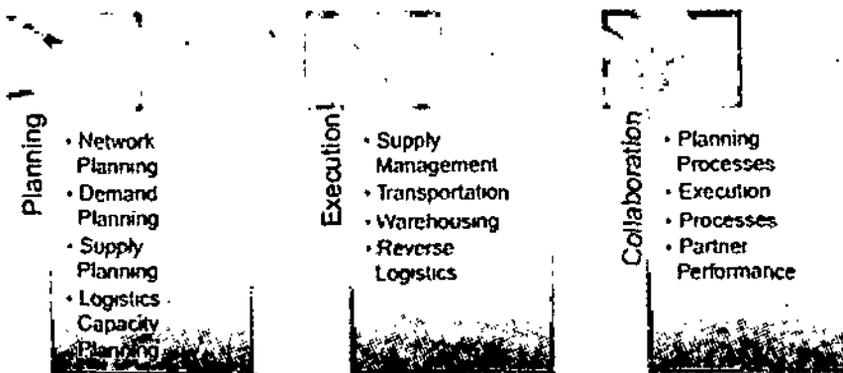


Figure 1.8. Overview of Supply Chain Landscape

The rest of this book is organized into the following parts, reflecting the organization of supply chain functions, also depicted in figure 1.8.

1.7 SUPPLY CHAIN PLANNING

Supply Chain Network Design

NOTES

Supply chain network design is the process of establishing the network nodes and flow-paths in a supply chain. These nodes can represent either of manufacturing, stocking, or distribution locations. This process helps plan the most desirable physical locations and their types that will constitute the supply chain for most efficient flow of materials and merchandise.

The selling locations (such as stores) are outside the scope of this process as the factors governing the ideal location of a store are very different from those of warehouses or manufacturing plants. Supply chain network design is a critical process for distribution intensive industries such as retail. In such industries, the cost of distribution of merchandise is a substantial part of their total operational costs. Large retailers typically have thousands of stores and may have hundreds of warehouses.

Together, this network creates a complex set of flow-paths along which the merchandise can flow. An optimally designed network can substantially reduce the costs and lead-time for distribution. This is also true for large manufacturers that have vendors, factories, and warehouses distributed across geographies and can benefit from optimizing their network flows.

Some of the questions that this process answers are:

- What is the best network configuration to address the current and projected demand patterns while maintaining desired service and cost levels? How many facilities are required, and where should they be? What does it mean in terms of inventory deployment?
- Do the warehouses have enough capacity for the current and future operations? Can they handle optimal product flows within the warehouse for all types of products (conveyable/nonconveyable)?
- Which stores will be replenished from each warehouse?
- What transport modes and lanes are best to move products through the network? Is there enough negotiated capacity along each flow-path in the network?
- What is the cost of maintaining and operating the current network? How is this cost affected by various scenarios where certain facilities are closed, expanded, or contracted, or new ones started?

In most cases, this network of suppliers, warehouses, and stores is a combination of organic growth and deliberate planning. When the companies are small, their supply chains are simple and easier to manage. As the companies grow, so do their supply chains. They become complex and

expensive to manage. Planning and managing them effectively becomes a clear differentiator.

Optimal supply chain network design helps in controlling the capital as well as operational costs. For retailers, the cost of distribution is the second largest cost after the direct cost of merchandise. The retail store locations are determined based on customer demographics and competition, and are largely independent of supply chain operation cost considerations. But other locations, such as those required for warehousing or manufacturing, can be planned based on supply chain operational costs. The choice of these locations and type of operations they support impacts the fixed costs of land, buildings, and equipment, as well as the variable costs of personnel, utilities, transportation, maintenance, and so on. The objective of the supply chain network design process is to minimize these operational costs, while maintaining the ability of the supply chain to effectively service the demand and supply requirements. This function allows the business to model the existing supply chain operations, with the planned supply chain growth, and evaluate the operating costs of the network for each option.

Inputs and Outputs of the Supply Chain Network Design Process.
This process considers the following inputs:

- Existing locations of stores (also called *Consuming* locations). For the new Web-based businesses, without any physical stores, the equivalent inputs will be the number of individual orders fulfilled in specific regions. For manufacturers, this will be the receiving locations of their customers' warehouses.
- Existing and/or proposed locations of warehouses or factories (also called *supplying* locations). This may also include the locations of the shipping warehouses for the major vendors.
- Products carried at each of the locations (warehouses and stores).
- Fixed- and variable-cost models for each of the locations for stocking, handling, shipping, and other warehouse activities.
- Cost models for transportation lanes/routes (also called *flow-paths*) between the above nodes and transportation modes.
- Volume of goods transported along these flow-paths based on historical data, and future projections for the same, as well as desired inventory/service levels at the receiving nodes.
- Other costs are modeled that reflect the cost of opening a new facility or closing an existing facility. These costs may also be

NOTES

weighted by the user to reflect the user bias toward closing existing facilities or opening new facilities.

NOTES

The process then consists of either computing the cost of the existing network model to operate or suggesting new locations or changes to existing locations in the network. The solutions supporting the network planning process routinely utilize mathematical programming to formulate and solve the problem for minimizing the total costs of operating the network. The output of the process may consist of the following:

- Multiple scenarios with different locations and costs of running the network in each scenario
- Proposed new locations and their size, or changes to existing locations including expanding, contracting, or closing the existing facilities
- Projected product volumes at nodes and flow-paths.

Applications supporting the network planning process provide rich user workflows for creating, evaluating, and comparing alternative scenarios. They also provide visualization tools for pictorial representations of the supply chain network typically superimposed on a map to provide geographic context. The actual selection and building of a facility requires further study around the proposed locations and will consider additional inputs such as labor market, demographics, education levels, and so on. However, the optimization process helps in narrowing down such choices and helps direct these efforts on a sound cost-based initial analysis.

Due to high-level of capital investments and the long lead times involved in setting up the distribution centers, the supply chain network process covers a longer-term horizon. This is truly a decision-support system to help the users make objective decisions based on cost analysis. The output of the process is widely adopted by most of the supply chain processes that need the supply chain network model. Demand and supply planning applications use the network models to propagate the demand and supplies across the network echelons to create location-specific plans.

1.8 LOGISTICS CAPACITY PLANNING

Future capacity planning for logistics (warehousing and transportation) operations is another process related to network planning. Based on the projected sales plans, the network planning process can help in projecting warehousing and transportation capacity needs over the years. Analyzing these requirements can help in better planning for a growing network.

Such plans may require changing warehousing capacity by opening new warehouses, expanding existing ones, mechanizing warehouses to increase throughput, and negotiating transportation contracts in advance to address the projected changes for the transportation capacity.

As opening a new warehouse can take a long time, the projected growth in logistics capacity requirements provides useful information for planning and action in advance.

NOTES

1.9 DEMAND PLANNING

The objective of the demand planning process is to forecast the demand for products so that this demand can be fulfilled through existing inventory, manufacturing, and new purchases. Demand planning is done for a product at a location for a given time bucket. Demand planning is probably the most important supply chain process in that it drives almost all other processes directly or indirectly toward fulfilling the demand.

The projected demand determines what a retailer should buy or a manufacturer should build. This in turn drives the factory capacity and resource utilization, raw material demand, and orders on vendors for such raw material. Within the enterprise, the demand is projected at the downstream or demand end of the supply chain and gets propagated through the network until it is satisfied with the supply from a supplying node. For example, demand at a store will be propagated to the upstream warehouse. If the warehouse can satisfy this demand from the available inventory, then the demand propagation stops at this node. If the warehouse does not have enough available inventories, then the rest of the demand signal will be propagated to the next upstream node in the supply chain, which can be a vendor or another warehouse.

The supply chain within an enterprise can be considered simply a part of the larger supply chain consisting of supply chains of many such enterprises. Extending this example, when the warehouse is unable to satisfy the store demand, it must place an order on its vendor. Through this order the demand is conveyed to the vendor's supply chain, which in turn must start propagating the demand signal upstream until it can be addressed. Demand planning consists of various subprocesses:

- *Demand forecasting* provides the projected forecast into the future usually based on the historical data for the specified product-location combination.

NOTES

- *Allocation planning*, also sometimes called *push-based replenishment* is the part of the demand management process that allows for managing seasonal merchandise in an effective manner.
- *Replenishment planning* takes the unconstrained demand forecasts as input and generates the replenishment plan, taking the available inventory into consideration.

Together these processes answer the following questions:

- What is the unconstrained projected (forecast) demand for a product at a location at a specific time?
- What do I need to fulfill this demand? How much inventory do I need at various points in the network to ensure that the demand at all consuming nodes can be fulfilled?

1.10 DEMAND FORECASTING

Demand forecasting is the process of using the sales history of a product at a location and projecting the demand into the future. Most of the forecasting solutions use statistical methods for projecting the future demand. Such statistical methods can vary from a simple moving average, to curve-fitting techniques, to time series analysis.

Demand forecasting simply answers the question, "What is the projected demand forecast for a product at a location at a specific time based on the historical sales of that product at that location?" This process provides the input for all the subsequent processes for demand planning.

It is important to determine the level at which the demand should be forecasted. Retailers routinely forecast demand for what they sell, while manufacturers may forecast demand for subassemblies rather than the finished goods. For example, consider a computer manufacturer. It is almost impossible to precisely determine the demand in a given time period of a laptop computer with a 2 GHz dual processor, 2 GB RAM, and 250 GB HDD. However, if the demand is forecast for the subassemblies, such as the motherboard, RAM module, HDD, and so on, then a more accurate and reliable forecast can be produced. The manufacturing schedule can be planned using the subassembly demand while the final assembly can be finished quickly after the order is received.

1.11 SUPPLY PLANNING

The supply planning processes complement the demand planning functions in a supply chain. Once the net demand has been calculated, the next

step is to create the supply plan to fulfill the demand. All the functions that help in the fulfillment of demand are collectively covered under the supply planning processes. These processes primarily cover inventory planning, purchase planning, production planning, and supply (or order) allocation functions. The supply planning functions are further supplemented by execution functions such as sourcing, production scheduling, purchase order management, and vendor management functions, which are discussed under the supply chain execution processes. These functions together help fulfill the planned demand.

NOTES

1.12 INVENTORY PLANNING

The inventory planning process establishes the optimal inventory levels that must be maintained to meet expected fulfillment service levels. Any two nodes in a supply chain can be viewed as having a supplier-consumer relationship as the material flows from one node to another. When viewed as such, the node that acts as a consumer is placing demand on the node that acts as a supplier. This demand must be fulfilled by the supplying node at a user-specified fulfillment service level. To guarantee such service levels, the supplying node must maintain an optimal level of inventory.

Artificially high service levels will push these inventory levels too high, and result in unusually high inventory costs and low inventory turns. The relationship between the amount of inventory required and service level is exponential, and therefore every little improvement in service levels will push the inventory levels higher and higher.

1.13 LOGISTICS CAPACITY PLANNING

Logistics capacity planning is focused on longer-term transportation and warehousing capacity planning. It consists of analyzing the current and projected needs for transportation and warehousing based on the enterprise's business plans for the future.

The following processes cover the transportation capacity planning and procurement and the warehouse capacity planning. The transportation planning process ensures that enough capacity is available under contract with the carriers on the projected routes/lanes to address the changing demands of shipping between suppliers, factories, warehouses, and

NOTES

stores. The warehousing capacity planning ensures that there is enough warehousing capacity to stock the projected inventory levels to serve the planned future business volumes. Warehouses have a long lead-time for setup and operations, and this capacity planning exercise allows the enterprise to be proactive as warehousing needs change.

1.14 TRANSPORTATION CAPACITY PLANNING

As part of the strategic and long-term growth plans, transportation capacity planning processes provide the projected growth in the transportation requirements of the company. This is more important in distribution-intensive industry verticals such as retail, as the transportation costs in the retail industries can be a substantial part of the sales revenues. Planning the logistics capacity for warehousing and transportation requirements ahead of time allows for an optimally planned network that is geared to support the growth in merchandise volumes and stores.

Transportation capacity planning processes answer the following questions:

- What are the projected needs for transportation capacity to support the corporate growth goals?
- What is the best way to address these needs (modes/lanes/routes)?

Inputs and outputs of the transportation capacity planning process

Transportation capacity planning needs the following information as inputs:

- Future network model of the supply chain. This network may consist of existing and planned stores, warehouses, factories, and major vendor locations.
- Projected transportation volume and mode requirements along the supply chain arcs in the projected network.
- Current shipping data; volumes, rates/routes/lanes, costs, equipment types, modes, carrier capacities, carrier contracts.

The process primarily consists of analyzing the current and projected shipping volumes along each existing route/lane, projected requirements by mode, projected costs, budgets or targets, and available and expiring contract capacities. It provides the basic output as follows:

- New route and lane requirements
- Shipping volume requirements by mode (ocean/air/rail/road)

- Carrier selection guidelines
- Projected volume requirements along existing and new routes, existing contracted capacities, and gaps by mode.

NOTES

1.15 TRANSPORTATION CAPACITY PROCUREMENT

These processes refer to the carrier bidding, evaluations, and contract awards. Transportation procurement is generally a well-established process for most retailers, as expected in any *distribution-intensive* industry. It is also a prime process for subcontracting due to industry-wide standardized communication messages and established business *practices*.

The process takes inputs from the transportation capacity planning function and generates bids. Carriers can be invited to respond to the bids and responses are evaluated for costs, capacities, lanes offered, equipment available, committed capacity, and other factors that may be relevant, such as *financial stability of the carrier*. The contracts are then awarded to the selected carriers for selected lanes.

The process and strategy for obtaining the capacity for domestic carriers for rail/road transport will be *very different from planning for ocean-carrier capacity for international freight*. For both of these requirements, some capacity may be contracted/dedicated and other capacity can be obtained from the open market at the actual time of need.

The actual requirement for transportation capacity will vary depending on product demand cycles, holidays, and seasons. Such fluctuations are normal and expected. These are fulfilled with a combination of contractual and dedicated capacity that is purchased in advance, and finally by buying the capacity on demand from the open market.

This process primarily addresses the following questions:

- Which carriers should be used for fulfilling the current and short-term projected transportation needs? What modes and equipment types are ideal? How much of this must be dedicated capacity?
- How much of the above capacity requirements are covered by existing contracts, and where do the gaps exist?
- What will it cost?

NOTES

Inputs and outputs of the transportation capacity procurement process. Transportation capacity procurement needs the following information as inputs:

- Current and projected transportation volumes by mode and equipment type, along lanes/routes
- Current contracts, committed capacities, expiration dates, and gaps in the required and available capacity for each lane
- Target carriers to be invited for tendering (especially when the carriers are required to be short-listed based on other overriding criteria such as corporate status, financial status, credit rating, etc.)

The process consists of publishing the bids on a portal, or via other methods, and inviting carriers to respond. The responses are then evaluated and compared using a predefined criterion that may include carrier costs, accessorial charges, available equipment, available lanes, process automation, prior relationships, and carrier historical performance for on-time delivery, tender acceptance rates, and any other criteria important to the corporation, such as financial viability. Contracts are awarded based on these comparisons.

The output of the process is then:

- New and/or renewed carrier contracts to address the transportation capacity needs
- Analysis of the projected transportation capacity requirements, and fulfillment plans.

1.16 WAREHOUSE CAPACITY PLANNING

Like transport capacity planning, the strategic and long-term growth plans should cover the projected growth in the warehousing requirements of the company. This is another process that is important in distribution-intensive industry verticals to ensure that the warehousing growth is aligned with the planned business growth. As setting up a physical warehouse may take a long-time, in some cases up to three years, planning for the warehousing capacity ahead of time helps maintain an optimal network to support the growth in merchandise volumes and stores.

Warehouse strategy is closely related to the network planning process. A whole host of other factors go into the warehouse location selection even after the warehouse capacities have been planned and optimal locations have been identified using a network planning solution. Such factors

involve diverse decision inputs, ranging from demographics to average salaries in the target area, skills, local taxes, and government attitudes, and are not always quantifiable. This process here refers only to the quantifiable inputs for the purposes of capacity planning.

Warehouse capacity planning processes answer the following questions:

- What are the projected needs for warehousing capacity to support the corporate growth goals?
- What is the best way to address these needs? Where should these warehouses be? What types of warehouses should these be? What flow paths should they support, and what level and type of mechanization should be planned at these facilities?

Inputs and outputs of the warehousing capacity planning process

Warehouse capacity planning needs the following information as inputs:

- Current and planned network models of the supply chain
- Projected storage volume; receiving, shipping, and flow-through expectations in the projected network
- Current warehouse capacities for storage and warehouse operations
- Level of mechanization, merchandise attributes, and volumes, (conveyable and nonconveyable).

The process primarily consists of analyzing the current and projected storage volumes, and the transaction volumes for receiving, shipping, and flow-through requirements. It provides the basic output as:

- Warehousing storage requirements and recommended levels of automation to support the projected transaction volumes; recommendations on the type of facility (cross-docking, stocking)
- Projected throughput requirements for various warehousing activities required to support the future distribution models, and volumes.

1.17 SUPPLY CHAIN EXECUTION

Supply Management

The supply management functions of a supply chain have a large scope from sourcing to purchasing, manufacturing, replenishment, and vendor performance management. This is the other side of the demand equation, and consists of everything that needs to be done to fulfill the demand.

NOTES

NOTES

On a broader level, there are two aspects of supply management functions. The first deals with supply management functions, examples of which are determining the best sources for merchandise, the procurement of the merchandise, and global trade. The second part of the supply management functions deals with the suppliers themselves and managing the relationship with them. All of these functions will be discussed in the following sections.

Strategic Sourcing

The strategic sourcing process consists of finding out the best sources of supply, determining the feasibility of a strong and lasting relationship with the vendor, and managing this relationship over time to mutual benefit and advantage. The "strategy" in the strategic sourcing comes from proactive trend management to ensure that projected business plans and demands can be fulfilled with adequate supplies, optimal costs, and minimal regulatory, financial, social (brand), and legal risks. As part of strategic sourcing, companies need to establish what they will need in the future and how much. This question is generally answered in the merchandising functions using the product portfolio analysis, profitability analysis, and other such techniques. Once the what and how much questions are addressed, strategic sourcing kicks in to establish where such needs may be optimally fulfilled.

The strategic sourcing processes consist of establishing guidelines for partnerships, creation and maintenance of approved vendor lists, procedures for on-boarding and off-boarding, vendor performance tracking, and partner compliance with the negotiated agreements, expectations, and behavior.

Partner Evaluation and On-boarding

Retailers deal with thousands of suppliers to replenish their warehouses and stores. Ever-expanding store assortments only increase the number of active suppliers at any point in time. Manufacturers also need a predictable supplier base to guarantee raw material supplies without interruption to ensure efficient utilization of their resources and ability to service their customers reliably. Partner evaluation establishes a consistent process to determine whether a potential supplier-partner will be a good fit. Several considerations go into this decision, and some of the primary ones are as follows:

- *Financial considerations.* Financial health of the prospective partner is important for various reasons. Most important among them are

the potential partners' ability to finance the merchandise order placed on them, staying solvent through the payment period, and being there for any product/warranty claims. This becomes more and more important in a global marketplace where lead-times are longer, and merchandise is sold in many continents, creating a widespread user base that then requires service and help. For publicly traded companies, such information may be available in the public domain. It can also be obtained from data providers that maintain such corporate data, update it at regular intervals, and sell the information for a price. These data providers can supply data on current operations, cash-flows, creditworthiness, lawsuits, business plans, and executives. It is not unusual for corporations to establish thresholds for each relevant attribute that their partners must pass to do business with them.

NOTES

- *Assortment considerations* answer some basic questions. Does the partner have what the retailer needs? Does the assortment supplied by the partner have any unique selling points that can be leveraged? Should this be an exclusive supply relationship? Is the assortment deep, or wide? What is the quality of the assortment? What types of returns history does the partner have for similar assortment?
- *Legal and social considerations*. This aspect of evaluation ensures that it is legal to deal with the prospective partner and that their social positioning is agreeable to the retailer's image. Governments and other regulatory agencies routinely publish lists of blacklisted countries, corporations, and individuals. Corporations based in the home country of such governments may not be permitted to do business with those on the blacklists.
- *Social and cultural considerations* affect the brand and the corporate image (think of a corporation importing shoes or carpets from a country where child labor is prevalent). Such associations can be expensive and may be part of the corporate evaluation for selecting partners.
- Finally, considerations such as the manufacturing facilities, capacities, currency regulations, process certifications (e.g., ISO 9000 compliance), technology (e.g., ability of the partner to communicate using EDI messages), and communication (linguistic barriers) may be additional parameters in selecting partners.

Partner evaluation and on-boarding typically takes the form of a long collaborated information exchange either through paper forms, or

NOTES

increasingly through a Web portal. The datafeeds from third-party corporate data providers are also added to the data provided by the supplier. The host corporation can review the data to decide whether a supplier passes its partnership credentials.

The next step in the on-boarding process may require additional tasks of certifying vendor processes that will be common for all business communication, such as commonly transacted EDI messages, and setting up the high-level partner terms (or a master contract), which might cover things like payment terms, transit insurance, price basis, and returns, and so on.

Inputs and outputs of the partner evaluation and on-boarding process

As described earlier, the partner evaluation process can be very specific to a corporation. There are no standard or "right" inputs or parameters to evaluate a partner. This is a process that needs to be customized to identify evaluation parameters for partners that are relevant to a corporation, for instance:

- Financial parameters, such as credit rating, operating cash-flow, balance sheet, profit and loss (P&L), projected growth versus industry, financial ratios, and other standard financial information to determine the financial health, growth prospects, and creditworthiness of the company
- Legal parameters, such as ability to do business with the host country, past and current lawsuits for product liability, intellectual property, or poor service, and any other indicators that may show the company's service record for honoring contractual obligations
- Social parameters, like brand image in home country, manufacturing facilities, manufacturing accidents and compensation history, worker welfare programs, worker unions, and worker rights
- Product and process quality inputs, international accreditations, and events such as product recalls, other quality issues, and process capabilities.

The output of a successfully completed vendor evaluation process is an approved and on-boarded partner. However, if the prospective partner did not successfully comply with the requirements of the evaluation process, then the partnership will be denied. Successful vendors are typically added to the approved vendor list of the enterprise, allowing the business systems to transact with the new partners.

NOTES

Material distribution is a core supply chain function in most business operations. In the manufacturing industry, it is the movement of raw materials from the vendors' warehouses to factories, and of the finished goods from the factories to the distribution warehouses. In retail, such movements extend from vendors to the retailer's warehouses, and then to the stores.

As a large retailer can have thousands of stores, supported by a large number of warehouses, the efficiency of the distribution of merchandise from warehouses to stores is very important and can have a substantial impact on profitability.

Transportation management functions address these business needs to move goods and merchandise from one location to another, pay for such moves, buy the required shipping capacity, track the movements of material in transit, and manage the transportation assets if they were owned by the retailer.

The two other functions that would also be within the scope of transportation management are the transportation procurement and transportation capacity planning functions. These two functions are less frequent, and are expected to be completed prior to any of the transportation management functions in supply chain execution. Transportation Planning and Execution. The transportation planning and execution processes help in optimally moving the merchandise from one location to another. Any business process that needs merchandise movements from one point to another can be optimized by using the transportation planning functions. These movements can be between two internal locations, such as shipping from warehouses to the stores, or between an external location such as a supplier's warehouse and an internal location like one of the retailer's warehouses or stores.

Purchase orders, work orders, and distribution orders are used as transaction mechanisms to manage material movements. The transportation optimization process leverages all these transactions to plan for the best method of moving the merchandise from one location to another.

The transportation planning process primarily consists of reviewing all the purchase orders or internal fulfillment orders that are ready to ship. The orders are typically flagged as "ready to ship" when the inventory to fulfill these orders has been identified and committed.

NOTES

This ready-to-ship trigger can be internal or external to the enterprise. For the purchase orders, this inventory belongs to the supplier, and therefore the supplier identifies the purchase orders that are ready to ship. For the internal material transfers, the same could be done at a warehouse either by a warehouse management system or by an enterprise order fulfillment process that identifies the inventory and allocates it to fulfill such requests.

The transportation planning process then takes all the ready-to-ship orders, and consolidates them based on common source-destination pairs that have the same need dates. Need date is defined as the date when the merchandise is required to reach the destination. Other relevant factors may also be considered during the consolidation process, such as transportation classification of the material to be moved, hazmat flag, special handling instructions, or special equipment required, such as refrigerated vans. The objective of the consolidation process is to aggregate or split orders to create shipments that optimize the loads and the routes while simultaneously constraining on the need dates for delivery and resource constraints. The consolidation process can produce many different types of shipments, such as truckloads (TLs), Less-Than-Truckloads (LTLs), multistop loads, transshipments, and multimodal shipments. To ensure operations feasibility, all of these shipments are constrained based on the need date at the destination, pickup and delivery time windows at origin and destinations, equipment type constraints, and the shipping mode constraints.

The consolidation step produces the transportation capacity required to ship all these orders along the identified lanes/routes, and transportation modes. Then the transportation planning process looks at all possible alternatives to move this merchandise. This is also called the *resource or carrier selection process*. These alternatives exist when many carriers can be used along the identified routes/lanes with available capacity and equipment types. The solution models the cost equations for these alternatives, and may consider other parameters like carrier performance, preferred providers, volume commitments, and continuous moves (opportunistic and/or planned). It solves the problem of optimizing the cost and schedule of shipments. This intermediate output of the transportation solution looks like planned loads that are ready to be shipped with short-listed carriers for each shipment.

The next step in this process is the tendering of these loads to the carriers. The shortlisted carriers are selected based on user preferences,

NOTES

historical performance, available capacity, required equipment type, costs, lanes, and other relevant criteria. This short list may have the contract carriers as well as general carriers that do not have prenegotiated contracts with the company on selected lanes. The planned shipments are tendered to this short list of carriers for acceptance. Once the carriers accept the load tender, the shipment is released to the selected carriers, suppliers, and receivers (external or internal) of the shipment; the relevant parties can use this information for scheduling labor and operations at the shipping source and destination locations.

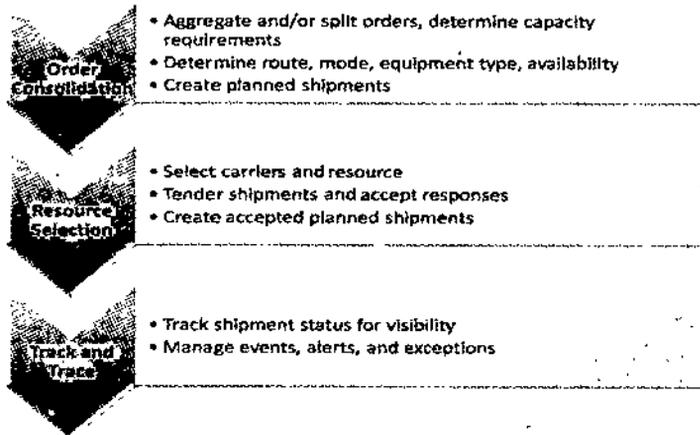


Figure 1.9. Transportation Planning and Execution Steps

Figure 1.9 provides a quick overview of the transportation planning and execution process as presented here. Conceptually, the optimization process has two main steps: (1) consolidating shipments to create optimal loads and routes, and (2) resource selection to select the carrier and the equipment. Advanced transportation solutions can formulate the transportation problem to model and solve both of these steps together. These shipments have now entered the execution phase and can be tracked until they are delivered. The execution phase tracking of shipments is usually done using electronic messages between the carrier and the shipper. EDI transaction 214, also called *Shipment Status Message (SSM)*, is used for these messages and it follows an industry-wide standard that is commonly adhered to across all carriers and shippers so that the messages can be interpreted by anyone. In spite of the common definition, partners need to work together for integration testing and successful on-boarding to ensure that their systems can run unattended. Each shipment can generate many such status transactions during its lifetime from pickup to delivery depending on the number of stops.

Other interactions between the shipper and carrier can also use the electronic messages for communications, and such integration makes

NOTES

the process efficient and allows high levels of automation. Examples of such interactions are the load tender that uses EDI transaction 204 and a tender response using EDI 990. The transportation planning and execution process addresses the following questions:

- What is the most efficient way to move the merchandise for fulfilling the current orders in the supply chain? How should the shipments be built, loads configured, routes selected, and resources and carriers determined?
- What carriers should be selected for managing these moves?
- How much will each shipment cost (estimates based on the carrier contracts)?

The following are some of the relevant industry terms for this process: *Carrier* commonly refers to the transportation service provider. *Shipper* refers to the entity buying the transportation services from the carrier. *EDI (electronic data interchange)* is an industry standard for exchanging electronic messages.

Ready to ship is a status on an order when the supplier (internal or external) wants to flag an order to be considered for shipment planning. This status also means that the source of the shipment, shipment quantity, and inventory have been identified and committed for this order. This ensures that the correct transportation lane can be picked up, and transportation attributes for the shipment such as weight and volume can be accurately determined.

Consolidation is a subprocess within transportation planning that refers to an initial review of ready-to-ship orders, and creation of groups that share certain characteristics such as the same source-destination pair and need dates.

Carrier or resource selection refers to the subprocess that identifies the shortlisted carriers that are suitable for a planned shipment. *Load* is the part of a shipment that will fit on specified equipment (such as an 18-wheeler).

Load tender is the transaction that is used by the shipper to request a shipment pickup or acceptance confirmation from the carrier.

Tender response is the return transaction in response to a load tender that is used by the carrier to accept or reject the shipper's request for a planned shipment pickup.

Track and trace refers to the process of tracking a shipment through its lifecycle as it is picked up from the source and moves through its planned stops to the final destination.

SSMs (shipment status messages) are the messages used for the above track-and-trace process. Each shipment can have several of these messages starting at pickup through multiple stops until the final destination of the shipment.

POD (proof of delivery) is the message that confirms the successful delivery by the carrier at the shipment's destinations. In lieu of the POD, the shipper may consider the final SSM for a planned stop on a shipment's route as the POD for purposes of triggering the subsequent processes.

Continuous moves are the shipment legs that are built to enhance the efficiency of a shipment. It may result in round-trip tours where a carrier picks up merchandise from location A (e.g., a warehouse); drops it to a store B, and then goes to the nearest supplier warehouse C to pick up merchandise destined for warehouse A. Continuous moves typically result in higher utilization and lower cost.

Backhaul/deadheading refers to the return leg of a shipment. Deadheading refers to backhauls that are typically empty.

Pool-points/transshipments are shipments that are routed through an intermediate location with the objective of merging them with other shipments to create better loads/efficiencies. This is also called *merge-in-transit*.

Lane/route refers to the transportation lanes between two specified points. A route can consist of multiple lanes. The lanes are typically serviced by a carrier and specified as such in the contracts with the shipper. Each lane has equipment types available and, in some cases, dedicated capacity if desired by the shipper.

NOTES

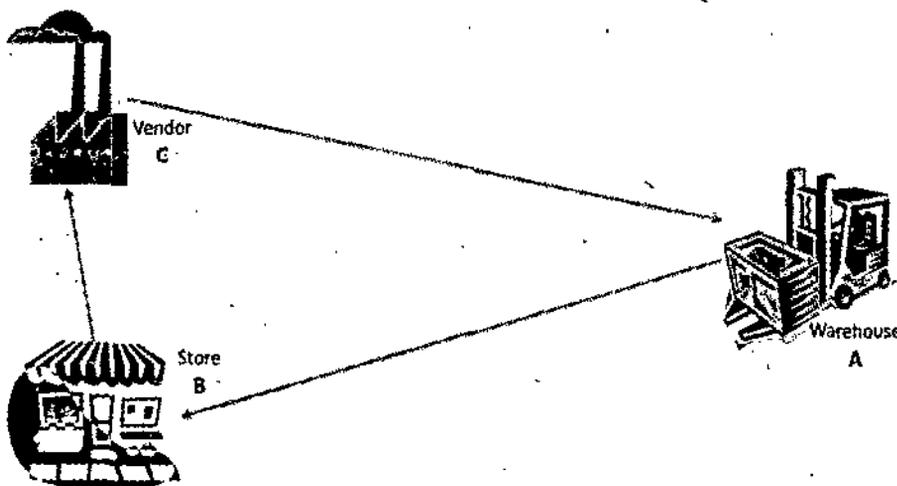


Figure 1.10. Example of a Continuous Move

NOTES

Rate is the cost of transportation along a specified lane for a specified equipment type and load type. Transportation planning systems use rate tables obtained from third-party data providers. Rate tables for different types of shipments (see below, TL/LTL/parcel) may be presented in different formats and have different attributes.

Multi-leg or multistop shipment is a shipment that has one or more intermediate stops between the source and destination. *TL/LTL/parcel* refers to the type of shipment. *TL (Truck Load)* refers to a shipment that completely fills up a truck. *LTL (Less-Than-Truckload)* refers to a shipment that partially fills up a truck. *Parcel* shipments are small package shipments that are generally handled through small package carriers (like UPS/FedEx). The TL rates are generally defined for a lane and for equipment type. The LTL rates are based on the weight/volume of the shipment in addition to lane and equipment type, and are defined in \$/lb/mile. Most carriers have published base rates for TL/LTL and negotiate for the discounted rates based on projected business. As fuel prices vary, prenegotiated fuel surcharges are added to the carrier invoices. Parcel operators do not have any standardized rate charts for shipping lanes. Parcel operators use zones, weight of shipment, and service level for determining the cost of shipment. The zone is decided based on origin-destination pair and generally is a function of distance between the two. For example, for shipments originating on the Eastern Seaboard, most of the West Coast destinations will fall in zone 7 or 8 with other destinations in the intermediate zones. For a specific zone, the parcel rates are published by weight and service level. Service level refers to the type of service selected for the shipment, such as two-day delivery, ground delivery, or next-day delivery.

Zone skipping is the process of shipment planning where retailers typically consolidate individual orders into a cheaper TL/LTL load terminating near a parcel carrier's distribution center. The shipment is then split into individual parcels and carried by the parcel carriers for delivery. The parcel rates depend on the zone, which reflects the distance between an origin and destination, and zone skipping provides the shipper with an option to cut costs of the parcel shipments to individual customers.

Multimodal shipment refers to shipments that have mixed modes, such as rail/truck or ocean/rail, to complete the shipment from source to destination. The business process and solution requirements for such shipments differ from single-mode shipments. Multimodal shipments are more complex to plan, rate, and execute. Such shipments have multiple providers managing a single shipment, and that requires enhanced system integration and messaging capabilities across all partners to make sure that the shipment

is properly tracked and visible to all parties at all times. Ocean and rail shipments may also need additional third-party services to manage yard operations.

Drayage in the transportation planning context refers to the management of ocean containers at the source, or destination ports, or rail yards. Drayage service providers take ownership of the containers on behalf of the shipper/carrier, and manage them from the port to any specified in-land point as the process moves through docking, unloading, and customs clearance. Similar services cover the rail-yard operations as well.

Customs brokers are service providers that manage the customs clearance of merchandise at the port for imports and exports. These companies create and manage the customs paperwork, settle customs and import duties, and sometimes also coordinate with the drayage companies to clear the containers from the port.

Routing guide is a document published by the shippers as guidelines for their suppliers to select and use carriers for shipments when the shipments are not being managed directly by the shipper. The shipper may audit the suppliers for compliance with the routing guide.

Accessorial charges are additional miscellaneous charges incurred on a freight invoice, and are reimbursable. Examples of such charges are expenses incurred due to delays in loading/unloading, an unscheduled overnight halt at the shipper's facility, a special tarp cover during rain, and so on. These charges are generally part of the carrier contract and are prenegotiated.

Fuel surcharge is the difference applied to the carrier invoice due to the changes in the cost of fuel after the carrier's rates were published or negotiated. These can be applied nationally or can be regional.

Mileage/mileage engine is a software application that calculates the mileage between any two points and can generate routes that are navigable by specific equipment such as over dimensioned vehicles (e.g., 53-foot trailers). Such applications are required for the transportation planning processes, and sometimes are embedded within the larger solution. These applications use map databases that need to be updated to reflect the changes in rail/road network.

Rate engine is a software application that can rate a shipment given the route. Rate engines may be embedded within the transportation planning solutions.

NOTES

NOTES

Geo-coding is a process of assigning geographic codes to maps and street addresses. One common example is the map-grids that are printed on maps for easy reference. Geo-coding helps determine the route between two points correctly and also provides alternative ways to create and rate a shipment when the precise street address is not known.

Line-haul charges are the basic charges for long-distance moves and are calculated based on the distance moved and the weight of the shipment. These charges are part of the carrier contracts and/or their published rates. When the distance moved is less than 450 miles, it is generally considered a short-haul move.

Container optimization refers to the process of optimizing the containers for ocean shipments. This process may be part of purchase planning or transportation planning. The objective of the process is to ensure optimal container utilization for the ocean legs of shipments. A similar process can be adopted for trailer optimization for road shipments and rail-car optimization for rail shipments.

Common carrier refers to carriers that can be bid for shipping by anyone. These carriers typically will not have a long-term contract with the shipper, and services are limited to a specific shipment that is accepted by the carrier.

Dedicated fleet is the fleet that is dedicated to the retailer. It can be owned or leased.

Domestic Shipping

Domestic shipping is generally a simpler process when compared with international shipping. It may sometimes involve multiple legs and multiple modes, though such shipments will be merely a small proportion of the overall domestic shipments. As no national borders are involved, there is no customs process. The payment terms, in-transit damages, and insurance practices are relatively standardized across the domestic shipping industry; in most cases, there is no inspection of goods prior to the clearance for shipping the merchandise. Therefore, the domestic shipping planning and execution process is simpler, and closely follows the description provided here. Tracking these shipments is also simpler as there is generally a single partner, and rarely a small number of partners, involved in completing the shipment. If rail is involved in the domestic shipping, rail-car optimization and rail-yard operations may be involved. Rail-yard operations are generally managed by a service provider other than the carrier, and may require additional points-of-process interfaces to track and follow the shipments.

International Shipping

International shipping typically involves more than one transportation mode and multiple legs to complete the transportation from source to destination. In addition to the transportation complexity, international shipping also involves compliance with global trade terms; customs rules for export and import; special financial and payment terms; and additional coordination with service partners like inspection companies, customs brokers, and drayage companies, to completely track and manage the shipments. This makes these shipments more complex, and requires solutions that are functionally richer.

When ocean lanes are involved in the transportation planning, *container optimization may be part of the purchasing cycle*. Container optimization ensures that the shipping container is fully utilized when it is being paid for full. Container optimization can be done prior to purchase planning to adjust the quantities originating at a specific port to fill the container, or it can be done as part of transportation planning, where multiple orders are consolidated at origin to optimize containers for a specified destination port. If the retailer has a consolidation port at the far shore, smaller orders can be consolidated into containers prior to shipping. If no such consolidation facility exists, it may benefit to complete the containerization prior to confirming the orders.

An ocean shipment planning process has unique characteristics that require additional solution capabilities. For example, ocean shipping frequently involves multiple legs in a mixed-mode manner. Figure 1.11 shows a typical ocean shipment. The whole shipment may consist of a road trip from the manufacturing plant to the port, drayage operations at the far-shore port, ocean journey, drayage operations at the near-shore port, and finally rail or road transport to the final destination. Optimizing multi-leg, multimodal shipments makes these processes more complex. The additional partners required to manage ocean shipments, such as the drayage companies, inspection companies, and customs brokers, also makes the process more complex to execute.

Inputs and outputs of the transportation planning and execution process

Transportation planning and execution processes need the following information as inputs:

- Master data such as items, suppliers, supplier locations, company locations, rates/lanes/routes, carriers, equipment type, carrier

NOTES

NOTES

contracts, and item/product transportation attributes such as packaging options, weight, volume, Department of Transportation (DOT) classification, and special handling and transportation requirements

- Orders, which can be purchase orders or material transfer orders
- Tender responses and shipment status messages
- User inputs for configurable options for system processes (such as regions, routes, parameters for consolidation and optimization, and so on).

The process creates the shipments, selects the carriers, tenders the shipments, and tracks them. It provides the following outputs:

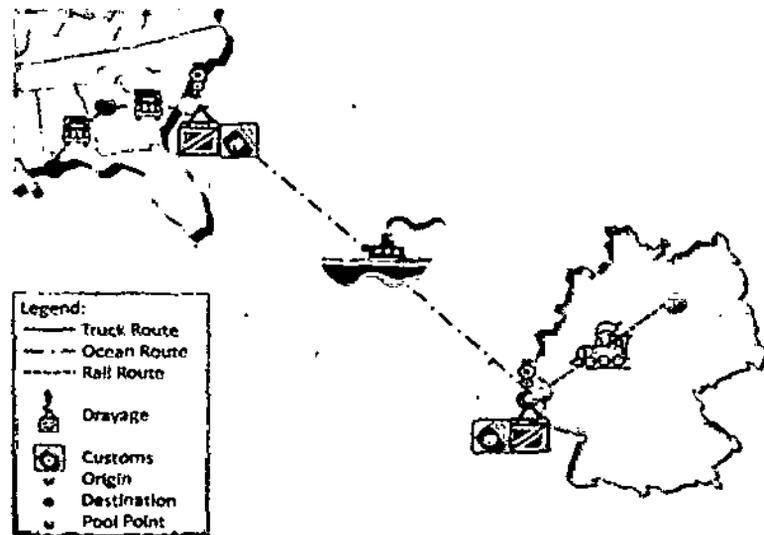


Figure 1.11. Example of an Intermodal Multi-leg Shipment

- Shipments, load tenders, selected carriers, shipment tracking, rating, and multitudes of electronic messages for interacting with the partners and their systems
- Data, reports, and analytics for tracking the process and measuring process efficiency.

Freight Audit and Verification

As shipments are completed and the freight invoices start arriving, the freight audit and verification process kicks in to ensure that these invoices are verified against actual shipments and their statuses, and that the invoices have been computed using the correct shipping rates, fuel surcharge rates, and accessorial charges according to the agreed contract between the shipper and the carrier.

The process also provides the functions for managing any claims against the carrier for loss and/or damage during transit. This is also a good place to execute freight cost allocations, if required. Freight is generally considered to be overhead that is allocated to the underlying cost centers to determine profitability of operations. For example, a retailer may allocate the cost of freight to the stores that are getting the shipments to account for the cost of freight. The cost allocation scenarios will differ among retailers, and depend on their cost accounting methods and the objectives for such allocations. The freight payment process has two general variations used in the industry. Match pay refers to the process of paying for shipments after receiving the invoices from the carrier, and matching them up against authorized/ referenced shipments. *Auto pay* is the process where the shipper chooses to pay immediately on completion of a shipment, after obtaining a proof of delivery from the carrier that may come as a final shipment status message.

NOTES

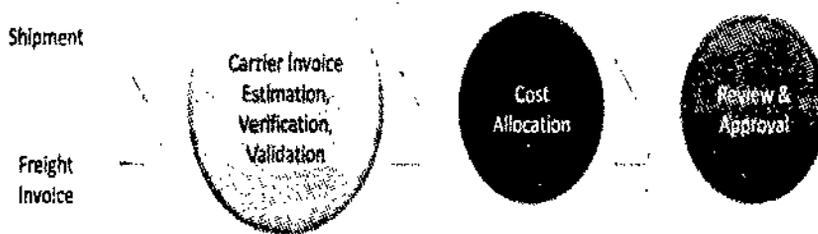


Figure 1.12. Overview of Freight Invoice Payment

An overview of the freight payment process is presented in figure 2.12. The freight audit and verification process addresses the following needs:

- Are the carrier invoices raised against the shipments authorized by the shipper?
- Are these shipments successfully delivered and invoices due?
- Did the carrier use the correct rate for the type of shipment, equipment, lane, and weight of the shipment? Are the additional charges aligned with the carrier contracts?
- How are these expenses to be allocated?
- Are there any claims due against this shipment? What are the value and status of such claims?
- Should the invoice be paid in full or in part?

NOTES

The freight audit process uses the data from the shipments created by the system and the carrier contracts to rate the shipment. When an invoice is received, it is verified against the reference shipment. If the shipment status is configured for payment processing, for example, "delivered" or "closed," then the freight audit process checks all the charges on the invoice and verifies them as valid. For example, the line-haul charges are checked against the shipping rates for the specific lane and shipment type; accessorial charges are validated against the type of charges allowed, and any limits; fuel surcharges are validated against the negotiated rates, and so on. Based on these validations and user configuration, the freight audit process may pass the invoice for payment, reject it, or hold it for user review and approval.

Approved invoices are sent to the accounts payable system for action. Based on the payment terms, these can become part of either accrued expenses or payables.

Inputs and outputs of the freight audit and verification process

The freight audit and verification process needs the following information as inputs:

- Master data such as vendor locations, company locations, rates/lanes/ routes, carriers, equipment type, carrier contracts, and item/product transportation attributes such as packaging options, weight, volume, DOT classification, and special handling and transportation requirements.
- Planned and executed shipments and shipment status messages.
- User inputs for configurable options for system processes and approval workflows.
- In-transit loss or damage information. This is typically received from the receiving applications at the warehouse or stores.

The process creates the list of carrier invoices, which are in approved, held, or rejected status. These can then be integrated with the financial systems as accrued and payable expenses. The process outputs are:

- Status of the freight invoices after verification and audit; approved, rejected, or held for user review.
- Journal entries for the General Ledger (GL) or the Accounts Payable (AP) subledger. Expenses that are accrued but not yet payable are

generally represented in the GL journal transactions, whereas those to be processed for immediate payments may be sent to the AP subledger.

- Carrier claims. These will typically involve communicating with the carrier, who can then accept or reject the claim, and final reconciliation of the freight invoice based on the claim disposal. This process is increasingly facilitated using portal environments for ease of collaboration.

NOTES

1.19 FLEET MANAGEMENT

Fleet management is another process within the larger transportation planning and execution business function. Many companies either own their fleet or have a leased fleet dedicated to them. This is common for shipments within their internal network, such as those between their distribution centers and stores. Managing a dedicated fleet requires considerations that may not be relevant to the shipment planning and execution process when the transportation is provided by a common carrier.

Having a dedicated fleet often provides retailers with flexibility in their day-to-day operations for managing store replenishments from the warehouses, as they do not have to go through the tendering process with the carriers.

Following are some of the business functions that go with this process.

Fleet Capacity Planning

This subprocess establishes the required capacity of the dedicated fleet. Using dedicated or own fleet provides scheduling and routing flexibility; if well utilized, it can provide cost savings as well. Managing the fleet, however, can mean additional process overhead to operations.

Fleet capacity planning involves analyzing historical data and projected requirements for shipments between warehouses and stores and other locations within the enterprise supply chain. These requirements may differ by season, and therefore shipment capacity requirements change over time within any given year. The planner may decide to use the average shipment volume numbers, or a base number that guarantees a *basic utilization of this dedicated fleet*. This target utilization may be anywhere between 60 and 80%. The rest of the capacity fluctuations

are then catered to by using the common carriers for internal shipment routes.

Fleet capacity planning addresses the following questions:

NOTES

- How much capacity should be dedicated?
- Where should this capacity be located?
- What type of equipment should be planned for a dedicated fleet?

The output of the fleet capacity planning exercise establishes the number and type of equipment needed, and the location where this equipment should be housed. As time goes on, the demand may change and dedicated equipment may be moved from one location to another to improve utilization.

Fleet Asset Management

The fleet asset management process provides the asset lifecycle management and asset tracking functionality. Asset lifecycle management consists of planning when an asset is introduced into the system, how the asset is depreciated, when the asset is retired from the system, and the final disposition of the asset.

Asset tracking capability allows managers to locate fleet assets within their facilities, and to ensure optimal asset positioning to support their shipping needs.

Fleet asset management addresses the following questions:

- When/how are assets introduced into the dedicated fleet? How many assets are introduced?
- Where are these assets at any given time (tracking)?
- How should these assets be depreciated?
- What is the retirement schedule for the assets? How will these assets be retired and disposed of?

This function may be part of the fleet management system within the larger transportation process. Alternatively, it can be addressed using the asset management functionality available in most of the ERP applications.

Fleet Maintenance and Scheduling

This process allows for fleet scheduling and regular maintenance. Fleet utilization depends on efficient scheduling. Fleet scheduling is constrained by the availability of drivers and by DOT regulations on the hours of

service. Equipment availability at specific locations may further constrain efficient scheduling if these assets are not optimally located.

The fleet maintenance and scheduling function addresses the following questions:

NOTES

- What is the optimal schedule for a given day for all the equipment in the dedicated fleet? What is the percentage utilization for the dedicated fleet?
- Where is the fleet at a given point in time (real-time tracking)? What type of equipment is available at a given location, and what is its availability?
- Does the process support the capability to create and analyze data required to support regulatory compliance?

Inputs and outputs of the fleet management process

The fleet management process needs the following information as inputs:

- Master data such as locations, equipment type, item/product, item/product transportation attributes, item/product to location relationships, asset types, asset costs of acquisition and maintenance, asset depreciation parameters, asset active life, drivers, resource availability calendars, and maintenance calendars
- Targeted shipments for the dedicated fleet, and the historical volume of such shipments between facilities
- User inputs for configurable options, such as for compliance and target fleet utilization.

The process helps establish the capacity requirements, manage the assets' lifecycles, and schedule and track their utilization. Expected outputs from the process include:

- Fleet capacity requirements by location and by equipment type, and projected utilization
- Asset introduction, maintenance, retirement, and disposal schedules
- Asset operation schedules and utilization reports.

1.20 WAREHOUSE MANAGEMENT

Warehousing is an equally important component of the distribution equation along with transportation. Warehouses provide the locations where inventory is stocked primarily to absorb demand fluctuations and to provide smoother operations of the supply chain. Warehouse

NOTES

warehouse helps retailers to reduce their own inventory and hence improve their operating cash flow and inventory turnover. Inventory ownership changes when the retailer decides to ship this merchandise to the store. The warehouse systems typically need integration with the financial systems to pay for the shipped merchandise.

Cycle counting is a type of physical inventory verification. Conventionally, the *physical inventory verification* was planned and executed on a specified day when all the other warehouse activities were suspended. Cycle counting is the process of *continuous* inventory verification without disrupting normal warehouse activities. There are several different processes to plan and execute cycle counting. It may involve conducting cycle counts for a subset of products regularly, or verifying inventory every time a product location is moved and/or inventory for that product becomes too low or zero.

Pick-to-light and *put-to-light* are process enhancements for the picking and putaway processes in a warehouse using lights. As the pickers scan the order/item/LPN, the lights on the correct bin location direct them for picking or for putaway. As the operators do not have to find locations, it increases their productivity and accuracy.

Pick-to-voice and *put-to-voice* are process enhancements for the picking and putaway processes in a warehouse using voice. The pickers are directed by voice for picking or putaway tasks, and need not interact with the RF device using a conventional keyboard or touchpad. As the operators do not have to use a keyboard or touchpad, it provides hands-free operation and increases productivity, accuracy, and safety.

Active locations are warehouse locations that are actively used for order fulfillment. These locations may be closer to the designated staging and shipping areas, with better accessibility and maneuverability. These locations are generally replenished from the reserve locations when empty.

Reserve locations are warehouse locations that are primarily used for bulk storage. These locations are used to replenish the active locations when required.

Order waves refer to batch processing of orders outbound from the warehouse. This process creates the order pick, pack, and ship tasks.

Engineered labor standards are the performance standards for the warehouse activities. These standards are established using industrial engineering methods and can also be purchased from the data providers. These standards are generally used in warehouse labor planning applications that support labor requirements planning, labor performance management, and performance-based incentive calculations.

Yard management refers to all the functions that help in efficiently using the warehouse yard and docks through better scheduling and visibility.

MHE (material handling equipment) is the mechanical equipment in the warehouse, such as fork-trucks, -lifts, conveyors, or any other equipment used for loading, unloading, and moving material within the warehouse. Some MHE, such as conveyors, can be interfaced with warehouse management systems and directed dynamically for better warehouse efficiencies.

GS1-128, UCC-128, or EAN-128 refers to a labeling standard that uses a high-density bar-code. They are all based on the code 128 barcoding standard that can encode all 128 characters of ASCII and uses double-density coding (encodes two numbers in one character space) for space efficiency on the labels. These codes can be used for pallets or individual packs of products and have information on source, destination, product ID, quantities, order reference, and any other required fields.

RF devices or handheld/truck-mount devices are portable mobile devices that are used by warehouse personnel to complete their tasks. These devices connect to warehouse applications using radio-frequency waves. The warehouse management application directs users to their tasks through these devices and also accepts their inputs through a keyboard, touchpad, or scan-guns attached to the device.

Ti-hi refers to the stacking of boxes in a pallet. *Ti* refers to the number of boxes/cases in a layer, and *hi* refers to the number of layers in the pallet. These are sometimes enforced by retailers to keep the standard package sizes that are helpful in better space planning in the warehouse, load planning in transportation management, and inventory handling at the warehouse. Compliance is typically ensured through use of machines at the warehouse inbound receiving operations that measure the weight and volume of inbound shipments.

Dimensioning system refers to machines used in the warehouses that can scan a moving package and produce its dimensions and weight. These attributes are used for optimizing storage and transportation, and to measure supplier compliance with the *ti-hi* guidelines provided by the retailer.

LPN (license plate number) is an identifier for a container. It contains the container information, including its contents. It is also called a serialized shipping container label (*SSCC-18*), which is an 18-digit number and bar-code. LPN can be coded at any level, such as container, pallet, or case.

NOTES

NOTES

Certified shipping and receiving refers to an agreement whereby the receiving party does not verify the product and quantity received, but rather depends on the scanned information at the time of receiving. This agreement is reached in advance between the shipper and the receiver and makes operations more efficient. Warehouse management processes can be logically divided into the following process categories.

Inbound Warehouse Operations

These functions address the receiving operations at a warehouse. This is one of the core functions in warehouse management. Inbound shipments to the warehouse are scheduled so that receiving docks, unloading equipment, and resources can be booked for these shipments. When the shipments arrive at the warehouse, they are unloaded and their disposition is decided. The disposition may involve putaway, staging, or shipping.

Appointment Scheduling and Pre-receiving

The appointment scheduling function allows warehouse operators to schedule inbound shipments in advance. This ensures that the inbound shipments do not have to wait long when they arrive, and that the appropriate dock doors and unloading equipment are reserved for them to be unloaded. Appointment scheduling can also be used for labor scheduling and task planning at the warehouse.

Other *pre-receiving functions* may involve determination of inbound inventory and an optimal disposition for this inventory. In many cases, this inventory is matched against outstanding fulfillment requests, and receiving tasks are paired with the putaway tasks directly to the staging or the shipping areas. This saves storage, putaway, order wave, and order-picking tasks and makes the process more efficient. Though this is highly desirable, its feasibility may depend on the products in the inbound and outbound shipments as well as inventory policies such as First-in-First-Out (FIFO) or Last-in-First-Out (LIFO) and the shelf-life of the products involved.

Receiving and Putaway

These are the actual tasks performed when inbound shipments arrive at the warehouse. Receiving involves unloading the product from the truck and scanning it to record receipt. Scanning also validates the order against which this shipment is being received and helps in reconciling the receipts against the orders. This information is further used to validate invoices for payment to suppliers.

NOTES

The labels on inbound shipments generally have order information, as well as detailed item information about the shipment. Sometimes the receiver provides the shipping label standards that all suppliers need to comply with. Such labeling standards, if enforced, make the process more efficient as consistent information is encoded on the labels and shipments are easily identified by both the users and the system.

Once unloaded and scanned, the system must determine the disposition of the unloaded products. This disposition determination is generally quite flexible and is based on various system- and user-defined rules. The disposition function creates the putaway task and determines the destination for inbound shipments. When the shipment needs to be put away for storage, the system also suggests a specific location for storing the received merchandise. This selected location is based on the merchandise, existing inventory in the warehouse, empty locations available, material classification of the merchandise, and physical dimensions and stacking attributes of the packaging. The receiver/retailer may also enforce standardized pack sizes for ease of handling and storage. The number of layers in a pallet is also referred to as *standard ti-hi* (tier-height) for pallets/packaging. Ti-hi affects the physical dimensions of the pack, and therefore the storage characteristics.

Some retailers collect such data (size, weight of packs) during the inbound processing of shipments. Such data can be used for planning better transportation and/or to measure compliance with retailers' packaging requirements by the supplier. All inbound shipment packs are sent through a dimensioning system that scans the packs and produces the physical dimensions and weight of the pack.

The destination for putaway tasks may be a shipping dock, staging area, reserve location, or active location.

1.21 REVERSE LOGISTICS MANAGEMENT

Reverse logistics management covers all the business functions that allow a retailer to process the merchandise returns generated at the stores, web sites, or warehouses. Reverse flow of merchandise can begin as:

- Retail customer returns at a store, and online or catalog returns at a returns facility.
- Vendor buybacks, which can be a result of new product introduction by a vendor in a category, or a competitive replacement of another

NOTES

vendor's product. Such buybacks may be triggered by merchants after appropriate negotiations with their suppliers. The buyback information is sent to the stores as part of daily action items to facilitate scheduling and execution of the related tasks.

- Retailer-initiated returns due to quality, safety, or compliance concerns. These returns can be triggered by merchants based on customer complaints, vendor request for callback, or a regulatory agency issuing a product callback.

Regardless of their starting point, the returns need to be managed so that the associated costs are minimized. Examples of such costs are the cost of handling returns at the store or for a web/mail channel, determining disposition, transportation, disposal-on-site, and financial reconciliation of the returns transactions.

The first step for customer returns may happen in a store in case of physical returns, or at a call center where online and catalog customers call for getting a Return Merchandise Authorization (RMA). This chapter focuses only on the supply chain aspects of returns management, and ignores the customer interaction part of the process.

Reverse logistics management consists of managing the flow of merchandise from stores and customers back to the supplier. This returned merchandise may pass through a consolidation center. The complete returns transaction can contain a few shipment legs, warehousing, packing, handling, and other warehouse activities. Due to the complexity of managing the reverse flow, many companies simply subcontract the reverse logistics to a third-party logistics provider. These contracts may be limited to transportation and warehousing, or may include all services, such as disposition determination, disposal, and supplier credit reconciliation. An overview of the process is presented in figure 1.13.

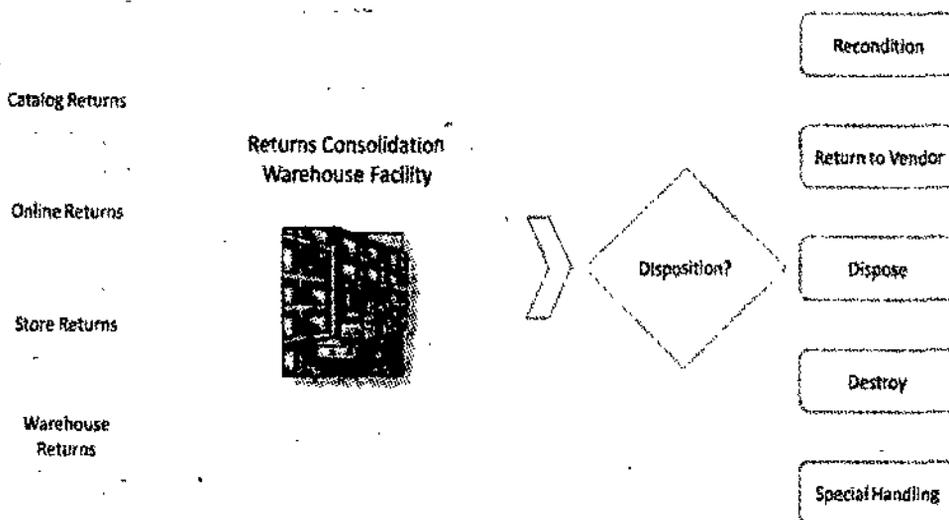


Figure 1.13. Overview of Reverse Supply Chain Process

1.22 RETURNS DISPOSITION DETERMINATION

The returns disposition process helps determine the best way to dispose of the returned merchandise. The disposition can take many forms:

NOTES

- The returned merchandise can be returned to the sales floor. It may need testing, reconditioning, repackaging, and restocking. It may or may not be marked down for clearance. This disposition action can result in store activities or shipping to a reconditioning facility, and tracking the merchandise back through to the sales floor. The markdown pricing decision may be derived from a corporate policy, or simply may be a store manager's privilege.
- It can generate a Return to Vendor (RTV) transaction. Such a disposition can then generate many supply chain activities, such as shipping back to a returns consolidation center or directly to the vendor. The process will also mean integration with accounting to adjust supplier accounts based on the terms of the returned merchandise.
- It can result in a decision to dispose of the returned merchandise. The disposal can be onsite or offsite. Onsite disposal may simply trash the merchandise in accordance with local regulations. Offsite disposal may be done by a third-party company that clears the disposed-of items on a regular basis from the stores.
- It can result in a decision to destroy the merchandise, onsite or offsite. This is generally a result of regulations in place for certain classes of merchandise.
- It can result in disposal with special handling instructions, such as for merchandise that is considered hazardous. Such merchandise needs to be tracked until it is safely disposed of, and records maintained for state and federal regulatory agencies.

SUMMARY

- *Flow and management* of these resources is key to supply chain management.
- Between the supply and demand ends of a supply chain are modeled other elements that constitute the *distribution network*.

NOTES

- The core functions of the supply chain relate to activities that are limited to within the four walls of the corporation. These are the processes that are typically covered within what is called the *Supply Chain Management (SCM) space*.
- Supply chain network design is the process of establishing the network nodes and flow-paths in a supply chain.
- Demand planning is probably the most important supply chain process in that it drives almost all other processes directly or indirectly toward fulfilling the demand.
- The supply management functions of a supply chain have a large scope from sourcing to purchasing, manufacturing, replenishment, and vendor performance management.
- Reverse logistics management covers all the business functions that allow a retailer to process the merchandise returns generated at the stores, web sites, or warehouses.

REVIEW QUESTIONS

1. What do you understand by supply chain management?
2. What is the significance of supply chain management?
3. What are the different components of supply chain management?
4. Draw the SCM model and explain each component in detail?
5. What are the different steps of supply chain planning?
6. What is Supply Chain Network Design?
7. Discuss Product Flow Analysis in the Warehouse.
8. What do you understand by logistics capacity planning?
9. What is demand planning? What are different aspects of demand planning?
10. What is demand forecasting?
11. What are the different aspects of inventory planning?
12. What is logistics capacity planning?
13. What is transportation capacity planning? What are different input and output of transportation capacity planning?

14. What is transportation capacity procurement process? What are the different inputs and outputs?
15. What is different warehousing capacity planning process in SCM?
16. What is Fleet management? What are different aspects of Fleet management?
17. What is Warehousing Management?
18. What is reverse logistics management?

NOTES

FURTHER READINGS

Supply Chain Management: Edited by Jayashree Dubey and ML Sai Kumar, New Century, 2007.

Supply Chain Management: J. Paul Sundar Kirubakaran, Serials Pub, 2008.

Supply Chain Management: Edited by John T Mentzer, Response Books, 2001.

Supply Chain Management: Edited by John T Mentzer, Response Books, 2001.

Supply Chain Management: N.H. Mullick and Mohd. Altaf Khan, Enkay, 2011.

NOTES

★ STRUCTURE ★

- 2.0 Learning Objectives
- 2.1 Introduction
- 2.2 Logistics as a Part of SCM
- 2.3 Logistics Subsystems and Activities
- 2.4 Logistics Cost
- 2.5 Defferent Models of Logistics
- 2.6 Logistics : Inbound and Outbound
- 2.7 The Bullwhip Effect
- 2.8 Distribution Management
- 2.9 Warehouse Management
- 2.10 Warehousing Fundamentals
- 2.11 Purchsing and Vendor Management
- 2.12 Purchasing Objectives
- 2.13 Impact on Profitability
- 2.14 Controlling the Process
- 2.15 Functions of Purchase Department and Purchase Policies
- 2.16 Evolution of Purchasing and Supply Management: Vendor Evaluation
- 2.17 Centralized Versus Decentralized Department
- 2.18 Accounting for Materials: Fundamental Steps to Complete a Purchase
- 2.19 Terms of Purchase
- 2.20 Completing the Purchase
- 2.21 Buying from the Right Supplier and Vendor
- 2.22 Source Selection
- 2.23 How Many Sources of Supply: Single Vendor Concept?
 - *Summary*
 - *Review Questions*
 - *Further Readings*

2.0 LEARNING OBJECTIVES

After going through this unit, you will be able to:

- describe the logistics subsystems and activities
- what is logistics cost?
- discuss about the distribution management.
- difference between buying from the right supplier and vendor.
- explain the importance of source selection.

2.1 INTRODUCTION

A *supply chain* may be considered as a group of organizations, connected by a series of trading relationships. This group covers the logistics and manufacturing activities from raw materials to the final consumer. Each organization in the chain procures and then transforms materials into intermediate/final products, and distributes these to customers. The supply chain can be defined as the integral management (within the company and through other companies) of the company's various logistical stages such as materials procurement, production, storage, distribution and customer service. The supply chain concept should be seen as a whole, that is, the entire system from the origin of procurement to the final consumption of goods or services.

NOTES

2.2 LOGISTICS AS A PART OF SCM

In supply chain network we must include all the organizations involved in the production of certain goods or services (from the origin of procurement to final consumption), and each of the logistical stages within these organizations. Thus, the supply chain is a network linking and interweaving different supply chains of all the companies involved in a production process. A diagram depicting the typical supply chain is shown in figure 2.1.

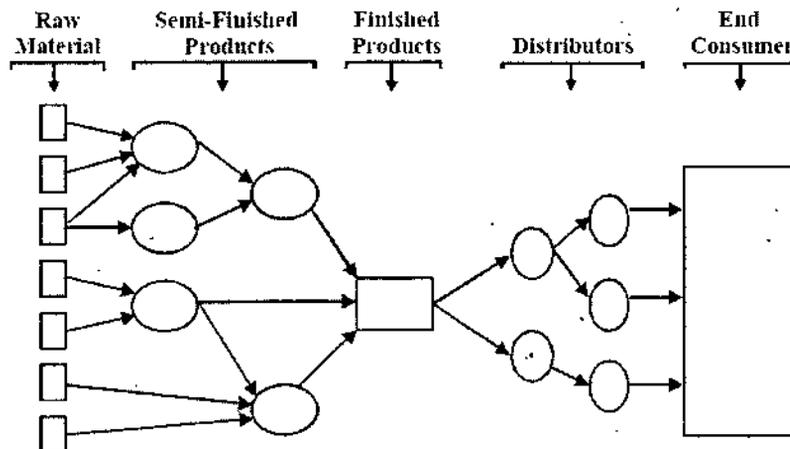


Figure 2.1. Typical Supply Chain

The supply chain activity therefore constitutes complex objects, as it involves decision-makers from many different companies, who sometimes have no direct relationship and are placed in very different geographical

NOTES

locations; yet the decisions they make are mutually dependent upon each other. Hence, there is a need for an information system capable of linking together the different members of the chain so that there is an open communication between them.

The concept of supply chain is not new. Historically we have moved from physical distribution to logistics management and then to supply chain management. This major difference seems to be that supply chain management is the preferred name for the actualization of "integrated logistics", with it acting as an enabler; it is now possible to have an integrated process view about the logistics and all allied processes related to business. Ideally the supply chain should be a "seamless" chain as shown in figure 2.2.

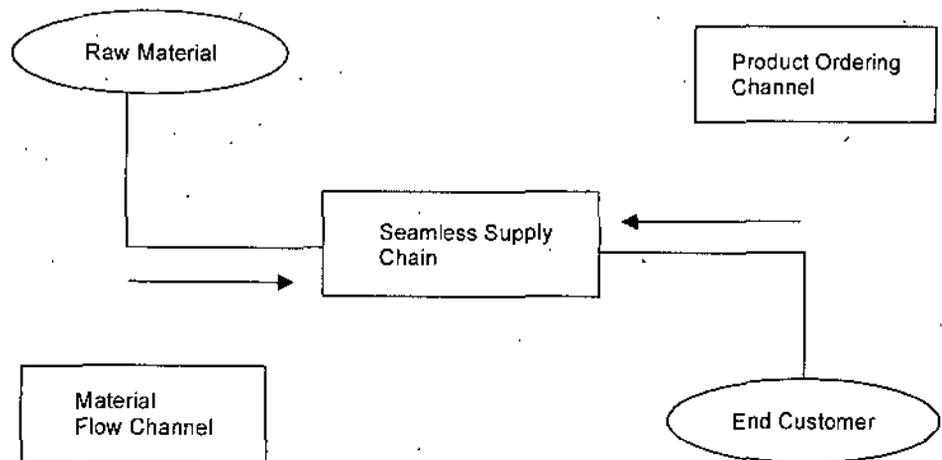


Figure 2.2. Seamless Supply Chain

The importance of logistics can be gained from the fact that logistics and supply chain management costs are in range of 10 to 15 of the GDP for developing countries while it is around 18 to 20 per cent for developed countries. The concept of integrated logistics consists of two interrelated efforts:

- *Logistics operation:* Logistic operation can be basically clubbed into physical distribution management, materials management and internal inventory transfer.
- *Logistic coordination:* Logistic coordination pertains to forecasting, order processing, operational planning and product procurement or MRP. This integration is effected through effective information flows.

Forrester (1961) suggested that the five flows of any economic activity – money, orders, materials, personnel and equipment are interrelated by an information network, which gives the "system," which is now called as supply chain due to its own character. According to Christopher (1992)

NOTES

supply chain is network of organizations that are involved, through upstream and downstream linkages, in the different processes and activities that produce value in the form of products and services in the hands of the ultimate consumer. Managing these linkages and delivering the product/service to the customer in a cost effective way is SCM. Supply chain management encompasses materials/supply management from the supply of basic raw materials to final product (and possible recycling and re-use). Supply chain management focuses on how firms utilize their suppliers' processes, technology and capability to enhance competitive advantage. It is a management philosophy that extends traditional intra-enterprise activities by bringing trading partners together with the common goal of optimization and efficiency.

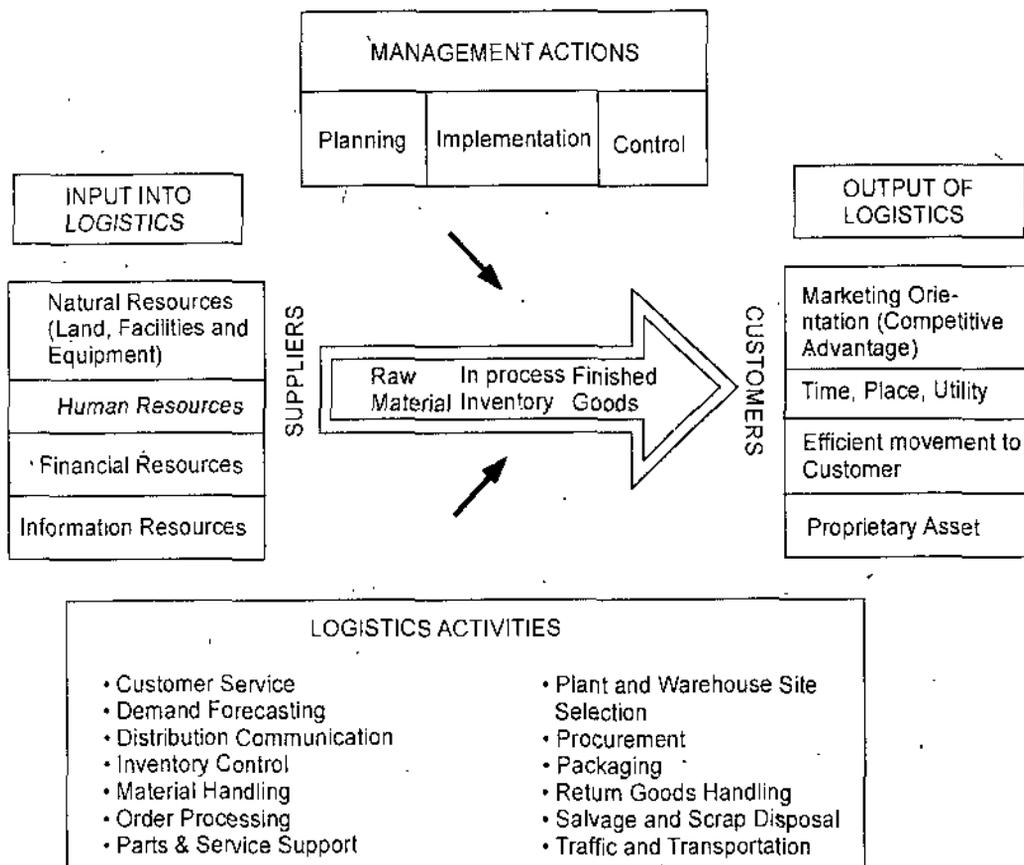


Figure 3.3. Components of Logistic Management

Supply chain management is a set of approaches utilized to efficiently integrate supplier, manufacturer, warehouse and stores so that merchandise is produced and distributed at the right quantities, to the right location and at the right time, in order to minimize system under costs while satisfying service level requirements (Levi (2000)).

The common thread in these definitions is that supply chain management seeks to integrate performance measures over multiple firms or processes, rather than taking the perspective of a single firm or process. Supply

NOTES

chain management has provided the next logical stage in the evolution of competitiveness for the manufacturing organization and added, importantly, a concern for the flow of materials to and from the organization. Supply chain management integrated suppliers to the end consumers and emphasized the need for collaboration to optimize the whole system. As such, supply chain management is the process of designing, planning and implementing change in the structure and performance of the 'total' material flow in order to generate increased value, lower costs, enhanced customer service and yield a competitive advantage. In effect, the addition of supply chain management to the marketing model created a truly 'systems' approach to the organization and its direct and indirect trading relationships. The content of supply chain management within a firm varies considerably with the type of business. Figure 2.3 shows the different components of logistics management. A representative list of logistic element for a firm is given in Table 2.1.

Table 2.1. Logistic Element

Facility Location	Determining location, number and size of facilities needed Allocation demand to facilities
Transportation	Mode and service selection Carrier routing Vehicle scheduling
Inventories	Finished goods stocking policies Record keeping Supply scheduling Short-term sales forecasting
Customer Service	Cooperate with marketing in: determining customer needs and wants for service determining customer response to service
Order Processing and	Sales order Procedure
Information Flows	Information collection, storage and manipulation Data analysis
Warehousing and Material Handling	Space determination Stock layout Material handling equipment selection

	Stock storage and retrieval Equipment replacement policies
Protection Packaging	Design for handling storage, protection
Product Scheduling	Co-operate with production in: specifying aggregate production quantities sequencing and timing of production

NOTES

2.3 LOGISTICS SUBSYSTEMS AND ACTIVITIES

In our definition, logistics is comprised of five interdependent activities: customer response, inventory planning and management, supply, transportation, and warehousing.

Customer Response

Customer response links logistics externally to the customer base and internally to sales and marketing. Customer response is optimized when the *Customer Service Policy* (CSP) yielding the lowest cost of lost sales, inventory carrying, and distribution is identified and executed.

The logistics of customer response includes the activities of:

- Developing and maintaining a customer service policy
- Monitoring customer satisfaction
- *Order Entry* (OE)
- *Order Processing* (OP)
- Invoicing and collections.

Inventory Planning and Management

The objective of *Inventory Planning and Management* (IP&M) is to determine and maintain the lowest inventory levels possible that will meet the customer service policy requirements stipulated in the customer service policy. The logistics of inventory planning and management includes:

NOTES

- Forecasting
- Order quantity engineering
- Service level optimization
- Replenishment planning
- Inventory deployment.

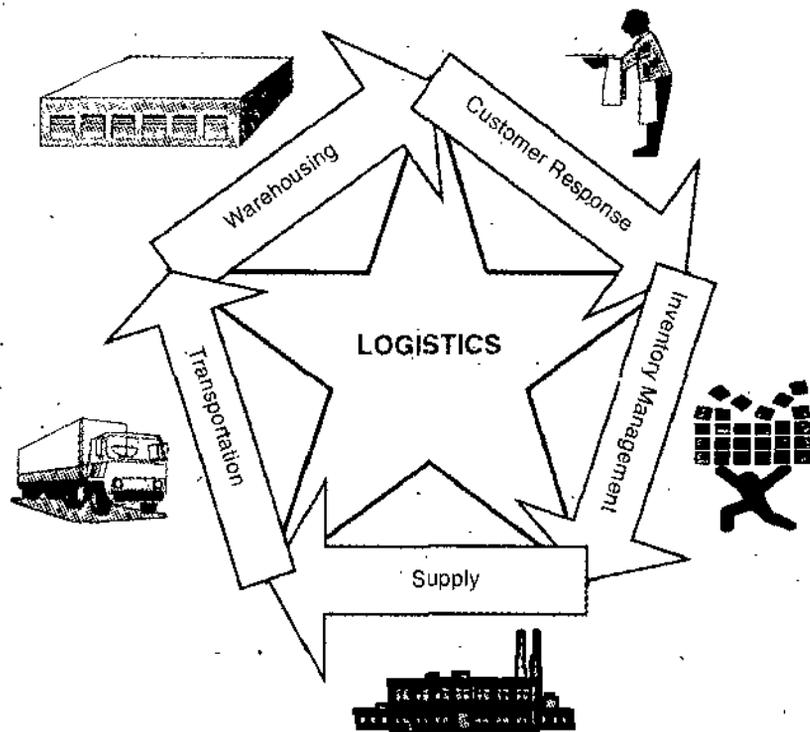


Figure 2.4. Interdependent Logistics Activities

Supply

Supply is the process of building inventory (through manufacturing and/or procurement) to the targets established in inventory planning. The objective of supply management is to minimize the *Total Acquisition Cost* (TAC) while meeting the availability, response time, and quality requirements stipulated in the customer service policy and the inventory master plan. The logistics of supply include:

- Developing and maintaining a Supplier Service Policy (SSP)
- Sourcing
- Supplier integration

- Purchase order processing
- Buying and payment.

Warehousing

I present warehousing as the last of the five logistics activities because good planning in the other four activities may eliminate the need for warehousing or may suggest the warehousing activity be outsourced. In addition, a good warehouse plan incorporates the needs of all the other logistics activities. Good or bad, the warehouse ultimately portrays the efficiency or inefficiency of the entire supply chain.

The objective of warehousing is to minimize the cost of labor, space, and equipment in the warehouse while meeting the cycle time and shipping accuracy requirements of the customer service policy and the storage capacity requirements of the inventory play. The logistics of warehousing includes:

- Receiving
- Putaway
- Storage
- Order picking
- Shipping.

Figure 2.5 summarizes our definition of logistics and its related activities. This definition of logistics has proven successful in a wide variety of industries and locales and is the basis for all of our consulting, teaching, research, and decision support tool development.

2.4 LOGISTICS COST

A logistics problem is that a mix of optimization techniques, common sense, business-best practices, and political savvy is required to develop and implement a workable solution. My experience is also that there is typically plenty of common sense, business-best practices, and political savvy to go around in most organizations. What is often lacking is the analytical resources required to model and solve logistics problems.

Because logistics problems tend to be complex and cross-functional, optimization techniques are and should be used to develop and quantify

NOTES

NOTES

an ideal solution. Executed properly, the optimization process tends to depoliticize a project and focuses a project team's attention on the solution that maximizes total corporate performance. Hence optimization is a key ingredient in our logistics master planning methodology.

In each case, the fundamental principle is the same—there is a quantifiable objective function that should be minimized/maximized, and a set of quantifiable constraints that make it difficult to minimize/maximize the objective function. For example, to determine the optimal customer service policy, the objective is to minimize the *Total Logistics Costs (TLC)*, including inventory carrying costs, response time costs (warehousing and transportation), and lost sales costs. The constraints are the availability of inventory and the response time requirements that make up the core of the customer service policy. Mathematically, we can write the following:

Minimize:

Total logistics costs = Inventory carrying costs + Response time costs +
Lost sales cost.

Constraints:

1. Inventory availability > Customer service inventory target
2. Response time < Customer service response time target.

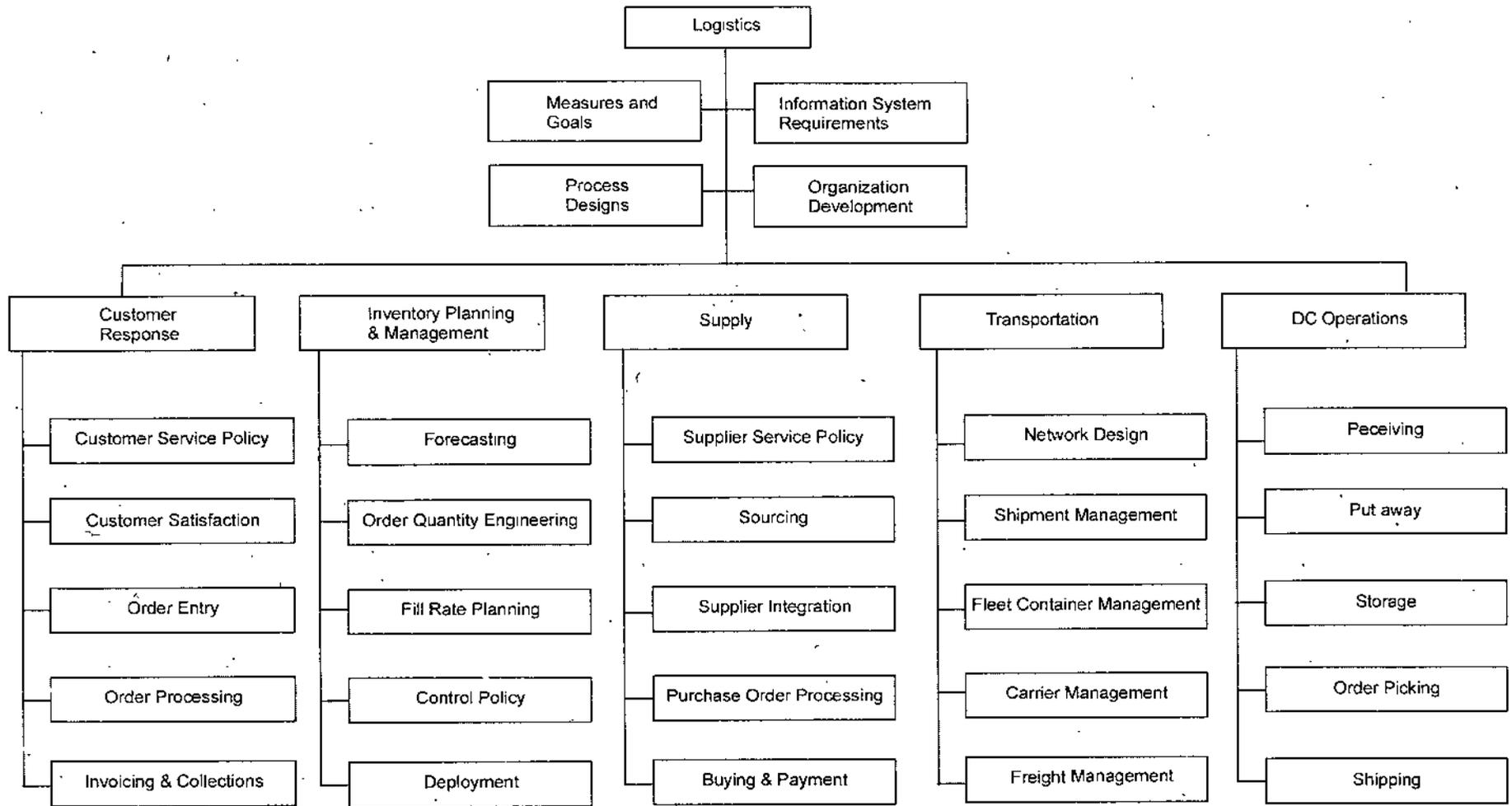


Figure 2.5. Logistics Framework of Activities

NOTES

NOTES

A major advance in logistics optimization is the graphical representation of supply chains and related tradeoffs. The customer service optimization problem is presented and solved pictorially in figure 2.6. The figure is an illustration of the tradeoffs involved in choosing an optimal customer service policy addressing inventory availability and response time. With inventory availability expressed as the unit fill rate, the greater the fill rate, the lower the lost sales cost, but the higher the inventory levels and associated inventory carrying cost required. In response time, we can reduce lost sales cost by responding faster; however, we will incur a higher response cost either for more expensive transportation modes or for more warehousing space located in close proximity to our customer base.

In the example, the total logistics cost is minimized with a customer service policy providing next-day response and 99.5 percent inventory availability. The optimization should be conducted for each item-customer pair because the parameters vary greatly with each item and customer's unique demand profile.

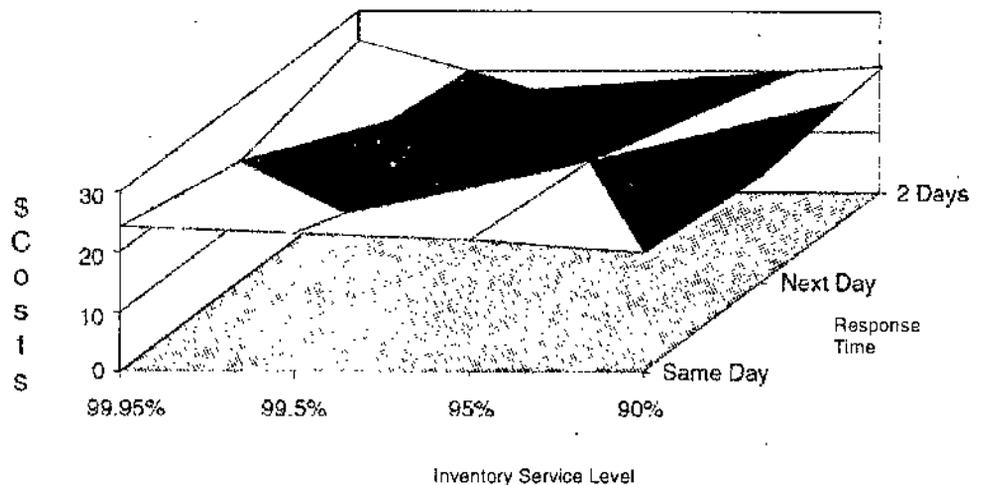


Figure 2.6. Logistics Optimization

2.5 DIFFERENT MODELS OF LOGISTICS

Paralleling advances in management theory and information systems, logistics has evolved in scope and influence in the private sector since the mid to late 1940s. In the 1950s and '60s, the military was the only organization using the term logistics. There was no true concept of logistics in private industry at that time. Instead, departmental silos including material handling, warehousing, machining, accounting, marketing, and

so on, were the norm. The five phases of logistics development-workplace logistics, facility logistics, corporate logistics, supply chain logistics, and global logistics- are plotted in time in figure 2.7.

Workplace Logistics

Workplace logistics is the flow of material at a single workstation. The objective of workplace logistics is to streamline the movements of an individual working at a machine or along an assembly line. The principles and theory of workplace logistics were developed by the founders of industrial engineering working in WWII and post-WWII factory operations. A popular name today for workplace logistics is ergonomics.

Facility Logistics

Facility logistics (see figure 2.8) is the flow of material between workstations within the four walls of a facility (that is, interworkstation and intrafacility). The facility could be a factory, terminal, warehouse, or distribution center. Facility logistics has been more commonly referred to as material handling. The roots of facility logistics and material handling are in the mass production and assembly lines that distinguished the 1950s and 1960s. In those times and even into the late 1970s, many organizations maintained material-handling departments. Today, the term material handling has fallen out of favor because of its association with nonvalue added activities.

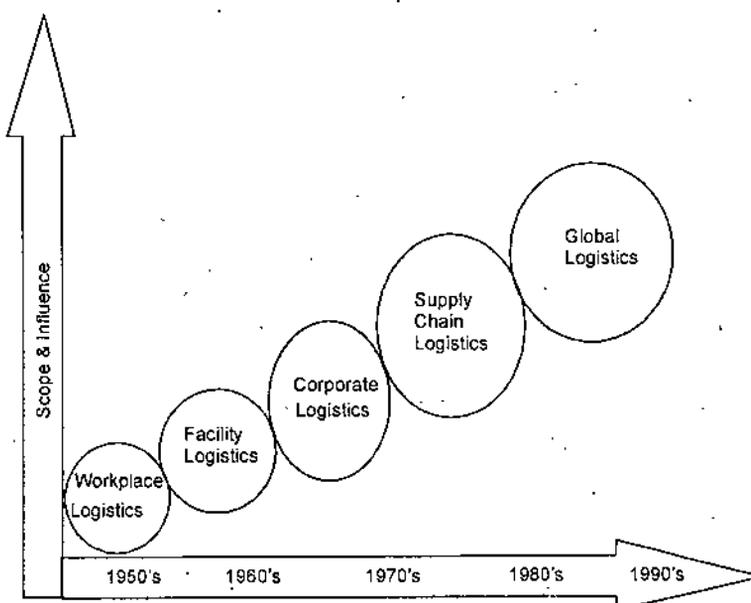


Figure 2.7. The Evolution of Logistics

NOTES

NOTES

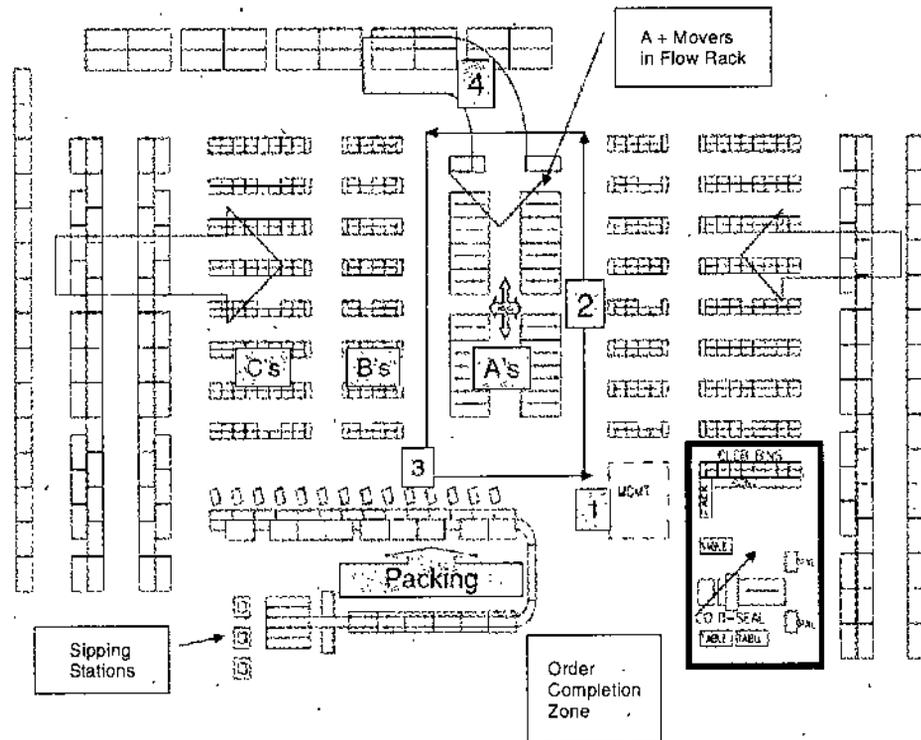


Figure 2.8. Facility Logistics

In the 1960s, material handling, warehousing, and traffic were grouped together to become known as physical distribution; procurement, marketing, and customer service were grouped together to become known as business logistics. (Even today in many academic institutions, logistics is still divided along these lines; where logistics is taught in the business school, it is taught as business logistics, and in the engineering schools as physical distribution.)

Corporate Logistics

As management structures advanced and information systems accordingly, our ability to assimilate and synthesize departments (material handling, warehousing, and so on) into functions (physical distribution and business logistics) in the 1970s permitted the first application of true logistics within a corporation. Corporate logistics became a process with the common objective to develop and maintain a profitable customer service policy while maintaining and reducing total logistics costs.

Corporate logistics (see figure 2.9) is the flow of material and information between the facilities and processes of a corporation (interworkstation, inter-facility, and intra-corporate). For a manufacturer, logistics activities occur between its factories and warehouses; for a wholesaler, between its distribution centers; and for a retailer, between its distribution centers

and retail stores. Corporate logistics is sometimes associated with the phrase physical distribution that was popular in the 1970s. In fact, the Council of Logistics Management (CLM) was called the National Council of Physical Distribution Management (NCPDM) until 1982.

NOTES

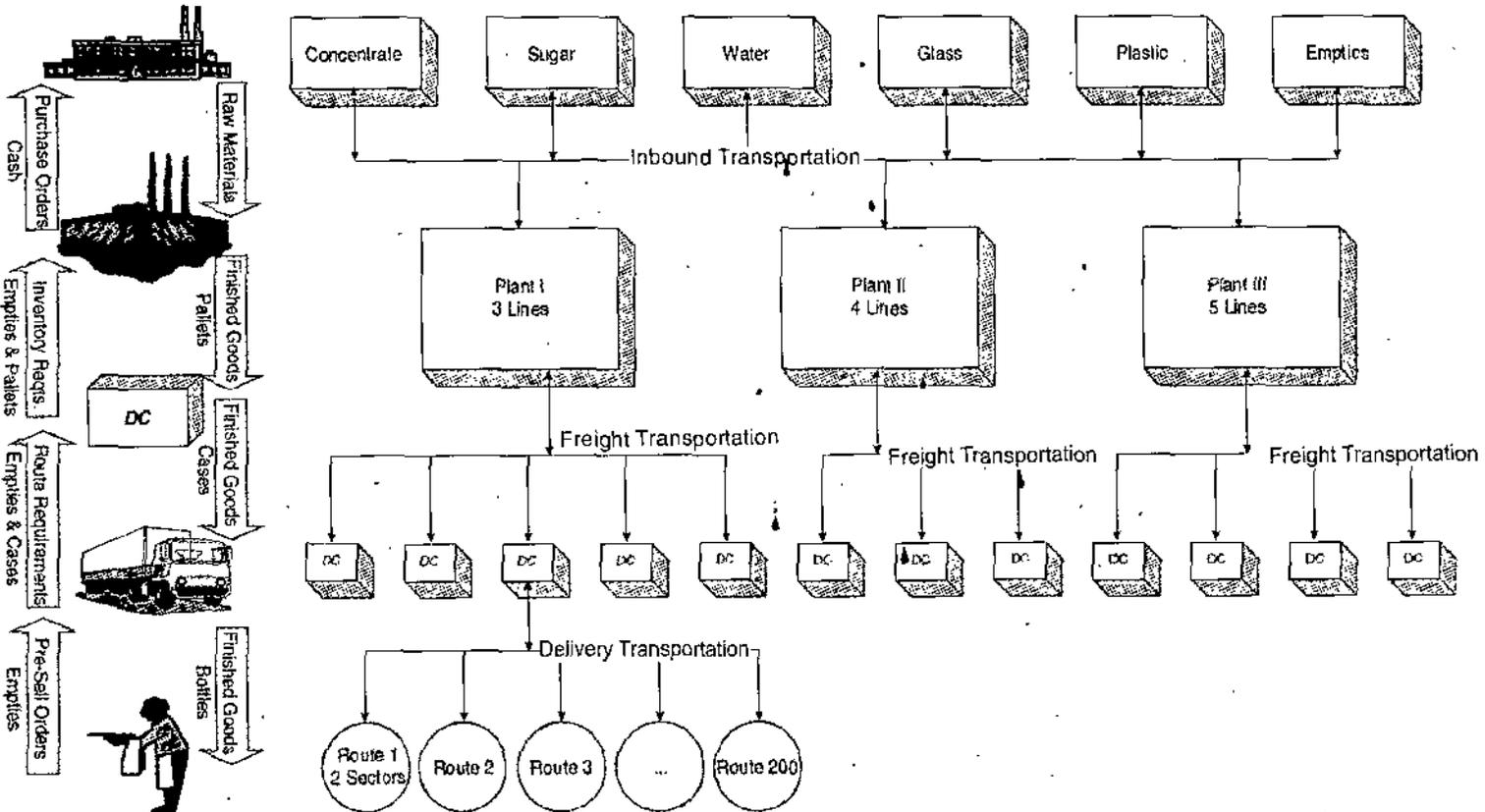


Figure 2.9. Corporate Logistics Flows

Supply Chain Logistics

NOTES

Supply chain logistics (see figure 2.10) is the flow of material, information, and money between corporations (interworkstation, interfacility, intercorporate, and intrachain). There is a lot of confusion surrounding the terms logistics and supply chain management. I distinguish the two by explaining that the supply chain is the network of facilities (warehouses, factories, terminals, ports, stores, and homes), vehicles (trucks, trains, planes, and ocean vessels), and Logistics Information Systems (LIS) connected by an enterprise's supplier's suppliers and its customer's customers. Logistics is what happens in the supply chain. Logistics activities (customer response, inventory management, supply, transportation, and warehousing) connect and activate the objects in the supply chain.

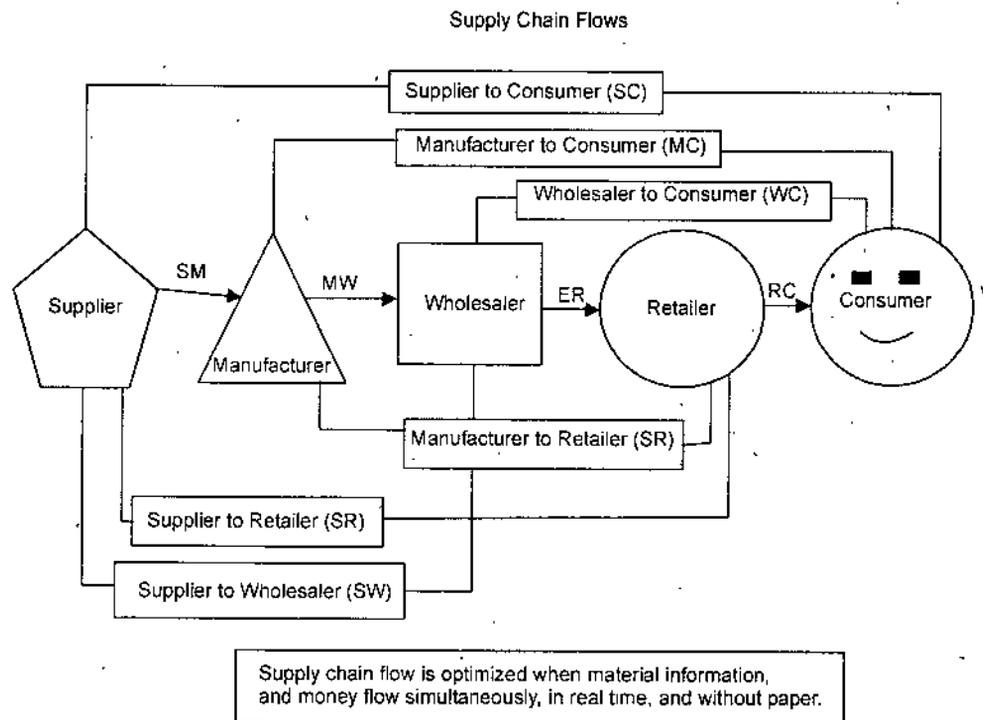


Figure 2.10. Supply Chain Logistics

To borrow a sports analogy, logistics is the game played in the supply chain arena. It is unfortunate that the phrase supply chain management has been so readily and commonly adopted as a reference to excellence in logistics. First, it is not supply (or demand) that should dictate the flow of material, information, and money in a logistics network. Actually, there are some links in the chain and some circumstances in which supply should dictate flow and some in which demand should dictate flow. Second, if you drew lines connecting all the trading partners in a typical supply chain, what you would see would not look anything like a chain. You would see something that looks more like a complex web of links.

A chain stretched full is a line. The danger in the choice of the term chain is that the term oversimplifies the complexities in logistics management and leads to inflated expectations for what can be achieved by supply chain management systems. Finally, the term management suggests that a single party in the chain can truly manage and dictate the operations of the supply chain. Instead, the best any party can do is to collaboratively plan the operations of the chain. Consider the computing industry supply chain with players like HP, Microsoft, Intel, UPS, FEDEX, Sun, Ingrams-Micro, Compaq, CompUSA, and so on. There is not a single one of those parties who can or should manage the entire computing industry supply chain.

NOTES

Global Logistics

Global logistics (see figure 2.11) is the flow of material, information, and money between countries. Global logistics connects our suppliers' suppliers with our customers' customers internationally. Global logistics flows have increased dramatically during the last several years due to globalization in the world economy, expanding use of trading blocs, and global access to Web sites for buying and selling merchandise. Global logistics is much more complex than domestic logistics, due to the multiplicity of handoffs, players, languages, documents, currencies, time zones, and cultures that are inherent to international business.

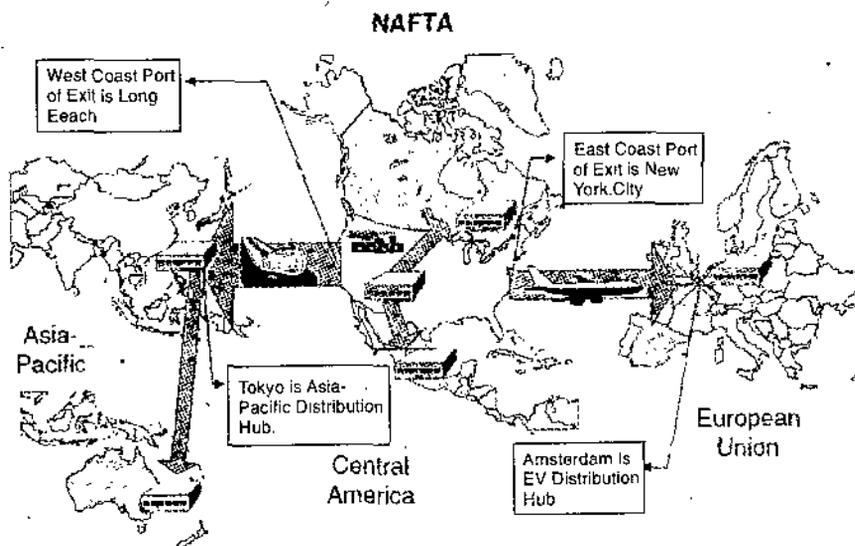


Figure 2.11. Global Logistics Flows

Next-Generation Logistics

There are many theories as to the next phase of logistics development. Many logisticians believe that collaborative logistics, logistics models

NOTES

built with continuous and real-time optimization and communication between all supply chain partners, will be the next phase of evolution. Other camps in the logistics community believe the next phase of evolution will be virtual logistics or fourth-party logistics, where all logistics activities and management will be outsourced to third-party logistics providers who are in turn managed by a master or fourth-party logistics providers acting kind of like a general contractor. I used to joke that interplanetary logistics would be the next phase of evolution until the director of logistics for NASA and the international space station program showed up in our Logistics Management Series and began asking my advice on how to get parts to Mars to support their next mission.

The only thing I can predict with confidence about the future of logistics is that it will continue to play a major role in the success or failure of most corporations, and that it will continue to expand in scope and influence as management theories and information systems continue to advance.

I can also predict with confidence that each stage of logistics development is and will be a prerequisite to success in the other stages. Many organizations have left behind the proven disciplines and best practices learned in the early stages of logistics development and are finding it difficult to succeed in the more advanced stages. I personally believe that poor execution of the basics of logistics management is the fundamental reason for the business failure of so many dotcoms and pure e-tailers, and that consistent execution of the basics of logistics management is the reason traditional brick-and-mortar companies have withstood and flourished during the e-wave. A wise prophet once said that when we are faithful with the small things, we will be blessed with the larger things.

2.6 LOGISTICS: INBOUND AND OUTBOUND

Let us now take a closer look at the logistics both inbound and outbound. Let me tell you this is the most intricate part of the system of SCM. If your goods don't reach in time and they are of inferior quality you as an entrepreneur earn a bad name too. So why give the consumer a chance? Plan it in a way that you ensure both quality and quantity in a reasonable time frame. Take for example 7 days trucker's strike in 2004. It was bad for economy of the country and above all worse for those manufacturer's who couldn't deliver goods on time. A strike or a bandh as we call it in India is a happy situation for the fleet owners but a bad time for the

drivers, mill owners, small timers, labourer, suppliers, manufacturers and the consumers. That is the reason contingency planning plays a predominant role in shaping our SCM system.

Suppliers to Manufacturers

The most complicated, yet, the most important phase in any production is the movement of raw materials from the supply point by the suppliers to the manufacturing unit. Identification of the right type of suppliers is therefore the key to effective SCM system.

Can you envisage the various agencies and steps that are involved in this total system? Let us see them one by one:

- What is the raw material that has to be moved?
- What is the cheapest and the best available with the suppliers?
- Where is it available?
- What are the credentials of the supplier?
- What is the mode of transport being utilized for the move?
- Is it cost-effective?
- What is the time factor involved in the movement?
- Does weather and climate play a predominant role in moving the raw material?
- What are the terrain conditions in the areas from where it has to be moved?
- What is the distance involved?
- Is it of acceptable quality?

All these have to be addressed before one plans for movement of these raw materials, that too in great detail. That is what is an effective SCM system to be followed by every firm.

Differences in Urban and Rural Areas

India is one such country, which enjoys a rare mix of both urban and rural pockets at regular intervals. Rural areas require tremendous amount of logistics supply and coordination to make the SCM system effective. That is the lay of Indian society and hence one has to understand and be live to the problem. Actually most of our supplies move generally

NOTES

from these rural areas and hence you should be aware of these areas in a nutshell. Let us discuss them for a while. The various criticalities pertaining to logistics in rural areas are:

NOTES

- Large quantities and more number of collection points.
- Distance between the manufacturers and users are large.
- Materials are bulky, perishable, and expendable and have inferior packaging.
- Certain places have to be communicated through handcarts, tractors, boats, cycles and bullock carts.
- Trips are generally one-way and hence not cost effective.
- Uniformity in work is missing, since; logistics are restricted to peak seasons only.
- A mix of intermediaries and direct delivery.
- Storage, movement and packaging of agro products are difficult and time consuming.

There are many more to this depending upon the nature of terrain and climatic conditions too, but these are the salient ones and you as a manager have to understand this aspect. Trading in rural areas is difficult and risky too.

Storage in rural areas is another criticality due to restriction in storage areas and because the agro produces are seasonal in nature. These are to be consumed round the year, both in season and off-season. Storage starts right from the time the harvest is ready till its distributed to the consumers. The various storage places available are:

- At the farm itself.
- Village collection centers/collection points.
- With the processor.
- Wholesaler.
- Bins and self-help store rooms under stringent conditions.
- Retailer.
- Market place/selling points.

The shelf life of these items generally the farm produce are very less and hence planned infrastructure has to be developed for proper storage facility like the cold rooms.

Transport in these areas is still primitive in nature; starting from bullock carts, cycles, hand carts, rickshaw van, boats, animal transport and even stragglers. This is due to bad roads and roads connectivity. India has one of the largest road networks in the world with approximately 2.5 million kilometers of road network.

National highway accounts to nearly 5200 km, which is barely 2% of the total roads in the country. Actually movement of goods from rural areas becomes expensive due to its handling costs and number of organizations involved in it.

NOTES

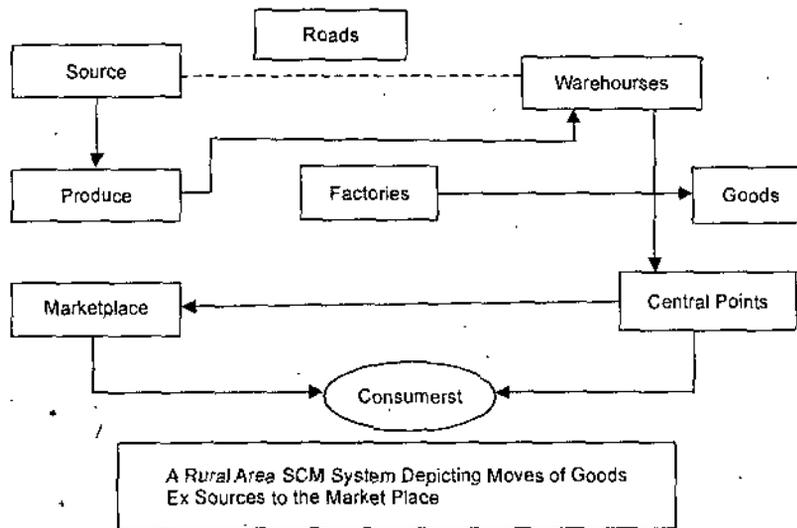


Figure 2.12. Rural Area SCM System

Urban Areas

Coming on to urban areas, the process is certainly different since; it doesn't have to go through the exercise of moving through bad roads too often and poor storage system. Things move more systematically and less time consuming, though at times the carriers perform move through difficult stretches of rural areas, generally a mix of urban and rural areas. What happens in urban areas? Let us see:

- The procurement is done generally closer home and very near to the towns and cities.
- The supplier's job is to supply the goods in the time frame and price that is fixed initially.
- The company management generally contacts the supplier who has nominated godowns close to the place of manufacture, for better and even time management.
- Unlike rural areas the suppliers in the fastest mode deliver the

NOTES

material and services in order to save on time; a combination of rail, air and road at places even waterways.

- Manufacturing takes lesser time in production and distribution thereafter.
- A better market available to the manufacturer for his goods.

From the above it's evident that a manufacturer in the rural area stands at a disadvantage visa-vie his urban counterpart for the following reasons:

- Movement of raw materials.
- Transport system.
- Storage facility.
- Production.
- Preservation.
- Distance from source to market area.
- Availability of market.

In a nutshell the SCM involved in managing a rural enterprise is more cumbersome than the urban one.

Manufacturers to Consumers

Let us now visualize the various stages involved in moving the finished products from the manufacturing units to the consumers. They are:

- Packaging of goods.
- Stocking them in warehouses/containerization.
- Loading into carriers/transportation.
- Delivery to the nearest wholesalers.
- Wholesalers to retailers.
- Retailers to market places/stores.
- To consumers.

These 7 steps are like any of those 7 days. It's difficult to skip one to save on another. Yes, there are direct marketing that the companies are following these days, but they are numbered. But the basic stages of these companies too move through pre-designated franchises and not directly. Hence, the time taken or cost per se generally remains the same.

Problems envisaged in movement of products from manufacturing units to consumers are many and can be listed, as follows:

NOTES

- Perishable products.
- Losses in transit.
- Accidents and calamities.
- Unavoidable delays in terms of strikes and bandh.
- Labor unrest.
- Rats and rodents.
- Breakages during handling.
- General costing since at times even double handling is involved.

Let us see this with the help of a diagram, (figure 2.13).

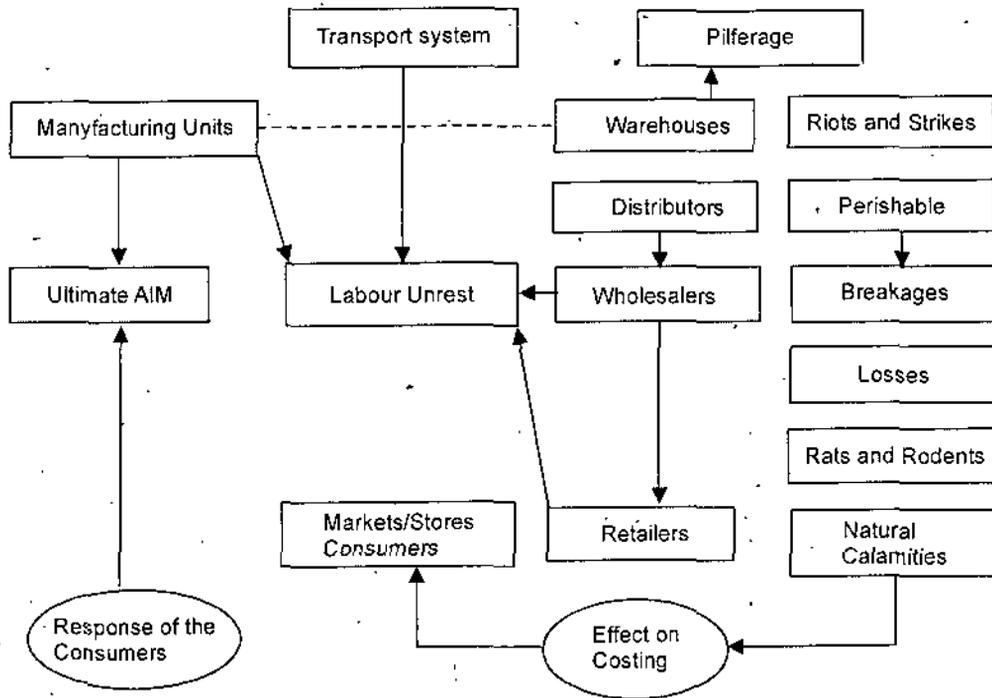


Fig. 2.13. Problems Involved in Logistics Support

From the above it's evident that labor's unrest is generally common in the complete process and an effective SCM in position can only help reducing these miscalculations and criticalities. Natural calamities and strikes do pose a problem for the manufacturer and indirectly increases the cost of items ultimately available to the consumers. What is therefore your ultimate aim in this process of SCM? It's the response of the consumer for whom you made this happen, and side-by-side what is the effect of the problems and criticalities on your product? It affects the costing per se, and this is what is shown in the diagram above (figure 2.13).

Logistics both inbound and outbound is very intricate in nature. A consumer sitting at the comfort of the room cannot virtually visualize how a packet of toothpaste reaches him every time he uses it. What

actually happens on ground can only be realized by him who makes it happen that way. Once you start thinking on it the various questions that arise are:

NOTES

- Where does the raw material come from?
- Who supplies it to you?
- What is the best course available to you in procuring the right material with in the cost per se from the available options? Who decides on that? You and the management.
- How is the material moved and where to?
- How do you store this?
- What are the various contingencies involved in this?
- What if the stores don't reach on time? What is the option available to you?
- What would be the losses in production?
- What would be the losses in packaging?
- If the production channel breaks down, then what?
- How do you transport the finished goods in the time frame available to you?
- How will your marketer's distribute or market the products?
- What will be the response of the consumers to your product, your ultimate aim?

2.7 THE BULLWHIP EFFECT

An unmanaged supply chain is not inherently stable. Demand variability increases as one moves up the supply chain away from the retail customer, and small changes in consumer demand can result in large variations in orders placed upstream. Eventually, the network can oscillate in very large swings as each organization in the supply chain seeks to solve the problem from its own perspective. This phenomenon is known as the bullwhip effect and has been observed across most industries, resulting in increased cost and poorer service.

Causes of the Bullwhip Effect

Sources of variability can be demand variability, quality problems, strikes, plant fires, etc. Variability coupled with time delays in the transmission

of information up the supply chain and time delays in manufacturing and shipping goods down the supply chain create the bullwhip effect. The following all can contribute to the bullwhip effect:

- Overreaction to backlogs
- Neglecting to order in an attempt to reduce inventory
- No communication up and down the supply chain
- No coordination up and down the supply chain
- Delay times for information and material flow
- Order batching - larger orders result in more variance. Order batching occurs in an effort to reduce ordering costs, to take advantage of transportation economics such as full truck load economies, and to benefit from sales incentives. Promotions often result in forward buying to benefit more from the lower prices.
- Shortage gaming: customers order more than they need during a period of short supply, hoping that the partial shipments they receive will be sufficient.
- Demand forecast inaccuracies: everybody in the chain adds a certain percentage to the demand estimates. The result is no visibility of true customer demand.
- Free return policies.

NOTES

Countermeasures to the Bullwhip Effect

While the bullwhip effect is a common problem, many leading companies have been able to apply countermeasures to overcome it. Here are some of these solutions:

- **Countermeasures to order batching:** High order cost is countered with Electronic Data Interchange (EDI) and Computer Aided Ordering (CAO). Full truckload economics are countered with third-party logistics and assorted truckloads. Random or correlated ordering is countered with regular delivery appointments. More frequent ordering results in smaller orders and smaller variance. However, when an entity orders more often, it will not see a reduction in its own demand variance—the reduction is seen by the upstream entities. Also, when an entity orders more frequently, its required safety stock may increase or decrease; see the standard loss function in the Inventory Management section.

NOTES

- **Countermeasures to shortage gaming:** Proportional rationing schemes are countered by allocating units based on past sales. Ignorance of supply chain conditions can be addressed by sharing capacity and supply information. Unrestricted ordering capability can be addressed by reducing the order size flexibility and implementing capacity reservations. For example, one can reserve a fixed quantity for a given year and specify the quantity of each order shortly before it is needed, as long as the sum of the order quantities equals to the reserved quantity.
- **Countermeasures to fluctuating prices:** High-low pricing can be replaced with Every Day Low Prices (EDLP). Special purchase contracts can be implemented in order to specify ordering at regular intervals to better synchronize delivery and purchase.
- **Countermeasures to demand forecast inaccuracies:** Lack of demand visibility can be addressed by providing access to Point of Sale (POS) data. Single control of replenishment or Vendor Managed Inventory (VMI) can overcome exaggerated demand forecasts. Long lead times should be reduced where economically advantageous.
- **Free return policies:** They are not addressed easily. Often, such policies simply must be prohibited or limited.

2.8 DISTRIBUTION MANAGEMENT

Material distribution is a core supply chain function in most business operations. In the manufacturing industry, it is the movement of raw materials from the vendors' warehouses to factories, and of the finished goods from the factories to the distribution warehouses. In retail, such movements extend from vendors to the retailer's warehouses, and then to the stores. As a large retailer can have thousands of stores, supported by a large number of warehouses, the efficiency of the distribution of merchandise from warehouses to stores is very important and can have a substantial impact on profitability.

Transportation management functions address these business needs to move goods and merchandise from one location to another, pay for such moves, buy the required shipping capacity, track the movements of material in transit, and manage the transportation assets if they were owned by the retailer.

The two other functions are the transportation procurement and transportation capacity planning functions. These two functions are less frequent, and are expected to be completed prior to any of the transportation management functions in supply chain execution.

NOTES

Transportation Planning and Execution

The transportation planning and execution processes help in optimally moving the merchandise from one location to another. Any business process that needs merchandise movements from one point to another can be optimized by using the transportation planning functions. These movements can be between two internal locations, such as shipping from warehouses to the stores, or between an external location such as a supplier's warehouse and an internal location like one of the retailer's warehouses or stores.

The transportation optimization process leverages all these transactions to plan for the best method of moving the merchandise from one location to another. The transportation planning process primarily consists of reviewing all the purchase orders or internal fulfillment orders that are ready to ship. The orders are typically flagged as "ready to ship" when the inventory to fulfill these orders has been identified and committed. This ready-to-ship trigger can be internal or external to the enterprise. For the purchase orders, this inventory belongs to the supplier, and therefore the supplier identifies the purchase orders that are ready to ship. For the internal material transfers, the same could be done at a warehouse either by a warehouse management system or by an enterprise order fulfillment process that identifies the inventory and allocates it to fulfill such requests. The transportation planning process then takes all the ready-to-ship orders, and consolidates them based on common source-destination pairs that have the same need dates. Need date is defined as the date when the merchandise is required to reach the destination. Other relevant factors may also be considered during the consolidation process, such as transportation classification of the material to be moved, hazmat flag, special handling instructions, or special equipment required, such as refrigerated vans. The objective of the consolidation process is to aggregate or split orders to create shipments that optimize the loads and the routes while simultaneously constraining on the need dates for delivery and resource constraints. The consolidation process can produce many different types of shipments, such as truckloads (TLs), Less-Than-Truckloads (LTLs),

NOTES

multistop loads, transshipments, and multimodal shipments. To ensure operations feasibility, all of these shipments are constrained based on the need date at the destination, pickup and delivery time windows at origin and destinations, equipment type constraints, and the shipping mode constraints.

The consolidation step produces the transportation capacity required to ship all these orders along the identified lanes/routes, and transportation modes. Then the transportation planning process looks at all possible alternatives to move this merchandise. This is also called the resource or carrier selection process. These alternatives exist when many carriers can be used along the identified routes/lanes with available capacity and equipment types. The solution models the cost equations for these alternatives, and may consider other parameters like carrier performance, preferred providers, volume commitments, and continuous moves (opportunistic and/or planned). It solves the problem of optimizing the cost and schedule of shipments. This intermediate output of the transportation solution looks like planned loads that are ready to be shipped with short-listed carriers for each shipment.

The next step in this process is the tendering of these loads to the carriers. The shortlisted carriers are selected based on user preferences, historical performance, available capacity, required equipment type, costs, lanes, and other relevant criteria. This short list may have the contract carriers as well as general carriers that do not have prenegotiated contracts with the company on selected lanes. The planned shipments are tendered to this short list of carriers for acceptance. Once the carriers accept the load tender, the shipment is released to the selected carriers, suppliers, and receivers (external or internal) of the shipment; the relevant parties can use this information for scheduling labor and operations at the shipping source and destination locations.

Conceptually, the optimization process has two main steps: (1) consolidating shipments to create optimal loads and routes, and (2) resource selection to select the carrier and the equipment. Advanced transportation solutions can formulate the transportation problem to model and solve both of these steps together. These shipments have now entered the execution phase and can be tracked until they are delivered. The execution phase tracking of shipments is usually done using electronic messages between the carrier and the shipper. EDI transaction 214, also called Shipment Status Message (SSM), is used for these messages and it follows an industry-wide standard that is commonly adhered to across all carriers and shippers so that the messages can be interpreted by anyone. In spite

of the common definition, partners need to work together for integration testing and successful on-boarding to ensure that their systems can run unattended. Each shipment can generate many such status transactions during its lifetime from pickup to delivery depending on the number of stops.

Other interactions between the shipper and carrier can also use the electronic messages for communications, and such integration makes the process efficient and allows high levels of automation. Examples of such interactions are the load tender that uses EDI transaction 204 and a tender response using EDI 990.

NOTES

2.9 WAREHOUSE MANAGEMENT

Under the influence of e-commerce, supply chain collaboration, globalization, quick response, and just-in-time, warehouses today are being asked to:

- Execute more, smaller transactions
- Handle and store more items
- Provide more product and service customization
- Offer more value-added services
- Process more returns
- Receive and ship more international orders.

At the same time warehouses today have:

- Less time to process an order
- Less margin for error
- Less young, skilled, English-speaking personnel
- Less Warehouse Management System (WMS) capability (a byproduct of Y2K investments in Enterprise Resource Planning [ERP] systems).

I call this a "rock and a hard place scenario" the plight of the warehouse manager. Never has the warehouse been asked to do so much and at the same time been strapped for resources. One barometer we have for the focus of business on the warehouse is the number of requests for expert witness work we receive. In the last year, we have had an unprecedented number of requests for expert witness work related to failed warehouse management or material handling systems. The fault is about evenly divided between the vendors and users; however, the

NOTES

number of calls is a testimony to the value that corporations are placing on warehouse operations. Never before has it been so critical for the warehouse to work efficiently, quickly, and error free.

The principles follow our warehouse master planning methodology (see figure 2.14) and cover warehouse performance metrics, receiving, putaway, storage, order picking, and shipping. We present warehousing as the last of the five logistics activities (see figure 2.14) for a variety of reasons. First, good planning in the other four areas of logistics may eliminate the need for warehousing. Second, requirements in the other four areas of logistics may suggest that a third party warehousing firm should be retained to operate the warehouse. Third, the warehouse must be designed to meet all the requirements of the customer service policy spelled out in the customer response master plan, house all the inventory required by the inventory master plan, work to receive in quantities stipulated by the supply master plan, and serve a mission stipulated by the transportation master plan. The warehouse is a service to all the other areas of logistics.

2.10 WAREHOUSING FUNDAMENTALS

This discussion begins with a description of the missions of a warehouse and the activities within its four walls.

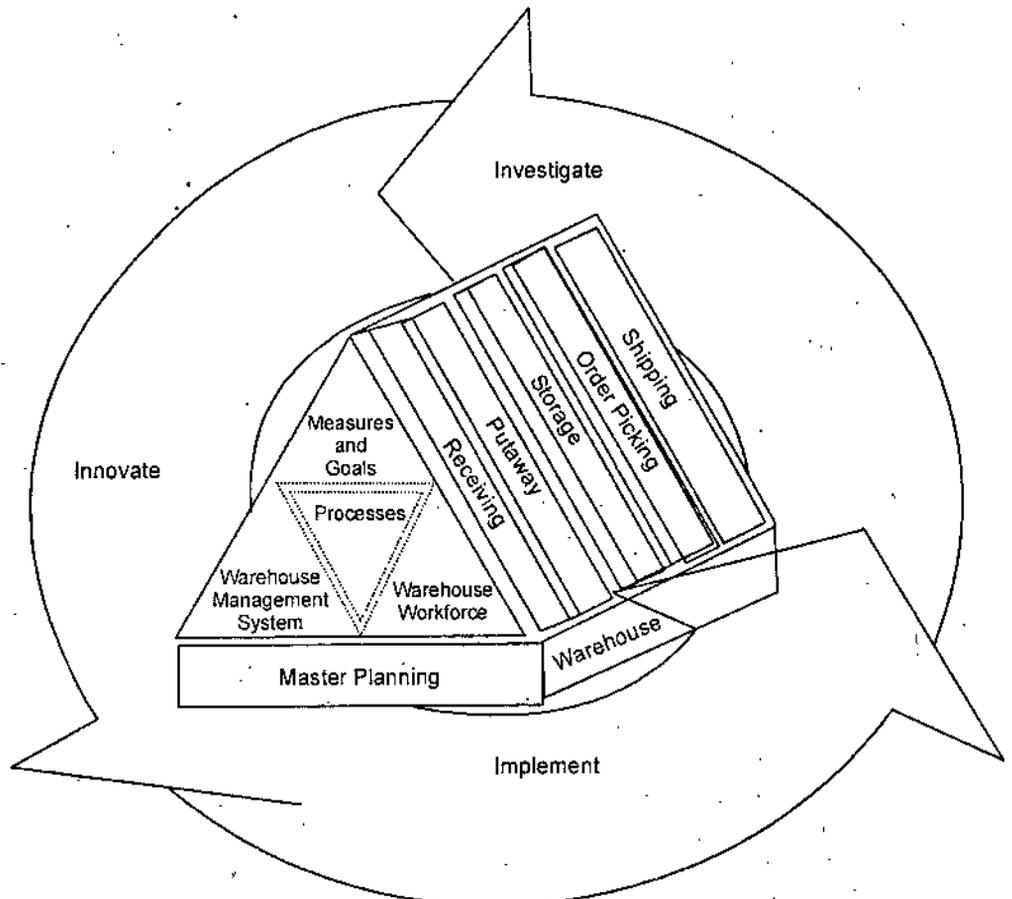


Figure 2.14. Warehouse Master Planning Methodology

In a distribution network, a warehouse may play one or more of the following roles:

- **Raw material and component warehouses:** Hold raw materials at or near the point of induction into a manufacturing or assembly process.
- **Work-in-process warehouses:** Hold partially completed assemblies and products at various points along an assembly or production line.
- **Finished goods warehouses:** Hold inventory used to balance and buffer the variation between production schedules and demand. For this purpose, the warehouse is usually located near the point of manufacture and is often characterized by the flow of full pallets in and full pallets out assuming that product size and volume warrant pallet-sized loads. A warehouse serving only this function may have demands ranging from monthly to quarterly replenishment of stock to the next level of distribution.
- **Distribution warehouses and distribution centers:** Accumulate and consolidate products from various points of manufacture within a single firm or from several firms for combined shipment to common customers. Such a warehouse may be located central to either production locations or the customer base. Product movement may be typified by full pallets or cases in and full cases or broken case quantities out. The facility is typically responding to regular weekly or monthly orders.
- **Fulfillment warehouses and fulfillment centers:** Receive, pick, and ship small orders for individual consumers.
- **Local warehouses:** Distributed in the field in order to shorten transportation distances to permit rapid response to customer demand. Frequently, single items are picked, and the same item may be shipped to the customer everyday.

Figure 2.15 illustrates warehouses performing these functions in a logistics network. Unfortunately, in many of today's networks, a single item will pass in and out of a warehouse serving each of these functions between the point of manufacture and the customer. When feasible, two or more missions should be combined in the same warehousing operation. Current changes in the availability and cost of transportation options make the combination possible for many products. In particular, small high-value items with unpredictable demand are frequently shipped worldwide from a single source using overnight delivery services.

NOTES

NOTES

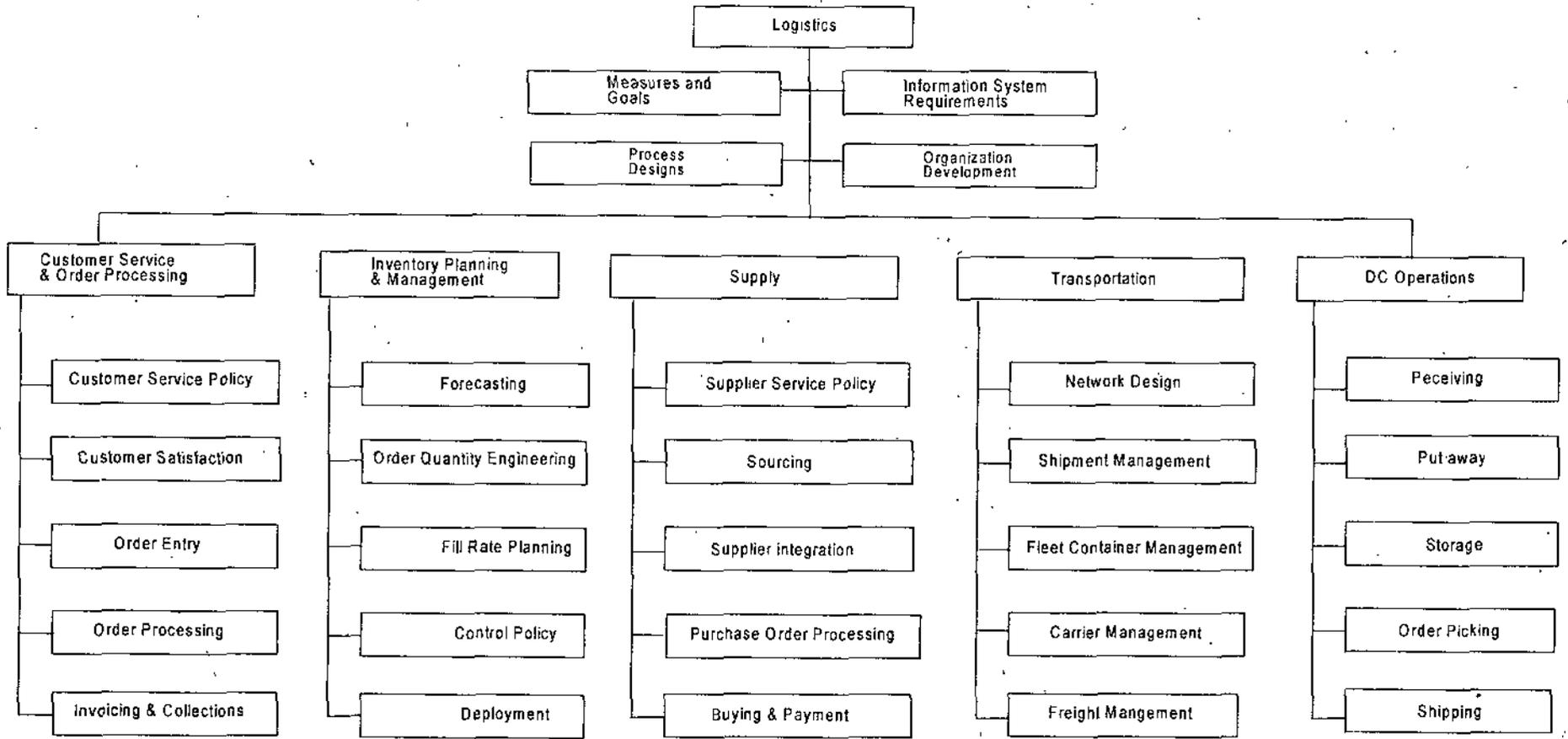


Figure 2.15. Warehousing in the Logistics Framework

No matter the name or role, warehouse operations have a fundamental set of activities in common. The following list includes the activities found in most warehouses. These tasks, or functions, are also indicated on a flow line in figure 2.16 to make it easier to visualize them in actual operation.

NOTES

1. Receiving
2. Prepackaging (optional)
3. Putaway
4. Storage
5. Order picking
6. Packaging and/or pricing (optional)
7. Sortation and/or accumulation
8. Packing and shipping.

The functions may be defined briefly as follows:

1. *Receiving* is the collection of activities involved in (a) the orderly receipt of all materials coming into the warehouse, (b) providing the assurance that the quantity and quality of such materials are as ordered, and (c) disbursing materials to storage or to other organizational functions requiring them.
2. *Prepackaging* is performed in a warehouse when products are received in bulk from a supplier and subsequently packaged singly, in merchandisable quantities, or in combinations with other parts to form kits or assortments. An entire receipt of merchandise may be processed at once, or a portion may be held in bulk form to be processed later. This may be done when packaging greatly increases the storage-cube requirements or when a part is common to several kits or assortments.
3. *Putaway* is the act of placing merchandise in storage. It includes the material handling, location verification, and product placement.
4. *Storage* is the physical containment of merchandise while it is awaiting a demand. The storage method depends on the size and quantity of the items in inventory and the handling characteristics of the product or its container.

NOTES

5. *Order picking* is the process of removing items from storage to meet a specific demand. It is the basic service a warehouse provides for customers and is the function around which most warehouse designs are based.

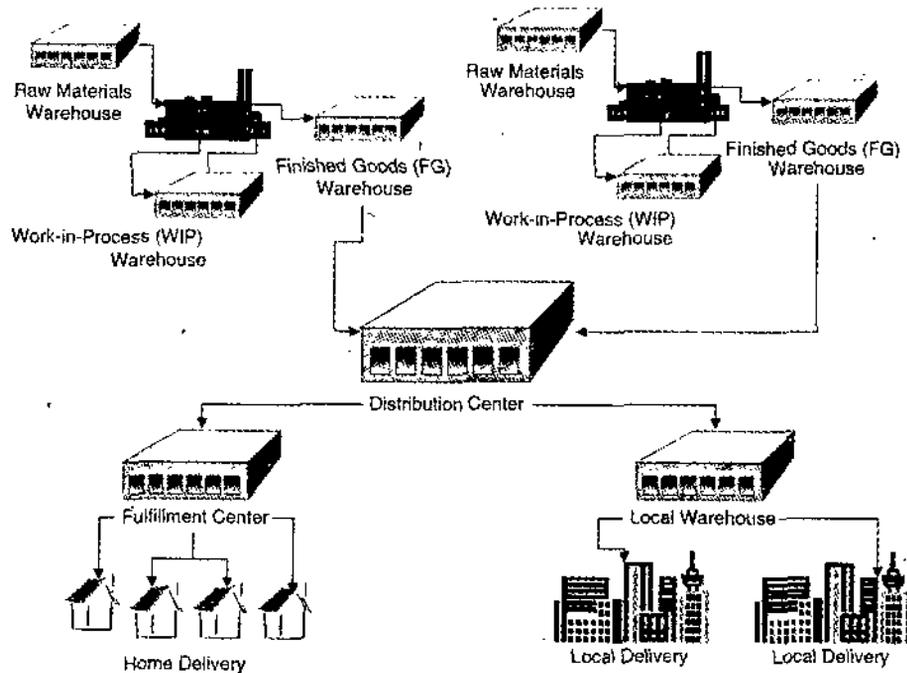


Figure 2.16. - Roles of a warehouse in the logistics chain

6. *Packaging* and/or pricing may be done as an optional step after the picking process. As in the prepackaging function, individual items or assortments are boxed for more convenient use. Waiting until after picking to perform these functions has the advantage of providing more flexibility in the use of on-hand inventory. Individual items are available for use in any of the packaging configurations right up to the time of need. Pricing is current at the time of sale. Prepricing at manufacture or receipt into the warehouse inevitably leads to some repricing activity as price lists are changed while merchandise sits in inventory. Picking tickets and price stickers are sometimes combined into a single document.
7. *Sortation* of batch picks into individual orders and accumulation of distributed picks into orders must be done when an order has more than one item and the accumulation is not done as the picks are made.
8. *Packing* and shipping may include the following tasks:
- Checking orders for completeness
 - Packaging merchandise in an appropriate shipping container

- Preparing shipping documents, including the packing list, address label, and bill of lading
- Weighing shipments to determine shipping charges
- Accumulating orders by outbound carrier
- Loading trucks (in many instances, this is a carrier's responsibility)

NOTES

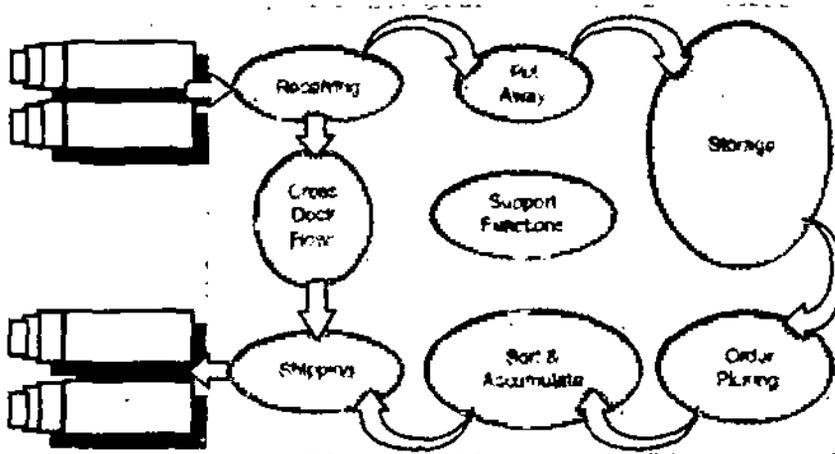


Figure 2.17. Common Warehouse Activities

For discussion purposes, this includes in receiving those activities described previously as receiving, prepackaging, and putaway; in order picking, those activities described previously as order picking, packaging, and sortation/accumulation; and in shipping, those activities described as packing and shipping.

2.11 PURCHASING AND VENDOR MANAGEMENT

Purchasing is indeed an unusual and multifaceted job. It operates at the vital intersection between buyer and seller, where supply and demand forces meet. As such, its scope is broad, encompassing both internal and external elements of supply interaction.

Purchasing is an exciting and challenging profession that is evolving rapidly. In small and newer businesses, historically the owners have almost always controlled the buying activity to keep control of the company's vital cash flow. As the businesses grew, one of the last duties to be delegated was buying—precisely because of its importance to the company's success. Delegation has accordingly become a necessary and inevitable result as management functions become more complex with positive business growth. With increasing size, it becomes necessary for the company to have someone pick up this responsibility.

NOTES

The terminology used in the purchasing profession has witnessed a similar evolution. The term "buyer" has taken on a generic connotation today, but in fact, many types of buyers exist. For example, a buyer can be a wholesaler, a contractor or distribution buyer, an industrial buyer, a technical buyer, a commodity specialist for metals, or electronics, and so on. Whether purchases are solely for individuals, for a small family operation or for a large corporation, the underlying principles are the same. However, while the buying process can be viewed as quite simple from a perfunctory "paperwork" standpoint, quite the opposite is true with respect to the complexities of controlling the expenditure process itself. We will explore both of these aspects in detail in this book.

Another term that has undergone some revision is *vendor*. While some conjure up images of "vendors" tossing packages of peanuts in the ballpark, others are quite comfortable in retaining the term. Some prefer the term "supplier". Although the words *vendor* and *supplier* are essentially synonymous, in this book the word *supplier* is used more often, in keeping with the supply management theme. Also, the terms "purchasing" and "procurement" have become essentially synonymous in the profession, so these terms are used interchangeably in this book. In addition, we have generally denoted the person who heads up the purchasing department as the *Purchasing Manager* (PM) while the *Chief Procurement Officer* (CPO) designates the top-level supply management executive.

Irrespective of the terminology used, it takes a seller and a buyer to reach an agreement. It has been said, "Nothing happens until someone makes a sale." So true! But, consider that "No sale was ever made until a buying *decision* was reached!" Many top sales managers have repeatedly stressed, "Know your customers and *how* they buy!" Going further, Peter Drucker, noted management spokesperson, has said, "The key to efficient and effective industrial marketing is not the supplier but the buyer." The job of purchasing continues to receive increased recognition as a vital management function. Profit, basically the difference between a company's income and outgo, is obviously dependent on either of these factors. Traditionally general management has given more emphasis to the revenue (incoming money) that changes with market conditions. And because competitive conditions make it difficult to increase prices automatically to cover increased costs, operations management interest has generally focused on the cost (outgo) aspect. Since purchases represent the largest single element of cost to a company (typically between 50 and 60 per cent of incoming sales dollars), this is quite naturally where more attention and effort will be directed.

In addition to the factors noted above, a number of historic factors have created renewed interest in purchasing and supply management. Purchasing evolved from an element of manufacturing or general management, and gained its independence as a financial contributor to a company's success. Progressive CEOs and owners of businesses came to realize that management of the supply base is critical. To manage supply, the manager and buyers must know and use the full range of techniques and procedures available to the true professional. Among the historic factors that generated awakened interest in purchasing and supply management are the following:

NOTES

- World War II, and the post war booms that brought serious material shortages, along with new government requirements and priorities.
- The cyclical swings of surpluses and shortages, with attendant fast-rising material costs.
- The accelerating "profit-squeeze" necessitating use of the full resources of the company to ensure survival.
- The brutal foreign competition encountered by U.S. products, and trade alliances such as NAFTA and ECC.
- The increased complexity of technologically driven products, with digital devices and electronic controls as notable examples.
- The emergence of truly global markets, with reduced tariffs and a freer flow of components between foreign and domestic companies.
- Growth of government oversight and control with respect to company procedures and reporting in areas such as minority subcontracting, environmental issues, and various other sociological demands.
- The growth of the Internet and the attendant ability to transmit information instantly worldwide.
- The emergence of the concept of the *extended enterprise*, where the organization's success is seen as resulting from not only its own efforts but also from the effectiveness of all participants in the supply chain.
- Evolution of a business philosophy of manufacturing only items falling within the business's *core competency*, and outsourcing virtually all else.

Although all of the above factors have played a part in purchasing becoming a key area of management focus, probably the most significant

NOTES

issue relates to the last of these; that is, the effect on purchasing due to the recent trend of much of corporate America to "downsize" (or as some prefer to say, "right size") as a means to reengineer the organization to improve competitive position. This effect can be viewed from two perspectives.

First, consider that an organization that cuts its manpower usually suffers some reduction in workload capacity—unless, of course, the reduction is based on the achievement of a breakthrough that entirely removed the need for the human resources affected by the reduction. Second, as the reduction is made, purchasing is often called upon to buy certain goods and/or services that were previously manufactured or performed in-house.

Examples include:

- Payroll and employee benefits
- Cafeteria and food services
- Certain non-core manufacturing, such as fabrication and subassembly
- Facilities maintenance, and janitorial services
- Customer and field service and repair
- Information technologies
- Logistics and transportation services.

In this case, increased outsourcing has put additional demands on the purchasing function. However, sometimes the paradoxical result has been a net reduction in overall procurement activity. As an example, let's consider the decision to henceforth outsource the cafeteria operations to a third-party supplier. Now the cafeteria services supplier buys the plates, the silverware, the mustard and the coffee! So the single (albeit substantially more complex) procurement award to the new supplier has eliminated perhaps hundreds of tedious procurement requirements from the buyer's direct responsibility.

Note that the buyer for the company has now assumed responsibility for both materials and labor in a purchasing arrangement that is much more complex and involves a substantially higher expenditure than previously.

2.12 PURCHASING OBJECTIVES

For any function to be successful, it must establish clear and measurable objectives, and work diligently to achieve them. Purchasing, as the caretaker of the largest share of the company's revenue inflow, is no exception. To maximize its contribution to the company's overall performance, purchasing must establish the following two overarching objectives:

1. Assure economic supply through the procurement of goods, supplies and services to keep the company in operation.
2. Contribute to profits by efficiently controlling the total cost to the operation.

NOTES

While many business people think of the first function only, it is through the smart handling of the second point (after the first is assured) that defines the difference between an average and a world class purchasing organization. In addition to the above overarching objectives, some specific purchasing objectives include:

- To get the *best* buy—suitable quality at minimum cost.
- To pay reasonably low prices, negotiating and executing all company commitments.
- To develop satisfactory sources of supply and maintain good relationships with them.
- To secure optimal supplier performance, sometimes by seeking process improvements across boundaries between trading partners.
- To locate new and better materials and products.
- To keep inventories throughout the supply chain as low as is consistent with company needs.
- To carry out programs to continually reduce total cost of purchases.
- To develop effective controls and procedures.

To keep acquisition costs at the minimum compatible with optimal performance. This list is far from all-inclusive; other objectives will become evident to the alert purchasing manager based on the specific nature of the procurement activity involved. Furthermore, although the above list is largely conceptual, it is important in practice that specific objectives be quantified to the maximum practical extent.

A company will have stated objectives, but the individual manager must interpret what company officials actually say and do. For example, Chief Executive Officers (CEOs), backed by the law of the land, will usually stress their responsibility to the stockholders. But the company's objectives are usually composites of many decisions, resulting in various cross-functional compromises. So in actual practice the CEO's goal is to balance the objectives of a fair return on investment to stockholders, stable and satisfying employment for employees, satisfaction of customers and the community, and so forth.

In setting procurement's functional objectives, the PM must be aware of the CEO's (and accordingly, the company's) objectives, and ensure

NOTES

consistency in constructing the specific objectives for the purchasing department. With increased focus on meeting customer needs more effectively, many enterprises have begun to evaluate the results of the entire supply chain in satisfying these needs. This has given rise to the concept of competition between supply chains rather than merely between companies. Consequently, the importance of supplier contributions to enterprise results has further increased expectations of the supply management organization.

2.13 IMPACT ON PROFITABILITY

It is clear that since purchasing is responsible for controlling a dominant share of the company's revenue dollars, it directly impacts profitability and the financial success of the overall business enterprise. As a buyer, simply maintaining adequate sources of supply is not enough. Making sure that suppliers are the "right" suppliers, selling at the "right" price—and then seeing that they keep serving well, are important activities. Let's look at purchasing's impact on profitability. The purchasing profit ratio shown in figure 2.18 is based on an average company with a 7 percent profit before tax. A \$1 reduction in the cost of purchased goods produces a profit of \$1, or a 1:1 ratio, whereas it takes \$14 of sales to produce the same amount of profit! A dollar saved in purchasing equals the profit from \$14 of sales: so, the profit leverage of the material cost reduction dollar is 14 times that of the sales dollar. The purchasing profit ratio can be computed for any company by dividing its annual sales volume by profit before tax.

Purchasing claims to be a profit-productive profession. Fine! But, where's the profit? As an example, a broom previously costing \$8 is now bought for \$7.00. A dollar is saved. We can agree on that, but where is that saved dollar? It's not itemized on the profit and loss statement, balance sheet, or "where-got-where-gone" cash flow comparison. Unfortunately, traditional accounting systems don't always take into account purchasing's contribution. So where is the dollar savings? We know the savings for buying brooms has to be in the budget of the using department, but the issue isn't solely about the budget for brooms. In 2002, the *Gross Domestic Product* (GDP) for the U.S. was \$10.45 trillion. That year the collective spending of about \$6 trillion by American buyers means that during any working day, over \$25 billion was spent throughout the U.S and the real question is, "How well was that money spent?"

NOTES

Let's look at purchasing's impact on profit in further detail. The profit ratio shown in figure 2.18 depicts a typical performance for a healthy \$20 million sales company. Purchases, in this case 53% of sales, are equal to \$10.6 million, and are part of company costs. The figures within the boxes are company results without purchasing's contribution. Starting at the lower right box, a 2 1/2% savings reduces purchases to \$10.3 million, which causes a chain reaction as it flows through the cost accounting system; first by reducing total cost that increases profit, and then profit margin, and ultimately *Return-on-Investment* (ROI).

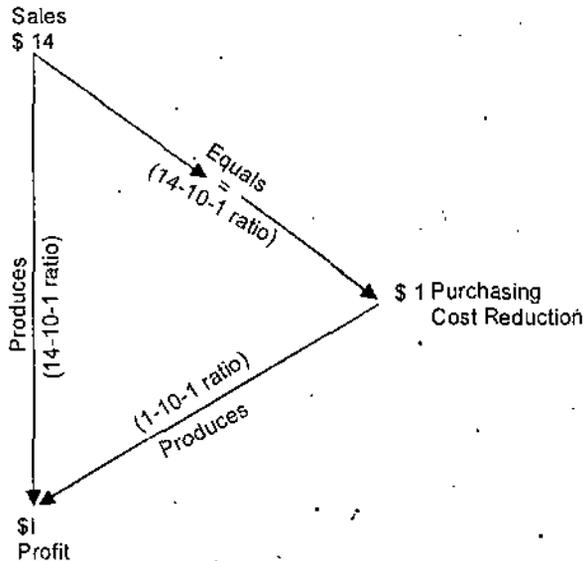


Figure 2.18. Purchasing and Profit Ratio

The return on invested capital for the company has increased from 10.5 to 13.6, which is a 28% improvement because of purchasing's profit contribution. In addition, lower material prices will reduce inventory value, or assets. So, the final result is an even higher investment turnover than shown. This is a measure of purchasing's effect on the total company results.

The management of successful companies is very aware of such results. Here is an interesting exercise. To prove the strong impact of good or bad buying on any specific company, fill in a blank ROI chart using the company's performance as stated in the annual report. Then simply add 2% (or a figure you judge appropriate) to the cost of purchases and compute the new ROI compared to the original numbers. Also, drop the purchases by 2% and note the change in ROI. A 2% change in *purchasing expenditures swings the return on invested capital dramatically!* This is a clear example of purchasing's leverage on profitability.

NOTES

Although the impact of purchasing on a company's profit is great, it is not easily achieved! It takes a skillful team of buyers under a competent manager who understands scientific purchasing techniques and methods. In marginal companies, the difference between operating at a profit or a loss may lie in the efficiency of the purchasing function.

If this purchasing function can make money, it can also lose money by poor performance that can reduce profits; so, purchasing is an heir to a profit-producing responsibility. The purchasing manager is key in the ability to influence company profit and thereby affect ROI.

2.14 CONTROLLING THE PROCESS

Procurement is a process with many components that can influence the result. Figure 2.19 shows the typical procurement process. It is doubtful that any other operating group is involved in more functional interrelationships than is purchasing, not only within its own company but also within the suppliers' organizations. This has been the source of many disappointments when installing *Business-to-Business (B2B) electronic commerce* solutions, because the implementers neglected to account for the individual roles of all the participants in these complex process steps.

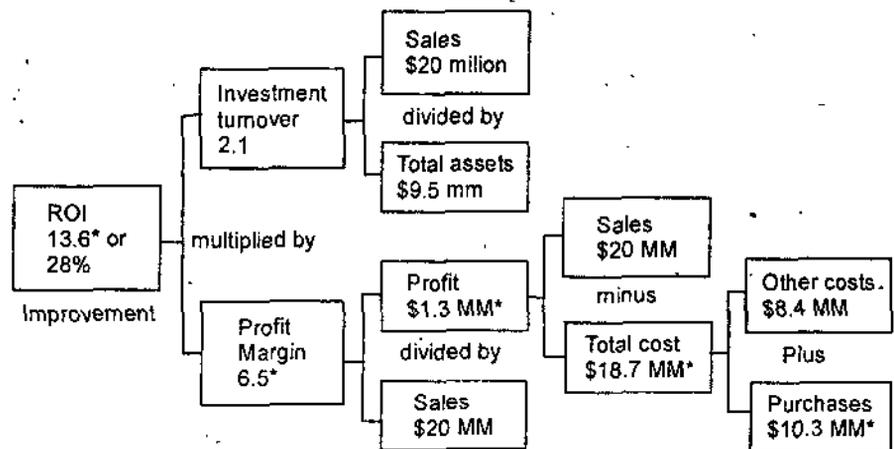


Figure 2.19. ROI Productivity Impact

Materials disputes must often be settled between requesting departments and suppliers. Rejected purchases must be adjusted, costs controlled, and replacements made. Many operating functions often represent a very narrow interest to the supplier. If purchasing is to settle disputes wisely, it must find a common ground for settlement; then it must balance the interest of its own company with that of the supplier, to protect long-range material availability and service.

To operate effectively, the purchasing executive must become a coordinator representing total company interests, and not solely those of purchasing. Often the buyer must be the arbitrator between the supplier's engineers and the buyer's own technical people. Sometimes under fire from many conflicting sources, buyers must get the most value in goods purchased at minimum cost. At the same time, the manager and buyers must keep inventories low to maintain or achieve high turnover ratios, yet always have material ready for production use. It takes a balancing of these often conflicting requirements to achieve optimum performance.

NOTES

2.15 FUNCTIONS OF PURCHASE DEPARTMENT AND PURCHASE POLICIES

Some say, "Anyone can buy!" Sure they can, provided they know: *where* to get goods; *how* and *why* the things they buy are used in their own company; how to *judge value*, how to *work with people*, and how to *control and follow through* on purchases. Further, they must be willing and able to use available purchasing techniques.

Today's purchasing chief must be one of the most knowledgeable managers in the company. Unless the CPO understands the design, engineering, manufacturing, marketing, and related functions in sufficient detail, the buyers can't possibly do their jobs effectively. Purchasing Managers often see themselves as managers of materials and expenditures. But how do others see them? Professor Renato Tagiuri of the Harvard Graduate School of Business analyzed the role of a purchasing manager comparing it to that of a production manager. The production manager works within the center of the sphere defined as manufacturing. The purchasing man or woman is at the border of this production sphere, but also on the border of a sphere of many suppliers. The PM is in "conflict between two worlds!" It takes a high degree of statesmanship to operate in such an environment. While progressive managements today accept Purchasing as a vital management function, there is still little understanding of purchasing's role among many non-purchasing executives. One reason has been the inability of those performing purchasing to clearly explain their own roles.

What about the buying job itself? We need a bigger vision or "mental picture." The buying job is indeed unusual and one of the least understood in industry. Because conflicts and disputes have to be settled with suppliers and contractors, friction is often an aspect of this job. It is easy for any buyer to let details drift and become a "paper pusher," but he or she will not survive in a highly competitive organization. Two buyers may be given identical purchase requisitions for a purchase valued at \$1 million dollars. One might buy the desired goods without

NOTES

sacrifice in quality for \$950,000, and the other buyer might spend the full \$1 million. Interestingly, the first buyer may not be as well liked as the second who is a real "good Joe." In the office, "Joe" will seldom question a requirement, rarely considers standardization to save money, and will simply buy it. Which of these two buyers is doing the best job for his employer? Buyers must often raise questions about a purchase. Why is a "special" needed? How about a different, standardized and more readily available model? The ideal situation is the buyer who has the technical ability to buy greater value and has good interpersonal skills.

The Accountability Concept

In many specific purchases, the buyer must control and coordinate two or more requirements dictated by other functions such as engineering, quality, and manufacturing. Yet, in no instance does the buyer have any direct authority over the people or other departments involved. Numerous other jobs require coordination, but they usually have more direct authority.

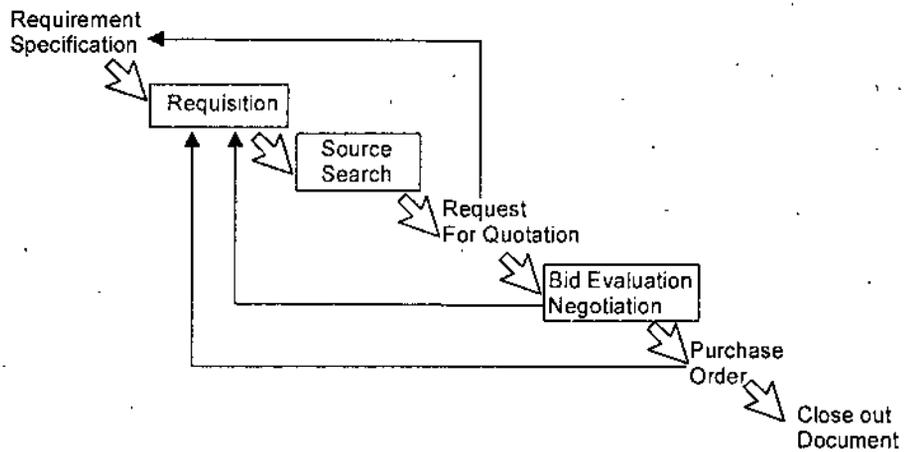


Figure 2.20. The Procurement Process

"If only the boss would give me the authority, I'd sure straighten out this mess. I won't be responsible unless I'm given complete authority to control this buy." What buyer or manager hasn't heard such a statement arising from occasional job frustrations? In the past, authority and responsibility supposedly went hand in hand. That seems a reasonable assertion—no authority, no responsibility—but it is a management myth that "dies hard."

Who in any company has all the authority he or she needs? It may be more accurate to say that almost no one has enough authority to completely control all activities under their responsibility. How many times do top executives state what they want done, yet it doesn't seem to happen? The threat of being fired or losing a job is a business reality, yet it is happening so often these days that it has lost much of the negative stigma.

Authoritarianism has given way to what might be termed "situation authority." Consider an analogy: when people drive by a serious traffic accident, they normally obey a citizen signaling traffic. That person has no authority over traffic, yet the situation demands compliance. So too, in buying, the situation often demands a similar response. A high degree of interdependence among people in the company is a fact of life. The buyer is the shock trooper on the line, assuring supply, resolving quality and specification issues and controlling costs. Supply and demand still affects prices and the balance is maintained at the buyer's desk. Buyers are often the only force combating the seller's natural drive for higher prices.

Buying Influences

Confusion about the buying job frequently stems from failure to understand the many and varied buying influences. Buyers should be able answer the question, "Who buys at this company?" Consider the major buying decision-making factors and who influences each of them.

Knowledgeable buyers know there are items for which they have absolute buying decision authority. They also know of other buys where they have very little control. Of course, they recognize that most buys are between those two extremes. Buying decisions reflect composite judgment. Depending on the situation, the buy can range from a one-person decision to group or committee decision where no one individual dominates. Many buying decisions may be shared, delegated, or coordinated, as seen in Table 2.2.

Table 2.2. Buying Influence

<i>Decision Factor</i>	<i>Influences</i>
Source and price	Buyer Design Engineer Purchasing Engineer
Quality	Design Engineer Manufacturing Engineer Quality Assurance/Control Buyer/Purchasing Engineer
Quantity	Material Control Buyer
Timeing	Sales Forecast/Order Scheduling Production Control Market Availability

NOTES

NOTES

Despite delegating authority to others, buyers must keep responsibility for the results, even in those cases when they have little say in what is bought. This is important even though it can be argued that the buyer controls little of what has been defined as “purchasing” Production tells the buyer how much to buy and when it’s needed. Quality is determined by engineering specifications and quality standards. Price may be nonnegotiable and controlled by supply and demand. Not too much “authority” here; yet, have a supplier deliver two weeks late, and who’s held accountable—manufacturing, engineering, quality control? Not usually.

Though it may be the supplier’s fault for missed production, it is the buyer whose performance is questioned. What makes a successful buyer? Two qualities are especially important—the ability to motivate and encourage others to perform, and the ability to find alternative solutions when under pressure. Flexibility, the ability to quickly shift mental gears, is key, as purchasing often occurs at a hectic pace beset by a variety of problems. Examples of buyer duties are: cost studies, supplier negotiations, and “fire-fighting” to overcome quality or delivery problems as they arise.

Buying is a demanding job, requiring a dedication and commitment to serving the company’s best interests over the long run. How do you measure up? The competent buyer will:

- Handle his or her share of the departmental workload.
- Perform work quickly and accurately.
- Accept that periodic assignment changes are sometimes required in a dynamic business environment.
- Accept some overtime work, with or without extra pay.
- Offer workable ideas for improving purchasing systems.
- Seek to continually improve process effectiveness.
- Know supplier capabilities and limitations.
- Foster long-term supplier relationships.
- Recognize that the suppliers’ success reflects on his or her individual performance.
- Keep up with market and technology developments.
- Stay abreast of his or her company’s products and services.
- Continue to add to personal knowledge of the job.
- Work within procedures and guidelines of the department.
- Maintain the highest personal ethical standards.
- Justify sourcing decisions based on total cost and the best interest of the company.

- Know how to tactfully challenge specifications and delivery dates that affect the ability to assure supply.
- Accept constructive criticism without becoming overly defensive.
- Pitch in to help other buyers during times where workloads become strained.
- Let the supervisor know when workload can be increased.
- Reasonably enjoy his or her work.
- Remain loyal to the supervisor, the department and the company!

NOTES

The buyer should be firm and decisive, yet, when necessary, eloquent in pleading a case for special treatment. It's all in the daily job; the individual that can't make swift transitions will be unhappy as a buyer. Purchasing's role will continually shift as supply and demand forces change. Scarcity of materials will cycle again. Higher prices are needed at times, to reduce consumption as the world's resources are being depleted. The buyer will need to be knowledgeable about global supply!

Of course, the buyer can't, like the chameleon, change colors as every market changes. An effective buyer will avoid extreme positions, and be flexible enough to understand his or her cross-cultural environment. Buyers can change many aspects of a purchase, while allowing others in the organization a say representing their sphere of interest and influence. Being knowledgeable about *what* is bought and *why* it is bought, plus this right to question, can affect profitable operation. Logically, purchasing personnel should: (1) understand buying influences, (2) be able to explain them to others, and (3) understand and accept that buyers do not make all buying decisions.

Does this influence detract from purchasing authority? Not at all, rather it emphasizes it! Who in any company other than the buyer can correlate the many decision factors in an organization engaged in a vital purchase? The more important the purchase, and the number of participants, the more urgent is the coordination role requiring the highest of competence. Purchasing must be of sufficient stature and position to handle these important situations.

Buying influence is a way of life. With absolute authority, the buyer would be the sole decision-maker. As it is, decisions must be made with involvement of others in the purchasing process. An understanding of buying influence emphasizes the *true managerial role* of the buyer. Savvy purchasing leaders have learned that attempting to tightly control the various interactions between company representatives and supplier

NOTES

contacts is not only time-prohibitive, but is also unnecessary. Figure 2.21 shows how the buyer and supplier interface has changed from one of salesman-to-buyer, each attempting to represent all areas of his or her respective company, to a multi-function interface with buyer and seller representatives working with each other across a broad range of issues. The role of the buyer has become one of quarterbacking this team activity. This has far-reaching implications for the skills required by a supply manager, as distinct from a traditional buyer.

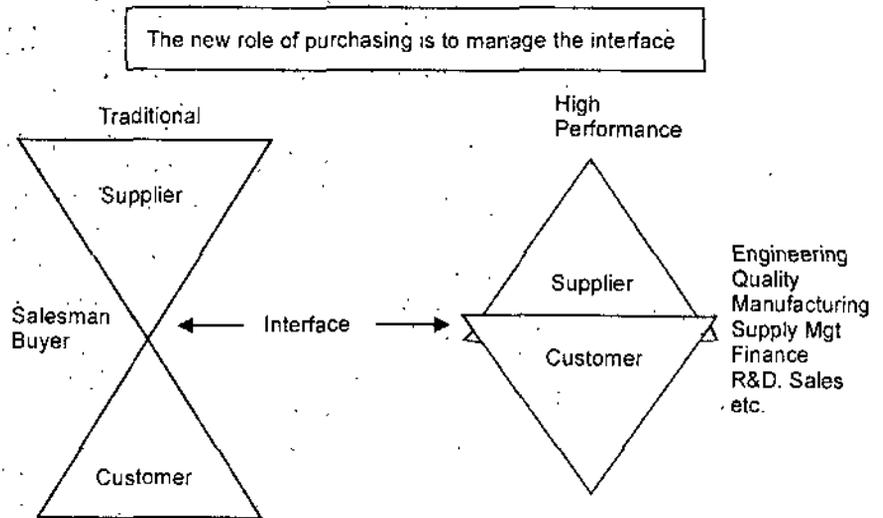


Figure 2.21. The Supplier-Customer Interface

The traditional approach shows that a supplier wishing to sell to a prospective customer sends out a salesperson. That person will probably come into contact with engineering, expediting, quality control, receiving and even management of the potential customer.

The buyer is in a position to coordinate the various functions within the buying company to present a united front to the salesperson. While this seems logical, there is just too much communication needed for everything to be processed through the buyer. It simply won't work. A buyer must work through others to get answers, guidance, and a coordinated decision to present to suppliers. There is a need to lead, but not funnel, the communication exchange.

In the high performance organization, communication lines may exist between the supplier and buyer's interested departments, as long as the buyer is leading the effort. This scenario allows free flow of vital information between the selling and buying companies. Here, purchasing is in position to maintain cost control over expenditures, as the buyer remains accountable for results. The skills required of the buyer have shifted from communicating and controlling to project management and influence. In short, the buyer

needs to maintain a screen and not a communication wall within his supply chain.

2.16 EVOLUTION OF PURCHASING AND SUPPLY MANAGEMENT: VENDOR EVALUATION

NOTES

To trace the development of the organizational status of purchasing, let's consider the origins of the buying organization. An organizational challenge first emerges when a business expands beyond a single location. Establishment of a second site location does not necessarily affect the marketing operation; after all, it is possible to keep up sales and related activities just as though the company still had a single operation. However, buying isn't quite the same. Management has several organizational choices to consider with respect to optimizing the purchasing function. Various organizational arrangements accompany business growth. Buying can be done (1) from the original site with existing people, (2) by new buyers at the second site reporting to that site manager, or (3) back to the purchasing manager at the original site, or (4) to other top management personnel.

There are four basic types of organization: (1) line, (2) line-and-staff, (3) functional, and (4) committee. In practice, purchasing departments are combinations of these four types. Though they seldom appear in pure form, it helps to distinguish them for analytical purposes.

A box chart usually depicts these organizational setups, but others such as a concentric or circular graph are occasionally useful. The concentric type has the advantage that no one is represented as inferior or of "lower rank" than anyone else. It is employed by at least one of the country's largest businesses and serves its purpose well.

The head of purchasing can use charts as a valuable management tool. They help in setting lines of authority and responsibility for both buyers and managers, and also in depicting formal communication lines. They show who has the right to hire, to promote and discharge, and to establish an orderly allocation of "jobs to be done." Deficiencies in an organization can often be detected through the use of well-prepared charts. In cases where a chart has never before been attempted, channels of reporting, for instance, may be more clearly recognized.

Responsibilities and limits of authority should be spelled out as clearly as possible. This is where the use of job descriptions and a purchasing manual come into play. The Chief Purchasing Officer (CPO), like most

NOTES

leaders, is constrained by tradition, practicality, requirements of teamwork, and other demands of the organization.

Authority derives from one's place in the organization, but it relies heavily upon the respect of others for the manager's competence. When that competence produces the trust of others, true authority will exist. Authority depends on the ability to enforce a reward or punishment. Two early examples of organizational enforcement were the church and the military.

The church used excommunication, while the military Articles of War read, "... or punishable by death." The four major types of organization are shown below, and are defined as follows:

1. *Line.* The concept of the line organization is, of course, borrowed from the military. The captain commands the lieutenant; who in turn commands the sergeant; and so on. This, in its pure form, may be practical in smaller and medium-size companies. (see figure 2.22)
2. *Line-and-staff.* The line-and-staff organization is the most prevalent in business and industry. A good example is the purchasing department of the typical large manufacturing concern. The "line" consists of those in command—the vice president, manager, senior buyers, and buyers. The "staff" is composed of vital specialists who collect and analyze data, recommend policy, work with the line to solve problems, and so relieve line management of much detail. Examples of staff functions in figure 2.23 are those of purchase analyst, price/cost analyst, and purchasing engineer. Staff functions and personnel become involved when line managers cannot personally handle all their responsibilities. They cannot delegate management duties; so, a staff assistant is added to help extend the management function by overseeing specific areas of responsibility. Currently, there is a tendency in business practice to combine the line and staff into a "fused" organization. Under this setup, staff analysts, for example, because of their knowledge of a particular study, may give instructions to the buyer as needed, whereas that would not normally be expected.
3. *Functional.* Some companies—for example, those that manufacture a broadly diversified array of products or have important functions other than buying—feel that organization by function is better suited to their particular needs than the ordinary line-and-staff setup. A Functional Commodity Buying Organization is quite common, as it makes no sense to have two or three buyers all talking to say, motor manufacturers. Channeling buys for motors through one

individual gives that buyer greater "economic voice" in dealings with suppliers. However, to do this in multi-plant operations is not simple.

4. A highly efficient organizational hybrid is the commodity manager arrangement (not shown). In this example, the central purchasing department does the buying, while the various plants are free to control their inventory, and release directly against the blanket orders. Each plant performs its own expediting, calling on the buyers only when they can't get the required delivery. Figure given below shows centralized functional control with decentralized buying.
5. *Committee*. A committee is usually grafted into an existing organization where a special function or project requires that the skills and efforts of several company areas be coordinated. In purchasing, such a function might be value analysis, which draws its members from purchasing, engineering, manufacturing, finance, and other areas as needed.

NOTES

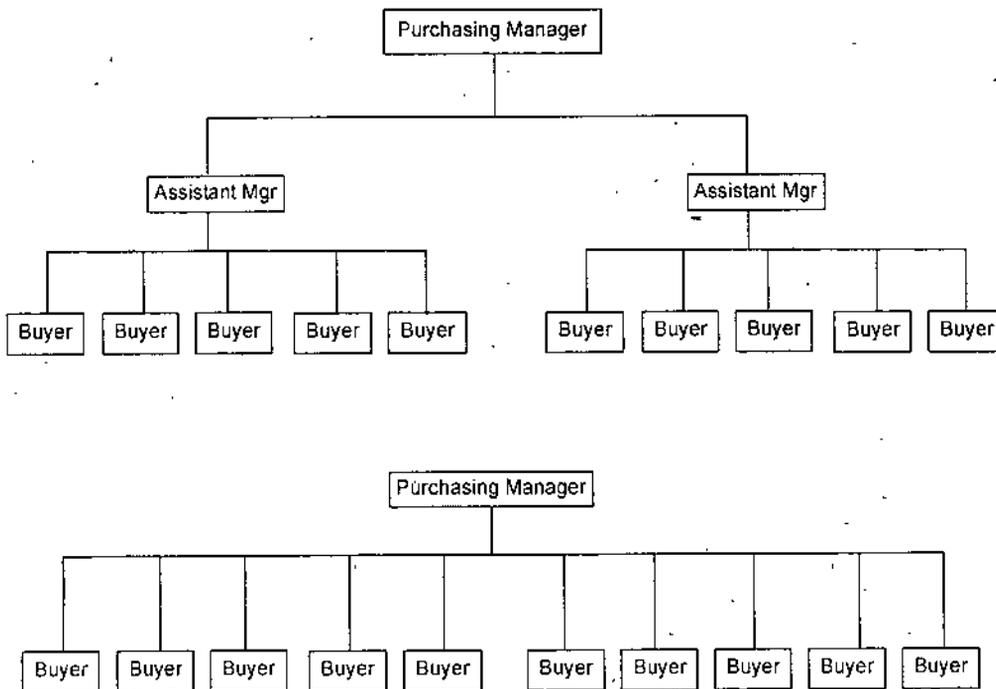


Figure 2.22. Line Organization

NOTES

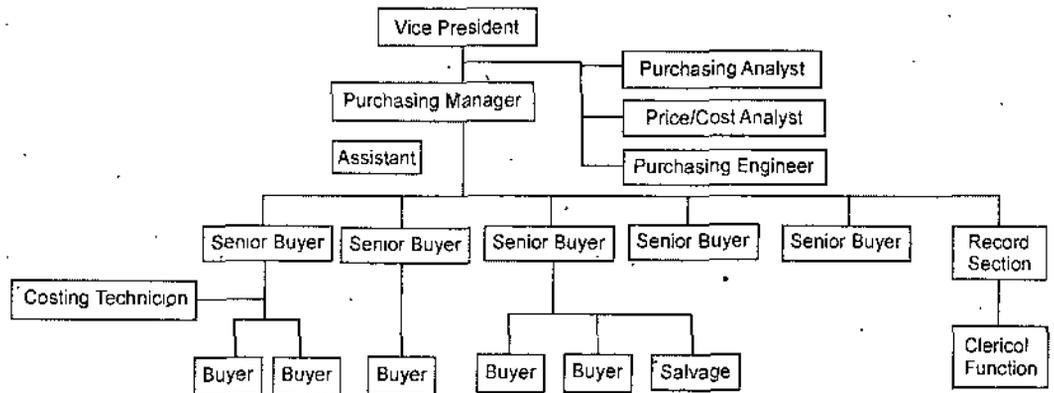


Figure 2.23. Line and Staff Organization

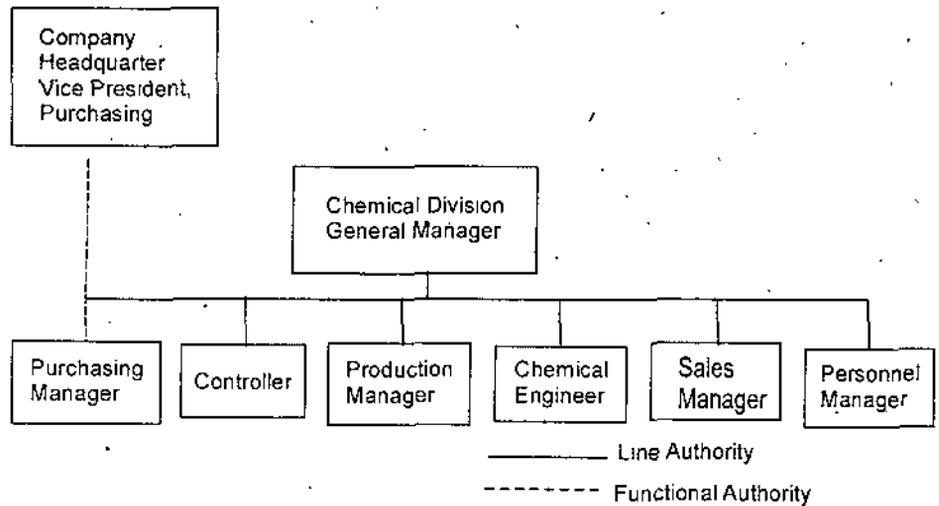


Figure 2.24. Centralized Functional Control with Decentralized Buying

2.17 CENTRALIZED VERSUS DECENTRALIZED DEPARTMENT

Centralized as applied to purchasing has two connotations. The first concerns the concentration of buying authority for a single plant within the purchasing department. There are situations where a company official, even the president, may buy a vital item because of the serious leverage it could have on the survival of the business. Examples might be hides for a tannery, wood for a paper mill, or lumber for a furniture plant. There are fewer such exceptions today than in past years. In general, most single-plant companies have centralized control of the buying function. The second, more common connotation of the term implies central purchasing control, usually at headquarters, even when there are several plants in different locations, run by division managers. Conversely, if there are

several independent purchasing groups reporting to the individual plant managers and not to one purchasing head, purchasing is decentralized. Either form of organization can, and does, operate in similar industries; strong management personalities will sometimes influence the choices. There are, however, situations that usually will make one of them more appropriate.

NOTES

Advantages of Centralization

Why is centralization desirable? Under this form of organization it is possible to maintain greater control over the total commitment of purchasing dollars. A buyer can offer the largest "buy package" to the seller, resulting in better buying agreements that take full advantage of company-wide usage.

Whether a department is centralized or decentralized may depend in the last analysis on such factors as top management preference, use of sophisticated information systems, the physical layout and location of the company's plants, and the types of products manufactured, or the processes utilized.

Centralized purchasing more readily attains uniform procedures and maintains better control over them. It is easier to bring new people into the larger department and train them properly before they are put on the important buying job. Individuals can be assigned the tasks for which they are best suited. Those who have exceptional negotiation skills may be designated to handle the large-value items; those with the most ingratiating personalities may be designated to the touchier areas of trade relations; and those who are especially aggressive may become excellent expeditors and troubleshooters. There is probably a point beyond which the purchasing operation cannot be centralized with a further increase in profitability. The fact remains, however, that some of the finest and strongest purchasing departments are centralized.

Advantages of Decentralization

Compare a decentralized company whose three plants require a salesman to call on three buyers with the one in which centralized purchasing enables the salesman to service the three plants in one call. This saves buying as well as selling time.

Usually the decentralized purchasing department can react more quickly in emergencies than the centralized group. Also, central buyers who are physically distant from the point of use may be less in touch with

NOTES

materials problems and specifications. The loss of a key person is not as serious as it might be in the strongly centralized group. And it is possible to keep responsibility and authority closer to the firing line to permit greater flexibility where decisions do not have to be referred to a remote head office. Like centralization, decentralization can be overdone. Small, scattered buying groups may have little opportunity to be heard by top management and be so weak that they have little voice in company affairs. Buying decisions may then be dominated by other, more powerful departments that are not aware of the role of purchasing in achieving profitability. Generally most companies start with centralized purchasing, frequently converting to a decentralized function as the company expands and grows into separate divisions. There are no strict rules to follow. Some large companies remain centralized even with many plants in different parts of the country; others are decentralized, having several departments in the same plant area.

In practice there are numerous variations on the organizational theme; however, they are usually combinations of the line and staff and functional types. They may be either centralized or decentralized. It is possible, for instance, to have centralized functional control along with decentralized buying as seen in figure given above. This sort of structure allows the divisional manager to retain authority over buying, but it permits procedural and policy control to be retained by the central purchasing authority. Many large corporations find it completely unpractical to centralize many buying organizations throughout the world. The global corporation presents an organizational challenge about how to bring together buying actions. How can buying be centralized despite confusing organizational channels? In organizing to do the job, the classic question is, "Do we buy centralized or decentralized?" We can do both! In dealing with suppliers, a specific item can be bought solely by a plant, or centrally. To enhance productivity, the challenge is to get over organizational barriers and form cross-functional teams.

Without question, the most popular organization is the central/decentralized organization. Purchasing is one area of materials management that a company can centralize, regardless of the organizational structure that exists. Whereas centralizing inventory may be difficult in a multi-plant environment, the buying activity can be controlled for maximum strategic and economic leverage, regardless of location of the buyers and suppliers. The challenge presented by these hybrid structures is to maintain strong communication between the centralized strategic people who are guiding the selection and oversight of key suppliers and the decentralized buying

activity responsible for supplier delivery and quality performance on a day-to-day basis. Many organizations have found electronic tools such as e-mail and Internet based collaboration to be highly effective in meeting this need.

NOTES

Titles Used in Purchasing

Purchasing uses a variety of titles, the most common today being purchasing manager, which replaced the title of purchasing agent used almost universally before 1960. If a company has several PMs, the person supervising them may be assigned the title Chief Purchasing Officer (CPO), *director of purchasing*, *director of procurement*, *general purchasing manager* or sometimes *materials manager* or *director of material or supply*, the latter titles usually implying added materials responsibilities. In smaller organizations, PMs may report directly to a vice president with a title similar to the above.

According to a 1995 study by the Center for Advanced Purchasing Studies, "Data about the Chief Purchasing Officer (CPO) showed: Title — Vice President (37%); Director (36%); Manager (21%); and 59 percent changed titles since 1988."

The person doing the buying is, logically enough, referred to as the buyer. At one time the title "procurer" was strongly favored by the National Association of Purchasing Managers (NAPM), but it hasn't found popular acceptance. Senior buyers handle vital items of high dollar value, or are in charge of several buyers and assistant buyers; sometimes the term *supervising buyer* is used.

The title *buyer/planner* has gained favor by those plants that prefer to tie buying, expediting, releasing, and inventory responsibilities to the same person. Sometimes referred to as the "cell concept," this relationship works well for some, though managers wanting concentration of attention on costs of acquisition might question placing more detailed routine with those doing the purchasing.

The expediter is, as the title implies, an individual who follows up the material bought to ensure delivery as required. In common usage are such additional titles as *purchasing engineer* and *research analyst*. These are the specialists who have proved valuable in ferreting out costs through special concentrated study.

Other titles used include: *purchasing engineer*, *analyst*, and *group coordinator*. The "purchasing and supply manager" title may become more popular. In practice, titles in purchasing are no different from other business titles; it is almost impossible to determine a person's

responsibilities from the title alone. In some companies a purchasing agent has more authority and responsibility than a vice president of purchasing elsewhere, while others may apply the PA title almost to the buying level.

NOTES

2.18 ACCOUNTING FOR MATERIALS: FUNDAMENTAL STEPS TO COMPLETE A PURCHASE

In the context of the overall process of completing a buy, editing the requisition is among the first administrative steps taken by a buyer. The fundamental administrative steps to the purchase are:

1. Editing the requisition
2. Making purchase decisions (source(s), split of business, pricing and terms of purchase)
3. Issuing the Purchase Order (PO)
4. Issuing change notices (as required)
5. Receipt of order acknowledgment
6. Follow up and expediting
7. Receiving records
8. Invoice reconciliation and approval
9. Corrections or changes, if needed
10. Recording purchase transaction and closing the PO.

Editing the Requisition

The first step in buying is always recognition of a need. It may be a request to replenish stock on a repetitive item, or it could be a special onetime buy of a less frequently ordered item. It may be for commodities, components, or services and it may be for a few dollars or millions of dollars. It is best to be in written form, usually a requisition ("req") that represents an unfulfilled need. Today this data is frequently transmitted electronically over intra-company computer networks, or sometimes via facsimile.

The person providing internal authorization for repetitive purchases sends a "traveling req.," usually in electronic form, to the buyer. A smaller firm may have the buyer order by review of the inventory records directly,

eliminating the req. Information typically identified on the req includes: authorization to acquire, account to be charged, description of what is needed, quantity, date wanted, ship-to information, and so on. The form may also contain vendor information, prices and part order history.

While buyers get lots of incoming mail, these reqs are actually "action orders," and hence, take top priority. The buyer must first identify those items that must be acted on quickly. Upon making the purchase decisions, buyers add this information to the requisition that ultimately becomes the basis for the purchase order: supplier's name, unit price, order dollar value, agreed delivery date, FOB shipping terms, shipment method, and terms and conditions including payment. In the case of electronic ordering systems, much of this information will be completed by default, usually from the past history for this item contained in the system. It is incumbent upon the buyer to be sure this default information is correct and intended for this specific requirement.

NOTES

Issuing the Purchase Order (PO)

What determines the type of contract to be negotiated? Some buyers most often use a single type; however, it's important to realize there are variations to suit special situations. Buyers should ask themselves the following questions:

Is more than one supplier willing or able to supply the product or service? How much money is involved, and how urgent are the deliveries? What risks are involved (delivery, quality and cost)? Has a similar item been supplied before? What is the financial status of the supplier? (An assessment of risk of failure to perform) Are cost and price analyses necessary? There are more than 20 known types of contracts that can be divided into three major categories—fixed price, cost plus and blanket orders..

Fixed price: This is most common type of contract, and can be used to buy anything. It has many variations, but the fundamental precept is that the price will not change during the term of the purchase order.

Cost plus: For most work, a cost-plus contract is not the most desirable type of contractual instrument as there is generally no cost limit, so price is difficult to control. But sometimes it is the only way to get a contractor to handle the job where significant or unknown risks abound. These contracts are usually reserved for construction, complex defense contracting needs, service or special contracts, where the buyer is

NOTES

uncertain what will be required until the work is in progress. Naturally, suppliers are not going to tackle this type of work on a fixed price basis unless they get a high price to cover any eventuality.

Normal practice is to get detailed analyses on hours worked and expenses. With cost-reimbursement arrangements, always include the right of audit, including the hourly rates for various classes of labor! The supplier's profit is either a percentage of the costs or is a fixed fee that is set during negotiation. That amount is paid regardless of other costs. Be wary of agreeing to profit as a percentage of cost, as there will be absolutely no economic incentive to contain costs; to the contrary the incentive may be to raise costs to get a better return.

Another variation on the cost-plus theme is the Cost Plus Incentive Fee (CPIF) arrangement that has been increasingly utilized by the Department of Defense. These arrangements can include a value-engineering clause that allows any supplier to keep a portion of savings achieved. The idea is to reward superior performance and cost savings and to penalize substandard performance or cost overruns. An excellent example was the rebuilding of highways after an earthquake in California. The contractor worked night and day, bringing the job to completion months ahead of the experts' best judgment of time to complete. The incentive was large, but well worth it to return traffic flow patterns to normalcy.

Blanket Orders

Blanket orders are generally based on fixed priced arrangements, but because they cover a period of time over which pricing is applicable, may also include price adjustment features. The blanket order will be reviewed in more detail, but first let's identify the types of documents used to make an acquisition. Below are some different formats:

- Purchase order
- Blanket order
- Systems contract
- Letter of intent
- Letter order, or letter contract
- Memorandum of Agreement (MOA) or Memorandum of Understanding (MOU)
- Cost/price agreement

- Corporate purchase agreement.
- Legal agreement document.

Buyers may use a Letter of Intent to arrange early parts buys and plan their production schedule. Use this format with caution. Often the only legally enforceable content of the letter of intent is the commitment to purchase. A Letter of Intent is a binding arrangement that obligates the buyer to complete a purchase if it causes the seller to start action. A contract is usually more complex and detailed than a Purchase Order (PO), although a PO is actually a contract itself. A handshake may still work for some purchases, but for most buys a written agreement is needed to give proper documentation and to meet the legal requirements of the Uniform Commercial Code (UCC). For all but the most unusual circumstances, use a purchase order, and spell out anything that is important.

NOTES

SUPPLY CHAIN ADVISORS		Purchase Order		
The following number must appear on all related correspondence, shipping documents and invoices				
P.O NUMBER:				
To _____		Ship To. _____		
_____		_____		
_____		_____		
P.O DATE	REQUISITIONER	SHIP VIA	F.O.B POINT	TERMS
				See Reverse
QTY	UNIT	Description	Unit Price	TOTAL
			SHIPPING	
			TAX	
			OTHER	
			TOTAL	
1814 Bunker Hill Drive Sun City Center, PL 33573				
			Authorized by _____	Date _____

Figure 2.25. Sample Purchase Order form

Purchase orders are issued considering the supplier's quoted prices and leadtime, and other specifics relevant to the purchase agreement. The forms in use vary greatly, and an example is shown in figure 2.25.

NOTES

An occasional review of the format and terms and conditions versus other available formats is helpful. Larger firms generally have good models because they created their forms using the guidance of legal staff. The purchase order is the legal document by which buyers commit their company to pay for desired purchases. Problems are minimal if buyers plan and prepare a well-documented purchase order. Specific prices should always be defined in the fixed price purchase order. Buyers have to think defensively when preparing the purchase order. Although difficult to do, the objective is to try to consider all possible events that could go wrong. A buyer's PO checklist of terms and conditions (T's and C's) may be useful to ensure that the basics get covered:

- If order is confirming agreement, with whom?
- Exact quantity, and unit of measure—piece, gallon, keg, bale, bag, etc.
- Accurate and complete description, or specification of goods or services ordered.
- Unit price (identified by currency if other than U.S. dollars).
- Date delivery is needed. Invoice instructions: Invoice to be sent to: (name and address). "Ship to" information: (name and address).
- Type of packing and container to be specified. Method of shipment, "FOB" INCOTERMS (denotes ownership transfer point and risk of loss).
- Routing instructions.
- Method of payment (*i.e.*, prepaid, paid on delivery, cash discounts, and the like.)
- Insurance details— extent of coverage and whether to be paid by buyer or seller.
- Any general or special conditions.

Any special documents required, such as:

- Packing List
- Commercial Invoice
- Airway bill or bill-of-lading.

Also, for offshore buys look for the following:

- Letter of credit
- Certificates of origin
- Insurance certificates

- Special instructions, or other documents required, such as special inspection, and condition.
- Various technical clauses that should be included.
- Signature(s) of authorized person committing the company.
- Any *special transportation, insurance, marking or packaging* requirements should be spelled out in separate clauses. Specific documents used break down into credit documents, commercial invoice, transport and insurance documents.

NOTES

Use of Blanket Orders for Repetitive Purchases

A one-time buy means that a new purchase order is issued each time an item is bought. That can be costly. When an item is bought frequently (4 or 5 times per year), it will pay to consider an open, or blanket PO. Releases are made—sometimes by telephone or electronically—and this keeps the ordering costs down. Each buyer decides when to blanket order based on knowledge of the costs. By grouping items into larger packages that can be purchased more economically, there is the added bonus that administrative costs are greatly reduced as well.

A buyer can use a blanket order for these types of items (as examples):

- High dollar value items
- High volume items
- Repetitively purchased items
- Maintenance, repair and operating items (MRO).

Blanket POs are ideal for mill supplies, small tools, and office supplies, among other things. The objective is to combine small, relatively unattractive quantities into reasonably large packages to gain price and service advantages. So the result is that time and expense to buy are reduced. The person who is closest to the need to replenish stocks is often authorized to release the quantities needed *without intervention from the buyer* as long as the price does not change and total dollars committed are not exceeded.

Also, the burden of stocking inventory is largely shifted to the supplier. The advantages in using blanket orders can be summarized as follows:

- Saves repetition and time
- Simplifies paperwork by eliminating many reqs
- Allows expediting by using department

- Assures continuity and uniformity
- Decreases leadtime for buyer and seller
- Usually provides price advantage
- Terms and conditions of purchase are standardized.

NOTES

In addition to the “nuts and bolt” issues covered by the purchase document, such as prices, delivery dates and quality requirements, other terms and conditions specific to the purchase will usually need to be clearly worked out between buyer and seller. When workflow is automated as in the case of e-commerce, these terms are usually set at a default value. Buyers should be aware of these defaults and assure each is as desired for the particular transaction. The defaults can be overridden but the buyer must act to do so. Some common terms are described below.

2.19 TERMS OF PURCHASE

Cash discounts are part of the terms of purchase and should not be confused with quantity discounts, package discounts, or trade discounts that are reflected in the price of the items purchased. Cash discounts are an allowance extended to the buyer to encourage prompt payment of the seller’s invoice before a stated time interval. Suppliers usually have standard discounts used for this purpose. Sometimes, these discounts can be negotiated higher as one of the considerations when buying. Usual discounts range from 1/2, 1, and 2%, while a 3% discount is usually tops. Any larger discount is a signal that something may be wrong, as the seller may be desperate for cash, or be in financial trouble.

As an example, a typical discount will be expressed as “2 percent 10/Net 30,” which means 2% of the value of the purchase may be deducted if the invoice is paid within 10 days of receipt. Otherwise, the invoice is to be paid “net” within 30 days. “Net” terms require that payment be upon receipt of invoice, while “Net 10” implies a 10 day grace period, and so on. “Net 10 prox.” means payment of the entire invoice by the 10th of the month following the month of invoice. “1% e.o.m.” means that a 1% discount can be deducted if paid before the end of the month. While the term “or Net 30” is usually added, even if omitted it is customary that the invoice be paid 30 days after receipt.

Although ethically questionable, the truth is that many companies delay payment when they can get away with it. A good buying practice is to achieve the best terms possible in all other areas first, then negotiate

payment terms as a stand-alone savings opportunity. Be sure to consult your finance department for your organization's cost of money. If your cost of money is less than the suppliers it should be possible to get advantageous payment terms. Electronic forms of payment or Electronic Funds Transfer (EFT) offer buyers some new opportunities in payment discounts. Using EFT, payment can be made within the same day if necessary. Because of this ability to pay precisely when you wish, it is possible to hold the funds until the last moment, pay on the day specified and accept payment discounts. Use a Payment Terms Clause such as: "Payment terms shall be Net 30 (or as negotiated), per this PO covering this purchase." Add if an international buy: "Payment shall be in U.S. dollar funds (or a foreign currency, if so negotiated). "Documents to accompany shipment shall include items as spelled out herein below, or in the Letter of Credit" (or other type of collection).

NOTES

Shipment Terms

An "FOB" term spells out the division of responsibilities for transportation and passage of title. The goods are deemed to be legally delivered by the seller to the buyer at a point spelled out in this clause. Based on identifying the transfer point for possession of goods, the term determines who will pay the costs and who assumes the risks. Called *INCOTERMS* (a contraction for "International Commercial Terms"), they spell out "What the buyer must do" and "What the seller must do." Lacking mention to the contrary, a PO is assumed to be a "shipping point contract," which means that the buyer is responsible when the seller has delivered the goods to the carrier.

Change Notices

If important conditions of purchase change following the issuance of a purchase order, a formally numbered *Change Notice* should be issued to confirm the action being taken. Failure to formally document and issue a Change Notice can be cause for later dispute. With the advent of ecommerce, this has become a critical issue. Because the matching of order, invoice and receipt is now automated, the lack of a perfect match will create a system error. Therefore it becomes vital to be sure that all elements are correct at all times. The good news is that keeping the order record current is as simple as updating a record in the system.

2.20 COMPLETING THE PURCHASE

NOTES

Although formal purchase order acknowledgments are still used by some, many companies have dropped these as unnecessary paperwork. Most suppliers insist on using their own acknowledgment forms anyway, and if the PO and acknowledgment disagree on terms of sale, the legal standing of the PO terms may be questioned. But the acknowledgment is mandatory for major purchases such as construction and equipment. A case is often made for their legal necessity. Although it may be said there is no contract without an acknowledgment, *shipment* can serve as a legally acceptable form of acknowledgment. Companies may prefer to use formal acknowledgments, but don't get caught up in an elaborate system of control for this document. Probably 50% of the major companies don't use one, and, of those that do, few insist on them in all circumstances.

Follow up and Expediting

Even when the job of expediting is delegated, buyers are ultimately responsible for deliveries. Sometimes referred to as "follow up," it's still one of the most important tactical parts of the buying process to get the goods into the plant or office as needed. Expediting is a problem-solving function, and in fact, the term derives from Latin, meaning literally, "to free one caught by the foot."

Most PO forms have a page devoted to follow-up notations. Routine follow up can be a postcard, or special form that is readily checked-off for information requested. Boxes to be checked for such information as "Will Ship," "Freight car No.," "Pro-bill No.," and so on. Still, most information will be by telephone or e-mail. Electronic tracking systems such as *radio frequency identification (RFID)* now make it possible to know the precise location of a specific shipment at all times.

Today, trying to minimize inventories using Just-in-Time (J-I-T) and lean manufacturing practices, if anything goes wrong, the "customer" can be badly damaged. J-I-T, by design, is not tolerant of shortages and requires that goods be delivered on time. Stores or someone watching over the inventory can handle routine expediting tasks. Even then, when difficulties arise, the problem comes back to the buyer's desk. Avoid repeated expediting for the same supplier or the same part. This condition suggests an underlying problem that must be solved to ensure on-time deliveries. The supplier must perform a root cause analysis to determine the source of the problem. It is incumbent upon the buying organization to be sure this is done,

even if it means intervening to assist. As a minimum the supplier should be required to submit a report of root cause investigation results for any repeated delivery problem. Common delivery problems that occur include:

- Late shipments
- Delivery promises not made, or given and not reliable
- Shipments seldom complete, with many backorders
- Lost or delayed shipments due to incomplete or late shipping documents
- Delayed shipments due to insufficient or incorrect information in the bill of-lading.
- Shipment by more expensive method than requested.

There should be some ground rules for expeditors to follow. "Tickler" or follow-up files may be manual or electronic, but should serve as a reminder and specify what action to take. Using the Web can also provide very timely information. As an example, Federal Express maintains a web site that can be accessed to track any of its shipments. Go to <http://www.fedex.com>, and click on "Tracking," and this displays a form to enter the airbill number. Upon entering the number, and clicking "Request Tracking Info" button, the delivery status is displayed.

When routine expediting fails, buyers must back up the activity by contacting whatever supplier management level is needed to get results. They must apply pressure for results that may include field expediting or buyer visits to the supplier's facility. Having expeditors report to buyers clearly provides the message, "They speak for me." But some companies do not segregate the expediting function, opting instead to leave it as a part of the buyer's job. The underlying philosophy is that buyers are accountable for all supplier performance following placement of the purchase order. When the buyer calls attention to poor service, action should follow, because the supplier has a vital interest in receiving the next order.

Receiving and Price Checking

Packing lists are used to identify the merchandise received. These are documents prepared by the seller for use in receiving, to verify that what is received conforms to what was ordered. Information typically includes the purchase order number, part number, quantity shipped and any other data the buyer requests. Receiving Reports are usually

NOTES

NOTES

matched against Invoices to authorize payment. Barcodes are used frequently to simplify and error-proof this process. When the goods are received, the barcode can be scanned, electronically matched with the purchase record on file and the receipt recorded, all at the same time. This method, in addition to being very fast, avoids the possibility of transcription errors and updates the files immediately. Be sure that all order changes have been recorded in the system before receipt or the matching and recording process will fail, losing the advantages of automation. If the shipment is being imported, the packing list is required by customs officials at both the port of export and the port of import to check the cargo passing through.

Payment is normally handled by the Accounts Payable function, with price or quantity exceptions routed to buyers for approval or correction. The buyer verifies price, quantity and any terms that do not agree, and adjusts any discrepancies. Automated systems will minimize the need for this process step if the information is kept current at all times. In most cases, the need to check prices after receipt is the result of a price change that was authorized but not recorded earlier. Electronic systems do not tolerate discrepancies and require added discipline by anyone who enters or updates information. Most suppliers appreciate prompt payment, so buyers should work to avoid unnecessary delays in payment processing in the interest of maintaining positive supplier relationships.

2.21 BUYING FROM THE RIGHT SUPPLIER AND VENDOR

The ability to select reliable suppliers is a mark of successful purchasing. To paraphrase an old saying, "Tell me who your suppliers are, and I'll tell you what kind of a purchasing department you have." It's not always easy, however, to identify good suppliers. There is no substitute for an objective means of supplier appraisal.

What should buyers look for in a "world class" supplier? The term has come to mean those suppliers who can deliver their goods anywhere globally at competitive cost in all marketing arenas. In the case of manufactured products, the engineering design and manufacturing plans both have a major influence over the choice of suppliers for materials, components, and subassemblies. Some other considerations affecting source decisions are the buyer's expectations, the seller's experience with the product or service, the stage of economic development of the supplier, and preferences

for geographical location. Bulky or heavy items can be costly to transport long distances.

2.22 SOURCE SELECTION

NOTES

Sourcing breaks down into two categories: source selection (a tactical activity) and source development (a strategic initiative that will be covered later). Source selection can be day-to-day buying for items now available in the marketplace, or looking for lower cost suppliers. Anyone can call a supplier and say, "Hey Joe, what's it cost for 100 mops?" That's why everyone figures they can buy—It's easy! But evaluation of suppliers is relevant *before* the buyer buys. Anybody can start a business relationship and find out it doesn't work. The trick is to verify the supplier's capability to perform in advance, before the requisition hits the buyer's desk.

From the initial search, the buyer will attempt to identify several potential suppliers. The possible choices are reduced to a few of the best candidates and, after doing the homework, the selection process is completed with the negotiation, agreement, and issuing of the purchase order, possibly to more than one supplier.

Request for Quotation (RFQ)

When no established market prices are published, the first decision is to choose whom to invite to quote. Much wasted time is avoided by picking the most logical sources for inquiry, and this brings into play the experience of the buyer. For a major purchase, the buyer may choose to first issue a Request for Information (RFI) to determine both the capabilities and interest of several suppliers. Recognizing that this information is provided by the supplier and is likely to be presented in its most favorable light, this information kept in its context will be useful in both prescreening the suppliers and in determining questions to include in the ensuing Request for Quote (RFQ).

An RFQ may be prepared in either paper or electronic form, and typically includes date, control number, name of company and buyer, description of goods wanted, quantity sought, any special patterns or die requirements, any tooling now available from the buying company, delivery destination, special handling and shipment, packaging, delivery date for goods, and finally a deadline to receive a reply.

Buyers may want to include additional special requests, such as:

- How long prices hold firm
- Request for supplier's blueprints or other documents
- Request for alternate proposals (if they will be considered)
- Any special or buyer-supplied materials or supplies to be used
- Any special tests or quality standards required.

NOTES

The buyer may list potential order quantities, and ask for price breaks and quantity discounts. By indicating a willingness to consider substitute items, the seller is encouraged to make creative suggestions. Ideas to save money might include grouping of items into blanket orders, packaging, or design changes. But, the buyer must take the initiative to search the market, and not wait for a sales pitch.

International purchases require special attention. Unlike a domestic inquiry, additional details need to be provided in the RFQ. ASME, UL or other codes may have to be spelled out, along with any special tests to which parts will be subjected. The buyer may have to provide the codes themselves, as the international supplier may not be familiar with them.

Local suppliers know these things from experience, but foreign suppliers may be hesitant to admit they do not understand, since they want to please. Comparing current quotes with past prices paid and to other competitors' pricing is a fundamental technique of buying value. In many cases there are factors, other than simply price, to be considered in the RFQ responses.

Purchase of foundry castings provides an example of a weighted comparison of prices and other factors. A chart is prepared showing all suppliers under consideration, price quoted by each, shipping costs, pattern charges, tool cost, and any other factors. Each factor is weighted in advance based upon its importance in making the source selection. The sum of the quoted values times the weighting factor for each will provide the buyer with a single number for each supplier for comparison. If all suppliers quoted to identical specifications, the decision is simple. But usually, there are differences of brands, quality, tooling, and so on. So, judgment is needed, and such analysis clarifies alternatives and provides valid evidence in making the right source selection.

Buyers are frequently criticized, sometimes legitimately, for considering only price when making a source decision. What factors might cause a buyer to discard a low quote and select a higher price source alternative? One survey ranked the reasons based on frequency as follows: quality

84%, delivery 84%, service 38%, past experience 32%, reputation 12%, facilities 11%, technical ability 11%, financial responsibility 8%, failure to meet specs 6%, and to keep multiple source of supply 3%.

It is important to be able to clearly state how a judgment to use other than the lowest price was reached. In government buying, the justification must be in the file and in writing. In addition, the buyer maintains credibility by telling the suppliers offering lower prices why they were not accepted. As stated earlier, source decisions should be made based upon the lowest total cost.

NOTES

Buyer's Checklist for Selecting New Suppliers

Before deciding on the "right" supplier, consider the specific supplier concerns below. This checklist provides questions that should be asked when considering selection of a supplier, and gives buyers some ideas to build upon.

Reliability:

- Is the supplier reputable, with a proven track record?
- Have the supplier's ability and integrity been proved by past performance?
- Is the supplier giving me savings along with product improvements?
- Is the supplier's management team experienced and stable?
- What is the supplier's position in the industry? Is it a product leader?
- What is the supplier's previous delivery history with the company?

Financial and cost factors

- What is the *total cost* of using the supplier's product, considering quality, delivery and transportation?
- How is the product priced, and have past price changes been reasonable?
- How will transaction costs be affected by dealing with this supplier?
- What is the supplier's financial position and credit rating stability?
- Does pricing meet internal targets?
- How will inventory-carrying costs be affected by use of the supplier's product?

- Is the supplier willing to negotiate?
- What, if any, cash discounts are offered?

NOTES

Technical capabilities

- Will the supplier provide application engineering or design assistance?
- Will the supplier provide analytical engineering that will help improve the efficiency of my basic processes?
- Can the supplier handle special needs and designs?
- Does the supplier contribute to general technical advancement through basic research?
- Does the supplier have special technical capability? What has been accomplished recently?
- What are the operating technology characteristics, such as manufacturing capacity, component design, and techniques used?
- Does use of this supplier's technology limit future source decisions?

Delivery and availability

- Will the supplier ensure on-time delivery?
- Are stocks available locally? On short notice?
- Does the supplier offer support services?
- Is the supplier's location an advantage to me?
- Does the supplier plan shipments to minimize my inventory?
- Can the supplier be depended upon to provide a steady flow of products or materials?

Buying convenience

- Does the supplier offer a full line of related products?
- Does the supplier package their product conveniently for my use?
- Does the supplier have a convenient sales contact?
- Are they qualified to help me? Can I call upon specialists for my difficult problems?
- Will the supplier help me cut acquisition costs such as qualifying visits, telephone calls, lab tests, incoming inspections, spoilage and waste, rejects, and complaints?
- Will the supplier respond promptly in answering queries?

Quality factors

- Quality—does it meet the specification? Are processes controlled to ensure it will do so consistently?
- Are the performance and life expectancy requirements satisfied?
- What quality methods and process controls are used?
- Is there an overall quality control system in place?

NOTES

Sales assistance

- Will queries receive the appropriate personal attention of supplier representatives?
- Does the supplier help develop mutual markets? Will they recommend our products?
- Will the appearance of supplier's product enhance the value of my own product?

After-sale service

- Does the supplier have a service organization available to assist when and where I may need it?
- Is emergency service available?
- Will replacement components be available when I need them?
- Does the supplier provide training and education aids in the use of the product or services provided?

Customer service factors

- Will the supplier provide timely information on fulfillment of orders?
- What is the supplier's labor relations record? What is the history of strikes?
- Does the supplier value our business?
- What are the warranties and claims policies?
- Will the supplier respond promptly to rejected materials and provide credits, as appropriate?
- Will the supplier comply with customer policies and procedures?

2.23 HOW MANY SOURCES OF SUPPLY: SINGLE VENDOR CONCEPT?

NOTES

How do we spot check prices, or assure we are keeping up with current technology, or benchmark quality and delivery performance? The implication of these questions is that the purchasing manager should consider having a policy about using multiple sources of supply as a precedent to deciding from whom to buy.

Why have more than one source? If you split the business, how do you determine who gets what? Should you use two sources if one is more expensive? Are you concerned that a supplier may be unable to supply because it has suffered a catastrophic fire or flood? Whether to use single or multiple sources is a controversial subject. Some buyers argue that multiple sources reduce risk while increasing costs. At the same time, some companies today are using fewer sources based on the philosophy of developing a more productive relationship with a supplier through a mutual long-term commitment to work together.

Arguments for multiple (does not imply many!) suppliers are:

- Competitive supply provides leverage to ensure performance at reasonable price levels.
- Assurance of supply may be increased.
- Buyers have greater flexibility should a supplier's quality slip, technology fall behind or they fail to maintain delivery performance.

Keeping multiple sources allows the buyer to become knowledgeable about competitive technical innovations. Unless the item is basic, how do buyers know which supplier will come up with technological innovation?

This is relevant when buying sophisticated electronics and tight tolerance mechanical items. A major impetus to the movement toward single source has been quality legend W. Edwards Deming. One of Deming's 14 points about quality is to have a single supplier. He proclaimed you're lucky if you get one company who can make what you want. While recognizing his contribution to quality, Mr. Deming was probably not an expert on contracts. An acquaintance told how Deming refused to visit with General Motors until they agreed in advance to keep him on the job for a long time based on the assertion that the "transformation" would require a long-term commitment. The spokesperson mentioned that Deming didn't know what the PO read, but quoted him as saying, "I will bill you from time to time based on my belief of your commitment to my principles."

Many have agreed with Deming's position on single sourcing, and some American automakers that single-sourced some items say the practice cuts down on component dimensional variability. They claim to be able to work more closely in meeting design and quality requirements if using fewer suppliers. They also claim it's easier to insist on a process for failure analysis when the supplier has total responsibility.

Believing the Japanese use only one source, some buyers jump on the bandwagon of the sole-source philosophy. But the truth is, the Japanese almost always have back-up suppliers. After 4 years of single sourcing with Inland Steel, Honda of America added both Armco and Bethlehem Steel as suppliers. As Honda's VP for Corporate Planning explained, "These new sources give us greater flexibility to meet our increased production and expanding operations."

What are some practical arguments for a single source of supply? Consider the following:

- It's easier to work out delivery schedules as may be needed for Just-in Time (JIT) delivery requirements.
- The supplier can be expected to share in continuous improvement efforts to provide savings and customer service benefits.
- Sometimes no one else is able or willing to supply.
- Concentrating purchases with one good supplier provides advantages of "economy of scale."
- Special dies, tools, molds or setup charges are often too expensive to duplicate.
- In the event of product defects or failures, corrective action can be taken sooner, as there is no delay in determining who supplied the defective parts.
- Requirements may not be large enough to warrant the added expense of testing and inventorying with another supplier.
- Suppliers who know they are solely responsible may be more accountable.

Yet, when only one source is used, competition is essentially eliminated after the initial point of partner selection. Single sourcing puts the burden of performance completely on the supplier partner, and in practice the supplying partner must step up to the challenge of true partnership. Some quality experts point out that if a backup source is available, each source will feel relief from responsibility.

NOTES

NOTES

A distinction can be made between sole versus single source. Sole source is said to mean there is no one else qualified or available, while single source means the buyer chooses to use only one of several available sources. So, it's usually beyond the ability of the buyer to overcome a sole source without a deliberate source development process. Not all buyers have embraced the single source philosophy. Most experienced buyers prefer a backup. Typical reactions from buyers have been, "What if my supplier goes on strike, or burns down, or gets flooded out?" Those are good questions. Whether to have a backup source or use a single source depends largely on whether there is time to recover from delays or problems. Buying for a high-volume assembly line favors having an alternative. If buying for resale, or the buyer can wait for new shipments, perhaps a single source is enough. When a single source does make sense, be sure to have the following provisions in place:

- A commitment from the supplier for disaster recovery and work stoppage contingency plans
- Cost-based formulas to determine in advance the basis for price increases or decreases
- A plan to deal with new technology development by competitors
- A joint improvement program, outlining specific cost and service improvement projects.

Clearly a factor in determining a company's sourcing strategy is the degree of trust and the quality of the relationship with the supplier. If a buyer wants to use a single source, but still have backups, here's one way of achieving both objectives: Divide the business for the broader commodity family, say castings, among two foundries. Give each supplier half the total purchase volume, *while sourcing all* of the volume of each pattern or of specific parts to a single supplier. This gives maximum item volume production to each supplier. Have an understanding that capacity will be made available for the parts that supplier does not currently supply, in case of an act of God or catastrophic problem. One automaker calls this approach, "single-source/dual-capability." In many circumstances, this is a logical approach to this difficult buying dilemma. A stated policy to use only one source limits the buyer's options. Certain higher risk environments not only justify but also actually support a multiple sourcing strategy. Each commodity or item should be judged on its own. Wise PMs will decide upon and prepare a policy statement based on their specific situational needs.

SUMMARY

- A supply chain may be considered as a group of organizations, connected by a series of trading relationships.
- Customer response links logistics externally to the customer base and internally to sales and marketing.
- A logistics problem is that a mix of optimization techniques, common sense, business-best practices, and political savvy is required to develop and implement a workable solution.
- The transportation planning process looks at all possible alternatives to move this merchandise. This is also called the resource or carrier selection process.
- Purchasing is indeed an unusual and multifaceted job. It operates at the vital intersection between buyer and seller, where supply and demand forces meet.
- Blanket orders are generally based on fixed priced arrangements, but because they cover a period of time over which pricing is applicable, may also include price adjustment features.
- Cash discounts are part of the terms of purchase and should not be confused with quantity discounts, package discounts, or trade discounts that are reflected in the price of the items purchased.
- Although formal purchase order acknowledgments are still used by some, many companies have dropped these as unnecessary paperwork.

NOTES

REVIEW QUESTIONS

1. What do you understand by logistics management?
2. What is Supply Chain Logistics?
3. What are different logistics activities?
4. What do you understand by logistics optimization?
5. Describe transportation and distribution management.
6. What are different transportation performance measures?
7. Write logistics network design in detail.
8. What is Inbound/Outbound Consolidation?

NOTES

9. Describe the significance and details of freight and document management.
10. What do you understand by warehouse management and performance measures?
11. What are different objectives of purchasing?
12. Differentiate between centralized versus decentralized purchasing.
13. What are the different steps of purchasing?
14. What do you understand by purchase order?
15. What is Blanket Orders?
16. What are the parameters to select a good supplier or vendor?

FURTHER READINGS

Supply Chain Management: Edited by Jayashree Dubey and ML Sai Kumar, New Century, 2007.

Supply Chain Management: J. Paul Sundar Kirubakaran, Serials Pub, 2008.

Supply Chain Management: Edited by John T Mentzer, Response Books, 2001.

Supply Chain Management: Edited by John T Mentzer, Response Books, 2001.

Supply Chain Management: N.H. Mullick and Mohd. Altaf Khan, Enkay, 2011.

★ STRUCTURE ★

NOTES

- 3.0 Learning Objectives
- 3.1 Introduction
- 3.2 Concept of Inventory
- 3.3 Benefits of Holding Inventories
- 3.4 Cost of Inventories and Risk Associated
- 3.5 Buffer Stock: Objectives of Inventory Management
- 3.6 Tools and Techniques of Inventory Management
- 3.7 Determination of Stock Levels
- 3.8 Determination of Economic Order Quantity
- 3.9 A.B.C Analysis
- 3.10 Ved Analysis
- 3.11 Perpetual Inventory System
- 3.12 Just in Time (JIT) Inventory Control System
- 3.13 Inventory Turnover Ratios
- 3.14 Kanvan
 - *Summary*
 - *Review Questions*
 - *Further Readings*

3.0 LEARNING OBJECTIVES

After going through this unit, you will be able to:

- describe the concept of inventory.
- what is the benefits of holding inventories?
- explain the cost of inventories and risk associated
- discuss about the perpetual inventory system.
- know about the inventory turnover ratios.

NOTES

foreseen, are taken care by the transaction motive, while forces that cannot be foreseen are guarded by precautionary motive.

Speculative motive: When the firm anticipates increase in prices of raw materials, in future, it stocks to take the advantage. Firm takes suitable decisions to change the stock holding pattern depending on the increase or decrease in prices. Bulk order discounts may be offered to attract higher purchases. Reordering costs may be another factor in holding more quantity of inventories, than needed.

3.4 COST OF INVENTORIES AND RISK ASSOCIATED

The following are the risks and costs associated in holding inventories:

- (a) **Capital costs:** Holding inventories involves funds. Funds may be used from own sources or borrowings. If own sources are not blocked up in inventories, they can be used elsewhere, profitably. This is the opportunity cost, the firm has incurred. If funds have been borrowed, interest has to be paid. So, in both the cases, firm incurs cost. In case of own funds, it is opportunity cost and in case of borrowings, it is interest cost.
- (b) **Recurring costs:** Firm incurs recurring costs, in the form of storage and insurance charges. Storage costs can be rent for the godown or warehousing charges, if stored in outsiders' godowns.
- (c) **Risk of deterioration:** Stocks may deteriorate in quality, due to long storage. Once goods lose their quality, they may not be in saleable condition.
- (d) **Risk of obsolescence:** Goods may cease to be useful, due to technological changes, changes in requirements and tastes etc. Now, we do not see floppy drive in the new computers coming into the market, as floppy drive has given place to CD drive.

3.5 BUFFER STOCK: OBJECTIVES OF INVENTORY MANAGEMENT

The primary objective of inventory management is to maintain the right quantity of stocks, in right location, at right time to ensure the uninterrupted production and, at the same time, minimize the investment in stock holding. Every firm is faced with two conflicting issues:

- Maximise investment, by maintaining excessive quantity so that production is not affected and business opportunities are not lost, for want of stocks.
- Minimise investment in inventories as they involve costs and affect profitability, adversely.

NOTES

Optimum Stock Holding

Both the issues-excessive and inadequate stocks are conflicting. Both are undesirable. Excessive stocks result in additional costs due to storage charges, interest cost, and deterioration loss and obsolescence risk. Above all, funds are tied up in inventories and this creates liquidity problem. Inadequate stocks result in stock-out situations and cause loss in profits. In other words, excessive and inadequate stocks move in opposite directions. Both the extreme situations are unacceptable. Firm has to maintain that much stock, just enough to meet the production needs so that there is no interruption in production and no customer goes back disappointed for lack of stocks. This situation can be achieved by maintaining optimum stock level, which is in between the excessive stocks and inadequate stocks. So, every firm tries to achieve that optimum stock holding. The level of optimum stock holding is not static. The optimum level changes due to changes in demand and problems of supply. Demand for the product varies and supply constraints crop up, which are not anticipated. The finance manager has to ensure the optimum stock holding to achieve the conflicting objectives of profitability and liquidity, at the same time. To sum up, the objectives of inventory management can be summarized:

- Maintain continuous supply of raw materials so that production is not affected,
- Minimise the carrying costs and lead-time in supplies,
- Maintain sufficient stocks of finished goods for smooth sales operations and business opportunities are not lost,
- Ensure perpetual inventory control so that physical stocks are always in agreement, with stocks shown in records and
- Facilitate furnishing of data for short-term and long-term planning and inventory control.

3.6 TOOLS AND TECHNIQUES OF INVENTORY MANAGEMENT

NOTES

Efficient inventory management requires effective control system. A proper inventory control system helps the enterprise in solving the problems of liquidity, eliminating excessive stocks and achieving increased profits, with substantial reduction in working capital. The following are the techniques of inventory management and control:

- (a) Determination of stock levels
- (b) Determination of economic order quantity
- (c) A.B.C analysis
- (d) V E D analysis
- (e) Perpetual inventory system
- (f) JIT control system
- (g) Inventory turnover ratios.

3.7 DETERMINATION OF STOCK LEVELS

Carrying too much stock and too little stocks, both are detrimental to the firm. If stock is too little, frequent stock-out situations firm faces. Due to inadequacy of stocks, firm misses business opportunities. If it is too high, profitability will be affected due to increased cost of stock holding. In this context, it is relevant to discuss various types of stock levels.

- (a) **Minimum level:** This is the minimum quantity that must be maintained, at all times. If the stock holding falls below this level, production stops, due to shortage of materials. This level is fixed, considering the following factors:

Lead-time: After placing the requisition for materials, some time is needed to process and place the order. After receipt of the order, supplier too takes some time to execute the order. So, raw material holding is needed, during the process time and execution time, so that production does not suffer, which is called 'Lead-time'.

Rate of consumption: It is the average rate of consumption of raw materials in a factory. This rate of consumption can be calculated

based on the earlier period's consumption rate, past experience and future plans. If the capacity of the factory enhances to match the increased production plans, the consumption rate also enhances.

Nature of materials: The nature of materials affects the minimum level. If the firm produces, soon after the receipt of the order, no minimum stock is needed. The formula for computation of minimum stock is as under:

$$\text{Minimum Stock Level} = \text{Re-ordering level} - (\text{Normal Consumption} \times \text{Maximum Re-order Period}).$$

- (b) **Re-ordering level:** When the stock level reaches the re-ordering level, the order is placed for replenishment of stocks. This level is fixed in between the maximum stock and minimum stock. This level is decided after consideration of the following factors, such as maximum consumption per day and maximum number of days required to supply the stocks. It is difficult to foresee the consumption pattern, with full accuracy. Days that may be required to get the supply of stocks may vary depending on the unforeseen problems of transportation, bottlenecks and other factors. To be on safe side, maximum consideration is given for both the factors. Supply of materials would be received when the stock position reaches the minimum level; even when materials are consumed at the maximum requirement.

The formula for calculation is:

$$\text{Re-ordering Stock Level} : \text{Maximum Consumption per day} \times \text{Maximum Re-order period}.$$

Maximum level: It is the level, beyond which the stock level should not exceed. If this level is exceeded, there would be blockage of working capital, loss due to wastages, risk of obsolescence and more rent for storage space etc. The formula is as under:

$$\text{Maximum Stock Level} = \text{Re-ordering Level} + \text{Re-ordering Quantity} - (\text{Minimum Consumption} \times \text{Minimum Re-ordering Period}).$$

Average stock level: The formula for calculating average stock is as under:

NOTES

Average Stock Level = Minimum Stock Level + $\frac{1}{2}$ of Re-order Quantity.

NOTES

Safety stock: Consumption of raw materials depends upon production level. Production changes on the demand for the finished products. The demand for the finished product is not always constant due to varying conditions. So, consumption of raw materials is not, always, constant. There should be safety stock to take care of fluctuations in consumption pattern of raw materials. The time taken for getting replenishment of stocks may also vary, due to unforeseen problems of strikes or lockouts. So, every firm has to maintain certain amount of stock as safety stock to take care of unforeseen consumption pattern as well as time for procurement of materials. Basically, safety stock is to meet unforeseen contingencies.

Danger level: This is the absolute minimum level, below which the stocks should not fall. When the stock reaches this level, stock would be issued only to the emergency requirements and just to maintain the machinery working, to avoid dry out situation. The formula for calculating danger level is as under:

Danger Level = Average Consumption \times Maximum Re-order Period for Emergency Purchases.

3.8 DETERMINATION OF ECONOMIC ORDER QUANTITY

For effective inventory management, it is necessary to determine what should be the quantity of stock that has to be ordered for replenishment, periodically. The stock that is ordered should be neither more nor less. To avoid accumulation of stocks, if frequent ordering of stock is made, more handling costs ordering costs would be incurred. On the other hand, lesser number of stock orders results in accumulation of stocks, which result in higher carrying costs.

Ordering costs: The costs that are associated with purchasing and placing an order is called ordering costs. These are also known as buying costs as they are incurred, at the time of purchase only.

Carrying costs: These are the costs for holding inventories. Higher the stock holding, larger would be carrying costs and they would be lower if the stocks are lower. Inventory may be high sometimes and low other

times. So, the carrying cost is calculated on the average inventory. The components of costs for both the categories are as under:

Components of Ordering Costs and Carrying Costs

Ordering Costs	Carrying Costs
<ul style="list-style-type: none"> • Requisitioning costs (Indent for Materials) • Processing & placing order • Transportation of goods • Receiving and inspecting cost for incoming materials • Cost of stationery, typing, postage and telephone etc. • Clerical and staff costs for rendering the above services 	<ul style="list-style-type: none"> • Interest on cost of capital, invested in inventories • Rent for storing • Handling costs • Clerical and staff costs for recording receipts and issues • Insurance • Deterioration and obsolescence loss • Cost of spoilage, in handling materials.

NOTES

Ordering costs and carrying costs constitute the total cost of stock holding: Ordering costs and carrying costs behave in an opposite direction. In other words, they have an inverse relationship.

Determination of economic order is important, from the viewpoint of achieving a compromise between handling costs and carrying costs. To avoid stock-outs, frequent re-orders have to be made. More orders result in more ordering costs. By holding lesser stocks than required, enterprise misses business opportunities and, in consequence, profitability is affected. To avoid frequent orders, the other alternative is to maintain higher size of stock holding. A higher size of stocks involves loss of liquidity, as more funds would be tied up. More so, too much stocks result in more carrying costs. Carrying costs are incurred for maintaining a given level of inventory.

Carrying costs vary with the size of the inventory. If the size of inventory holding is more, more costs will be incurred. So, a higher level of stocks mean liquidity problem and also cause reduced profitability too. This is also not an acceptable situation. In other words, if ordering costs are to be reduced, carrying costs become more. If carrying costs are to be reduced, ordering costs become more. The economic order

size of inventory brings a trade off between carrying costs and ordering costs.

The formula for determining Economic Order Quantity is:

$$EOQ = \sqrt{\frac{2AO}{C}}$$

where A = Annual consumption of unit, in rupees

O = Cost of Placing an order

C = Inventory Carrying costs, per one unit

Assumptions: While calculating EOQ, the following assumptions are made:

1. The total usage of a particular material is known and the usage is even through out the year,
2. Material is readily available and there is no time lag between placing an order and receiving the supplies,
3. Cost of carrying inventory is also fixed and uniform though out the period,
4. There are only two costs associated with the cost of holding, i.e. cost of ordering and cost of carrying and
5. The prices of the goods are stable.

Graphical presentation: The EOQ model can be presented graphically. The size of order is presented on the horizontal axis. The costs—carrying, ordering and total costs—are shown on the vertical axis. The picture show that the ordering cost decreases, with the increase in the size of the order. To explain, let us take a small example. If annual consumption of an item is 1,000 pices and order is placed for 200 pices, each time, orders have to be placed five times in a year. If we increase the size of the order form 200 to 500 pices, the number of orders has to be reduced from 5 to 2. The ordering costs would be lower for two orders, compared to five orders. In other words, with the increase in size of the order, total ordering cost would reduce.

As the size of the order increases, the total number of orders for a particular item decreases, resulting in decrease in the total order costs. Due to increase in size of order, more stocks are purchased and more money is tied up in inventory, which results in increase of carrying cost. To reduce carrying cost, the firm stats cutting the size of the order. Then, the carrying cost starts falling.

NOTES

NOTES

Now, let us see the reaction of the total cost, in the entire process. The behaviour of the total cost is interesting. The total cost is an aggregate of ordering cost and carrying cost. The declines, initially, due to reduction in the ordering cost on account of the bigger size of the order. But, later, the total cost starts increasing, due to higher carrying cost as the size of the order has gone up. The total cost starts increasing when the increase in the carrying cost is more than the decrease in ordering cost. At this level, the decrease in ordering cost is more than offset by the increase in carrying cost.

The order size, at this particular level, is designated as economic order quantity. If the firm places the order for that item at that economic order quantity, then the annual cost of inventory of that item will be minimized. To sum up, in inventory Management, Economic Order Quantity is achieved, when the total cost is at its minimum for the enterprise.

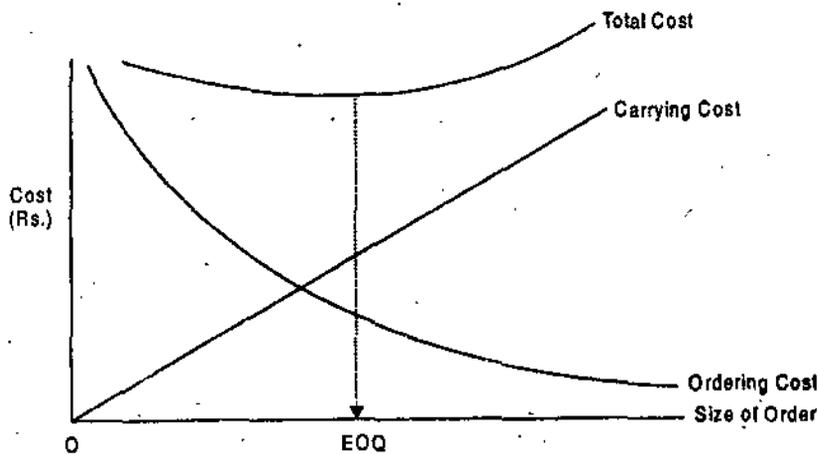


Figure 3.1. Graphical Representation of EOQ

3.9 A.B.C ANALYSIS

A.B.C Analysis is concerned with selective control of inventory management. An analytical survey of the composition of inventory in most of the manufacturing organizations has revealed that 10% of the materials contribute for 70% of the cost of materials, while 70% of the materials constitute 10% of the total cost. The first category is classified as 'A' category while the later is 'C' category. In between falls the 'B' category, this contains 20% of cost as well as materials. If same importance is given in respect of control for all materials, equally, result would not be effective. The essence of selective control of inventory management is to allocate the importance of control to goods based on the cost

NOTES

composition. So, organization has to give more concentration for 'A' category of items due to higher cost composition in the total inventory cost. As concentration is on the fewer items, result would be effective. The ABC analysis is based on the following presumptions:

- Managerial time and effort is scarce and limited and
- Some items of inventory are more important than others.

Under ABC analysis, the item is allocated to the group, depending on the amount of attention it deserves. "A" group requires the maximum concentration of the finance manager. This group constitutes a higher % in terms of value, while it occupies lesser significance, in terms of number of units. "B" group requires lesser attention, compared to "A" group. The last group "C" has to be given the least attention, as it constitutes less value in the total annual consumption. In other words, the procedure is to divide the total inventory into three groups, based on the total cost of each group. The first group should cover 70% of the total cost of inventory, where closer concentration has to be given to achieve better control on a selective basis. The second group should cover 20% while the last group falls into the category of 10% cost.

Method of preparation: The method of preparation is as under:

- Calculate the annual consumption of each item in the year.
- Arrange the annual consumption of the different items of materials, in the descending order i.e. highest value first and the next like that.
- Calculate consumption of each item, as a per cent of total consumption of all materials.
- Calculate the cumulative consumption, in terms of per cent.
- When the total touches around 70%, the first group where concentration is needed, is arrived at.
- The following groups are to be calculated for 20% and 10%, accordingly.

3.10 VED ANALYSIS

The VED Analysis is used for control of spare parts. A.B.C analysis is concerned with materials and is not totally and properly suitable for spares. So, the spares are divided into three categories, Vital, Desirable and Essential. Here, the cost is not of importance but its necessity for

the smooth production assumes importance. If the spares are vital, a must for the smooth running, they are to be stored in adequate quantity. Highest importance is to be accorded for this category of spares. If the vital spares, required for uninterrupted production, are not available there would be havoc in production. The classification has to be done by the technical staff depending on the necessity of spares for smooth running of the production. It is important that no interference is to be made with the classification, made by the technical department. Vital items have to be kept in high quantity, while essential items are to be kept, in reasonable limits. If the desirable items are readily available on placing the order, no need to keep those items, except a small quantity just to fill in the occasional need.

NOTES

5.11 PERPETUAL INVENTORY SYSTEM

Normally, stocktaking is done at the end of the year. In perpetual inventory system, the stock taking may be done either regularly or continuously. The procedure is as under:

- Stock taking team selects the storeroom, where stock taking is to be done, on a random basis.
- All the bins in that storeroom are checked.
- The physical balance in the bin is counted or measured, dependent on the type of the material.
- The actual stock is recorded in the sheets provided for this purpose.
- There is no prior intimation to the stores department to maintain surprise element.
- All the stores are checked, at least, three or four times in a year, on a rotation basis.
- There is a surprise element to the stores personnel so that shortages cannot be accommodated from other sources as intimation is given on the day of checking only.
- If there is discrepancy between stock ledgers, bin card with physical stocks, they are investigated, immediately, as there could be posting mistakes in stores ledger.
- Only after verification and obtaining proper approval, shortages

and excesses, if any, are recorded in the bin cards and stores ledger, as physical stocks rule the actual position.

Advantages: These are the following advantages:

NOTES

1. **Stock records are always updated:** As the inventory taking programme is not known, in advance, all the stores departments keep their bin records and stores ledgers, up dated, always.
2. **Quick calculation of closing stock:** Stocktaking need not be done, separately, at the end of the year. So, closing stock can be valued at the end of the year, without delay, and financial statements like profit and loss account and balance sheet are prepared, well in time.
3. **Check on the Stores personnel, due to surprise element:** Due to the surprise element, there is a regular check on the stores personnel. Stores personnel keep their records, updated. If advance intimation is given, there is a possibility for the stores personnel to accommodate the shortages, from some other sources, for a temporary period. Above all, there would be greater control on theft and pilferage.
4. **Errors and Shortages easily detected:** Due to continuous verification, the mistakes and irregularities come to light, early, for proper control. There would be fear that the defalcations would be detected early. Laxity in control is avoided.
5. **Reconciliation between stores ledger, bin card and physical stocks:** Reconciliation between Stores ledger, bin card and physical stocks occurs, periodically, which otherwise is not done in stock taking, except at the end of the year.
6. **Helping in formulating purchase policies:** The system is helpful in formulating the purchase policies. Stores personnel know when the materials are needed, which material is more needed by production department. They can provide the information relating to quantity, time and quality of the materials, which helps the management in formulating suitable policies.
7. **Investment in inventory, under check:** The system helps in fixing minimum and maximum quantity so that stock-out situation is avoided, while controlling the excessive maintenance of stocks. This helps in controlling the investment in inventories.

8. **Increases the overall efficiency of organisation:** The system tones up the performance of the organisation on all fronts, resulting in the overall improvement in liquidity as well as profitability.

NOTES

5.12 JUST IN TIME (JIT) INVENTORY CONTROL SYSTEM

The basic philosophy of JIT is to keep only enough quantity of stock on hand to meet the immediate production requirements. This concept relies on the suppliers to furnish 'stock' 'just in time', as and when needed. Just In Time (JIT) inventory control system aims at eliminating wastages, from every aspect of manufacturing. This was first introduced in Japan in 1950s. Toyota was the first company to practice this technique. Broadly, there are two aspects, (i) Just in time purchasing and (ii) Just in time production. JIT wants to avoid materials for storing and they should be available, only when they are needed to meet the requirements.

Goal of JIT: The conventional inventory control system is totally in contrast to this concept. The traditional system is based on maintaining a healthy level of safety stock to protect against the uncertainties in production. The traditional system has worked well, so long as the interest costs and storage costs have been low. When the carrying cost has gone up, due to high interest rate and other associated costs, the goal of JIT—maintain only essential stocks—is highly relevant, in the current context of competitive environment. The focus of JIT is to maintain relationship building with suppliers to enable them to purchase right quantities, at right time. The major thrust is to purchase or produce in response to need, rather than as per plan and forecasts.

Objectives of JIT:

- (a) Minimum/Zero inventory and associated costs.
- (b) Zero breakdown and continuous production.
- (c) Manufacturing the right quantity, at right time.
- (d) Ensure timely delivery of inputs as well as outputs.

Major advantages of JIT:

- (a) Right quantities are purchased and produced, in right time.
- (b) Wastages are eliminated, totally.
- (c) Investment in inventory is controlled.
- (d) Carrying cost is reduced.

received indicates a need to manufacture 100 more stem-bolts. For other types of components, bins, boxes or cages might be used instead of pallets. Or components might be stored on shelves in the widget assembly area. When a shelf became empty that signals that more components need to be manufactured and the shelf refilled.

In Kanban the method of handling the components is flexible, and depends on the needs of the manufacturing process.

NOTES

An Alternative Kanban Model

Kanban can also operate like a supermarket. A small stock of every component needed to make a widget would be stored in a specific location with a fixed space allocation for each component. The widget assemblers come to the "supermarket" and select the components they need. As each component is removed from the shelf, a message is sent to a "regional warehouse" or component manufacturing facility, requesting that the component be replaced. The "supermarket" might then receive a daily shipment of replacement components, exactly replacing those that were used.

If we just change the term "supermarket" to "warehouse" we have our manufacturing example. This "supermarket" model is different from the first Kanban example in that it would be used when components are manufactured in facilities that are distant from the widget assembly plant. Instead of moving around small quantities of components, larger quantities are shipped once a day to the centralized warehouse.

Kanban—Responsive to Customers

Kanban results in a production system that is highly responsive to customers. In the above example, the production of widgets will vary depending on customer demand. And as the widget demand varies, so will the internal demand for widget components. Instead of trying to anticipate the future (predicting the future is difficult), Kanban reacts to the needs.

Kanban does not necessarily replace all existing material flow systems within a facility. Other systems such as Materials Requirement Planning (MRP) and Reorder Point (ROP) may remain in operation. Kanban is most beneficial when high volume/low value components are involved.

For low volume and high value components, other materials management systems may be a better option.

Just-in-Time (JIT) / Continual Improvement

NOTES

Kanban is directly associated with Just-in-Time (JIT) delivery. However, Kanban is not another name for just-in-time delivery. It is a part of a larger JIT system. There is more to managing a JIT system than just Kanban and there is more to Kanban than just inventory management. For example, Kanban also involves industrial re-engineering. This means that production areas might be changed from locating machines by function, to creating "cells" of equipment and employees. The cells allow related products to be manufactured in a continuous flow.

Kanban involves employees as team members who are responsible for specific work activities. Teams and individuals are encouraged participate in continuously improving the Kanban processes and the overall production process. Kanban is not a system indented to be used by itself. It is an integral part of Kaizen and 5S. Kanban provides a number of benefits.

Reduce Inventory and Product Obsolescence

Since component parts are not delivered until just before they are needed, there is a reduced need for storage space. Should a product or component design be upgraded, that upgrade can be included in the final product ASAP. There is no inventory of products or components that become obsolete.

This fits well with the Kaizen system on continual improvement. Product designs can be upgraded in small increments on a continual basis, and those upgrades are immediately incorporated into the product with no waste from obsolete components or parts.

Reduces Waste and Scrap

With Kanban; products and components are only manufactured when they are needed. This eliminates overproduction. Raw materials are not delivered until they are needed, reducing waste and cutting storage costs.

Provides Flexibility in Production

If there is a sudden drop in demand for a product, Kanban ensures you are not stuck with excess inventory. This gives you the flexibility to rapidly respond to a changing demand. Kanban also provides flexibility in how your production lines are used. Production areas are not locked

in by their supply chain. They can quickly be switched to different products as demand for various products changes. Yes, there are still limits imposed by the types of machines and equipment, and employee skills, however the supply of raw materials and components is eliminated as a bottleneck.

Increases Output

The flow of Kanban (cards, bins, pallets, etc.) will stop if there is a production problem. This makes problems visible quickly, allowing them to be corrected ASAP. Kanban reduces wait times by making supplies more accessible and breaking down administrative barriers. This results in an increase in production using the same resources.

Reduces Total Cost

The Kanban system reduces your total costs by:

- Preventing over production
- Developing flexible work stations
- Reducing waste and scrap
- Minimizing wait times and logistics costs
- Reducing stock levels and overhead costs
- Saving resources by streamlining production
- Reducing inventory costs.

Getting Started with Kanban

Kanban is usually introduced gradually and typically may involve some trial and error:

1. **The first step:** It is to become familiar with Kanban and the options it offers. Some parts of Kanban may be suitable for your company, others may not.
2. **Select the components of Kanban:** That will work in your facility. Not all parts of Kanban may be appropriate for the types of products you produce. Kanban may be appropriate for one product, and not for another. In some cases a simple manual Kanban will work well. In other cases computer automation of Kanbans may be the best option. You will need to evaluate both

NOTES

NOTES

your in-house production and your suppliers in order to determine which Kanban options will benefit your facility.

3. **Plan your Kanban system:** Kanban involves more than just manufacturing. Other functions such as purchasing, warehousing, shipping/receiving, quality control, transportation, accounts payable and engineering will be involved. Include all of those who will be effected in your Kanban planning and design process. In planning, keep in mind that your object to to have what is needed (supplies, parts, manpower, information, energy, equipment, etc.), where it is needed when it is needed.
4. **Set goals for Kanban:** Based on your plan, set a schedule with measurable goals. What do you want Kanban to accomplish and when should that goal be reached? Determine what will be measured, and how it will be measured. Be sure to get baseline measurements of your current manufacturing system and inventory levels, before Kanban is implemented.
5. **Begin implementation of Kanban:** A common approach to implementing Kanban is to start with a generous number of Kanbans—containers, pallets, boxes, etc. Then systematically reduce the number of containers until the point at which the supply of materials is just in balance with the rate of use is reached. As containers are removed from the process, it will eventually reach the point at which production is delayed because the next container has not yet arrived. At this point add one container to the system to bring it back into balance. In using this trial and error approach, be sure a safety stock is available so that production is not interrupted. You identify the point at which there is one top few containers as the point at which material from the safety stock is used. This trial and error approach should be spread over a significant period of time to allow for normal fluctuations in production. In other words, don't remove a container every thirty minutes. Instead, remove a container once a day, or even once a week.
6. **Container identification:** It is important that containers are clearly identified. Workers should be able to immediately identify the contents of a container just by looking at it. Color coding and labeling containers is an effective approach. For example, paint pallets or containers different colors so that each color is associated with one component or part. Use large labels, that are easy to read from a distance, making it easy for anyone to identify the contents of a pallet or container.

NOTES

7. Define the term inventory control. What are the inventory control systems?
8. Explain the various tools and techniques used for inventory management.
9. What is meant by 'Economic order quantity'? What are the various costs, which affect economic order quantity?
10. What is a selective control of inventory? Why is it needed?
11. "In inventory management, economic order quantity is achieved, when the total cost is at its minimum for the enterprise". Explain the concept, with suitable pictorial presentation.
12. Write short notes on the following:
 - (a) A.B.C. Analysis
 - (b) Perpetual inventory system
 - (c) V E D Analysis
 - (d) JIT.

FURTHER READINGS

Supply Chain Management: Edited by Jayashree Dubey and ML Sai Kumar, New Century, 2007.

Supply Chain Management: J. Paul Sundar Kirubakaran, Serials Pub, 2008.

Supply Chain Management: Edited by John T Mentzer, Response Books, 2001.

Supply Chain Management: Edited by John T Mentzer, Response Books, 2001.

Supply Chain Management: N.H. Mullick and Mohd. Altaf Khan, Enkay, 2011.

UNIT 4 RECENT TRENDS IN SCM

★ STRUCTURE ★

NOTES

- 4.0 Learning Objectives
- 4.1 Introduction
- 4.2 Recent Trends
- 4.3 Role of Information Technology in Supply Chain Management
- 4.4 CRM and SCM
- 4.5 Benchmarking
- 4.6 Outsourcing
- 4.7 Value Chains Versus Supply Chains
 - *Summary*
 - *Review Questions*
 - *Further Readings*

4.0 LEARNING OBJECTIVES

After going through this unit, you will be able to:

- discuss about the recent trends.
- what is the role of information technology in supply chain management?
- describe the differences between CRM and SCM.
- know about the outsourcing.
- explain the value chains versus supply chains.

can help a company create a more customer-focused mindset, without sacrificing operational efficiency. Ultimately a demand-focused approach to planning can significantly improve demand planning and management efforts and help overall costs and customer service efforts.

Advanced demand planning systems and proper strategies can also help uncover data and identify trends buried in a company's information systems. We encourage companies to conduct an enterprise-wide internal Demand Review to gather information from all aspects of the organization. Goals are then set to gain consensus on what will be sold each month for each product line or category and the resulting revenue. Of course, the driver of the Demand Review process is continuous improvement of forecast accuracy.

Critical to the success of any Demand Plan is having all stakeholders, including sales, marketing, finance, product development and supply chain agree upon a consensus.

Demand Plan

It is important for all participants to discuss factors affecting customer demand patterns, such as new or deleted products, competitors or market conditions, the aggregate demand plans and associated revenue plans. Once all demand for products and services is recognized, the information is consolidated into one Demand Plan. Demand Planning is a key input to the larger Sales and Operations Planning process and can have a significant positive impact on new product introductions, inventory planning and management, customer service, supply planning efficiency and sourcing strategies. With our clients, we have often seen that Demand Planning success is often tied to organizational structure. We have found that companies with dedicated resources focused around demand planning and forecasting yield stronger results and drive more value to their company. Organizations that focus part time on demand planning and forecasting efforts yield substandard results. With the strategic importance of Demand Planning, companies need to be committed to this from both a resource and technology perspective.

Trend 2 - Globalization

The business landscape is rapidly becoming more global. Largely due to improvements in communications, globalization is dramatically impacting the way business is managed and transacted, even on the most local levels. No area of a business is affected more by the trend to a global business environment than the supply chain. Manufacturing, distribution,

NOTES

sourcing of materials, invoicing and returns have all been significantly impacted by the increased integration of a global customer and supplier base, and many companies find that existing processes and technology are not flexible enough for this new business environment.

For example, historically, many companies have brought in container shipments from Asia Pacific through the ports in southern California. As the volume of container shipments has increased, all of these ports have experienced capacity issues relating to customs clearance and transshipping. As a result, some companies are contemplating rerouting these inbound shipments to alternate ports. This change may seem subtle, but a shift in logistics of this magnitude has far-reaching effects on the overall cost and efficiency of the supply chain network. Dynamically repositioning the point of entry for inbound container shipments can have a positive impact on customs clearance times and access to increased transportation capacity, however there can be a negative impact as well. Better understanding the total landed cost and service implications of alternate ports of entry can help improve supply chain costs and performance.

The right Supply Chain Design is critical to managing the changes brought about by rapid globalization. A well thought-out Supply Chain Network Design can optimize the network and the flow of materials through the network. In doing so, network design captures the costs of the supply chain with a "total landed cost" perspective, and applies advanced mathematical technology to determine optimal answers to both strategic and tactical questions. Strategic questions answered by a well thought-out network design:

- Where should facilities be located?
- How many facilities should I have and what capabilities should they have?
- What kind of capacity should they have?
- What products and services should they handle?
- Whose manufacturing and distribution orbit should they source?
- Which contract packers or contract manufacturers should I use?
- How can I achieve operations synergies through integrating acquisitions?

Trend 3 – Increased Competition and Price Pressures

Historically, price, product features and brand recognition were enough to differentiate many products in the marketplace. With the continued

NOTES

commoditization of many products, companies need better ways to distinguish themselves. In one case, a large global consumer goods manufacturer saw prices around some of its commodity products drop as much as 60–80 percent. Product innovation and brand equity no longer were allowing them to command a higher price in the market. In order to continue to compete with that commoditized product they made significant cost improvements with supply chain re-design and technology.

Companies are looking to their supply chains in two ways to help offset this trend. First, they are looking at ways to reduce cost and are creating a more efficient value chain to remain cost competitive. Second, companies are looking at ways they can provide value-added services to meet the demands of more sophisticated customers.

Cost improvements around inventory management, logistics operations, material management and manufacturing costs, including raw material and component acquisition can be found with:

- Sales and operations planning
- Transportation/distribution management
- Improved product lifecycle management
- Improved strategic sourcing and procurement.

Suppliers can differentiate themselves in a number of ways as well as provide value, additional services and capabilities to their customers.

The differentiating factors include:

- Vendor Managed Inventory (VMI)
- RFID
- Labeling and packaging
- Drop shipping
- Collaboration.

Companies should not only look to their supply chain to drive cost improvement, but should increase capabilities as a means for staying competitive. Streamlining processes with better design, better collaboration across networks and new services will help your company stay competitive and strengthen relationships with your customers.

Trend 4 – Outsourcing

As many companies step back and examine their core competencies, some realize that outsourcing parts or all of a supply chain can be

NOTES

fully integrating business processes and organization structures across companies that comprise the full value chain.

The ultimate goal of collaboration is to increase visibility throughout the value chain in an effort to make better management decisions and to ultimately decrease value chain costs. With the right tools, processes and organizational structure in place, collaboration provides key people throughout the value chain with the information needed to make business-critical decisions with the best available information.

Recent examples of collaboration have emerged in the expansion of Sales and Operations Planning (S&OP) processes that include upstream and downstream value chain partners as regular participants. S&OP processes help maintain a well-coordinated and valid, current operating plan in support of customer demand, a business plan and a strategy. The improved resulting operating plan provides the management of each partner with a complete picture of forecasted demand, supply capacity, corresponding financial information with financial implications and allows them to make informed, critical decisions. Companies that expand the usage of Sales and Operations Planning have greater visibility across their own enterprise and respective value chain, gain the agility necessary to improve the Product Lifecycle Management (PLM) process, improve promotional planning, minimize unnecessary buildups of inventory, increase revenue predictability and execute customer service expectations.

The S&OP activity enables information systems to connect the value chain participants around key demand information, such as customer forecasts, and around key supply information, such as supplier inventories and capacities. Another recent example of collaboration is seen in the increased focus around RFID (Radio Frequency Identification). Value chain leaders are looking at functional areas to better integrate the supply chains of their partners with themselves. RFID can serve as a means to quickly and efficiently ensure that critical product information is communicated as products flow through the value chain and ultimately to the consumer.

Recent estimates show that major retailers can lose 3–4 percent of revenue per year due to shelf stock outs, while inventory is available somewhere in the value chain. Better coordination of store-level product availability would have a significant impact to the entire value chain for these retailers. Additionally, better visibility of retailer product availability can reduce overall logistics costs as products move through the value chain to fulfill safe stock levels and ultimately consumer demand.

4.3 ROLE OF INFORMATION TECHNOLOGY IN SUPPLY CHAIN MANAGEMENT

Supply Chain Management (SCM) is concerned with the flow of products and information between supply chain members' organizations. Recent development in technologies enables the organization to avail information easily in their premises. These technologies are helpful to coordinates the activities to manage the supply chain. The cost of information is decreased due to the increasing rate of technologies. In the integrated supply chain model (figure. 4.1) bi-directional arrow reflect the accommodation of reverse materials and information feedback flows. Manager needs to understand that information technology is more than just computers. Except computer data recognition equipment, communication technologies, factory automation and other hardware and services are included.

NOTES

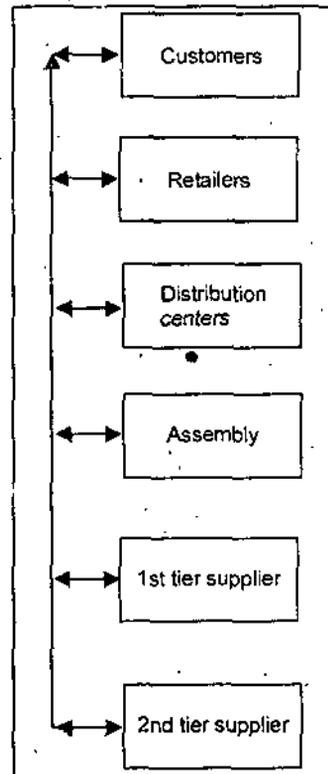


Figure 4.1. Integrated Supply Chain Model

Bi-directional arrow reflects the accommodation of reverse materials and information feedback flows. Managers need to understand that information technology is more than just computers. Except computer, data recognition equipment, communication technologies, factory automation and other hardware and services are included.

The Importance of Information in an Integrated Supply Chain Management Environment

NOTES

Prior to 1980s the information flow between functional areas within an organization and between supply chain member organizations were paper based. The paper based transaction and communication is slow. During this period, information was often overlooked as a critical competitive resource because its value to supply chain members was not clearly understood. IT infrastructure capabilities provides a competitive positioning of business initiatives like cycle time reduction, implementation, implementing redesigned cross-functional processes. Several well know firms involved in supply chain relationship through information technology. Three factors have strongly impacted this change in the importance of information. First, satisfying in fact pleasing customer has become something of a corporate obsession. Serving the customer in the best, most efficient and effective manner has become critical. Second information is a crucial factor in the managers' abilities to reduce inventory and human resource requirement to a competitive level. Information flows plays a crucial role in strategic planning.

Supply Chain Organizational Dynamics

All enterprises participating in supply chain management initiatives accept a specific role to perform. They also share the joint belief that they and all other supply chain participants will be better off because of this collaborative effort. Power within the supply chain is a central issue. There has been a general shift of power from manufacturers to retailers over the last two decade. Retailers sit in a very important position in term of information access for the supply chain. Retailers have risen to the position of prominence through technologies.

The Wal-Mart & P&G experiences demonstrate how information sharing can be utilized for mutual advantage. Through sound information technologies Wal-Mart shares point of sale information from its many retail outlet directly with P&G and other major suppliers.

The development of Inter organizational information system for the supply chain has three distinct advantages like cost reduction, productivity, improvement and product/market strategies.

Barrett and Konsynsik have identified five basic levels of participation of individual firms within the interorganizational system.

1. **Remote input/output mode:** In this case the member participates from a remote location within the application system supported by one or more higher-level participants.

2. **Application processing node:** In this case a member develops and shares a single application such as an inventory query or order processing system.
3. **Multi participant exchange node:** In this case the member develops and shares a network interlinking itself and any number of lower level participants with whom it has an established business relationship.
4. **Network control node:** In this case the member develops and shares a network with diverse application that may be used by many different types of lower level participants.
5. **Integrating network node:** In this case the member literally becomes a data communications/data processing utility that integrates any number of lower level participants and applications in real times.

NOTES

Four fundamental mistakes made when determining information requirements are as follows:

1. Viewing system as functional instead of cross-functional.
2. Interviewing managers individually instead of jointly.
3. Not allowing for trial and error in detail design process.
4. Asking the wrong question during the interview.

Information and Technology: Application of SCM

In the development and maintenance of Supply chain's information systems both software and hardware must be addressed. Hardware includes computer's input/output devices and storage media. Software includes the entire system and application programme used for processing transactions management control, decision-making and strategic planning. Recent development in Supply chain management software is:

1. Base Rate, Carrier select and match pay (version 2.0) developed by Distribution Sciences Inc. which is useful for computing freight costs, compares transportation mode rates, analyze cost and service effectiveness of carrier.
2. A new software programme developed by Ross systems Inc. called Supply Chain planning which is used for demand forecasting, replenishment and manufacturing tools for accurate planning and scheduling of activities.

NOTES

while the other focuses on planning, implementing and controlling the operations of supply chain.

Both the concepts are similar in the way that they can be used to improve organizations functionality in the respective departments. Both management tools can be integrated with the ERP software. Both CRM and SCM can offer benefits in terms of lower costs, higher revenue and improved strategy and performance measurements.

Customer Relationship Management (CRM) is a broad term that covers concepts used by companies to manage their relationships with customers, including the capture, storage and analysis of customer, vendor, partner, and internal process information. CRM applications attempt to provide insight into and improve the company/customer relationship by combining all these views of customer interaction into one picture.

CRM helps firms to organize marketing materials, track customers' histories and coordinate their multi-pronged interactions with their customers

Key function areas of CRM are as follows:

- **Marketing automation:** It helps target best customers, manage marketing campaigns and generate quality leads.
- **CRM tools:** There are various CRM tools like Data-cleansing tools, Data analysis or business intelligence tools, Content-management applications, Campaign management system. All these tools are designed to do fixed functions.
- **Sales force automation:** Companies can use SFA software to forecast customers need, based on the customers history and transactions, and to alert sales reps accordingly.
- **Call centre automation:** When customers call a company to get assistance with a company's product, representatives can query a knowledge management database containing information about the product.

4.5 BENCHMARKING

Product, service and process improvements can take place only in relation to established standards, with the improvements then being incorporated into new standards. *Benchmarking*, one of the most transferable aspects of Rank Xerox's approach to total quality management, and thought to have originated in Japan, measures an organization's operations, products

and services against those of its competitors in a ruthless fashion. It is a means by which targets, priorities and operations that will lead to competitive advantage can be established.

There are many drivers for benchmarking including the external ones:

- customers continually demand better quality, lower prices, shorter lead times, etc.
- competitors are constantly trying to get ahead and steal markets.
- legislation—changes in our laws place ever greater demands for improvement.

NOTES

Internal drivers include:

- Targets which require improvements on our 'best ever' performance;
- Technology – a fundamental change in processes is often required to benefit fully from introducing new technologies;
- Self-assessment results, which provide opportunities to learn from adapting best practices.

The word 'benchmark' is a reference or measurement standard used for comparison, and benchmarking is the continuous process of identifying, understanding and adapting best practice and processes that will lead to superior performance.

Benchmarking is not:

- A panacea to cure the organization's problems, but simply a practical tool to drive up process performance;
- Primarily a cost reduction exercise, although many benchmarking studies will result in improved financial performance;
- Industrial tourism—study tours have their place, but proper benchmarking goes beyond 'tourism'—to really understanding the enablers to outstanding results;
- Spying—use of a benchmarking code of conduct ensures the work is done with the agreement and openness of all parties;
- Catching up with the best—the aim is to reach out and extend the current best practice (by the time we have caught up, the benchmark will have moved anyway).

NOTES

There may be many reasons for carrying out benchmarking. Some of them are set against various objectives in Table given below. The links between benchmarking and TQM are clear – establishing objectives based on industry best practice should directly contribute to better meeting of the internal and external customer requirements.

The benefits of benchmarking can be numerous but include:

- Creating a better understanding of the current position;
- Heightening sensitivity to changing customer needs;
- Encouraging innovation;
- Developing realistic stretch goals;
- Establishing realistic action plans.

Table 4.1. Reasons for Benchmarking

Objectives	Eithout benchmarking	With benchmarking
Becoming competitive	<ul style="list-style-type: none"> • Internally focused • Evolutionary change 	<ul style="list-style-type: none"> • Understanding of competitiveness • Ideas from proven practices
Industry best practices	<ul style="list-style-type: none"> • Few solutions • Frantic catch-up activity 	<ul style="list-style-type: none"> • Many options • Superior performance
Defining customer requirements	<ul style="list-style-type: none"> • Based on history or gut feeling • Perception 	<ul style="list-style-type: none"> • Market reality • Superior performance
Establishing effective goals and objectives	<ul style="list-style-type: none"> • Lacking external focus • Reactive 	<ul style="list-style-type: none"> • Credible, unarguable • Proactive
Developing true measures of productivity	<ul style="list-style-type: none"> • Pursuing pet projects • Strength and weaknesses not understood • Route of least resistance 	<ul style="list-style-type: none"> • Solving real problems • Understanding outputs • Based on industry best practices

There are four basic categories of benchmarking:

1. **Internal:** The search for best practice of internal operations by comparison, *e.g.*, multi-site comparison of polymerization processes and performance.
2. **Functional:** Seeking functional best practice outside an industry,

e.g., mining company benchmarking preventive maintenance of pneumatic/hydraulic equipment with Disney.

3. **Generic:** Comparison of outstanding processes irrespective of industry or function, e.g., restaurant chain benchmarking kitchen design with US nuclear submarine fleet to improve restaurant to kitchen space ratios.
4. **Competitive:** Specific competitor to competitor comparisons for a product, service, or function of interest, e.g., retail outlets comparing price performance and efficiency of internet ordering systems.

NOTES

The benchmarking process has five main stages which are all focused on trying to measure comparisons and identify areas for action and change (figure given below). The detail is as follows.

PLAN the Study

- Select processes for benchmarking.
- Bring together the appropriate team to be involved and establish roles and responsibilities.
- Identify benchmarks and measures for data collection.
- Identify best competitors or operators of the process(es), perhaps using customer feedback or industry observers.
- Document the current process(es).

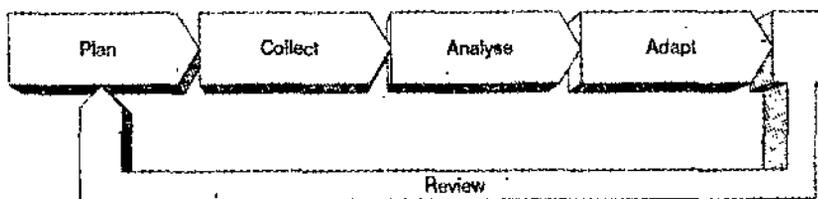


Figure 4.2. Five Main Stages of Benchmarking

COLLECT data and information

- Decide information and data collection methodology, including desk research.
- Record current performance levels.
- Identify benchmarking partners.

NOTES

- Conduct a preliminary investigation.
- Prepare for any site visits and interact with target organizations.
- Use data collection methodology.
- Carry out site visits.

ANALYZE the data and information

- Normalize the performance data, as appropriate.
- Construct a matrix to compare current performance with benchmarking competitors'/ partners' performance.
- Identify outstanding practices.
- Isolate and understand the process enablers, as well as the performance measures.

ADAPT the approaches

- Catalogue the information and create a 'competency profile' of the organization.
- Develop new performance level objectives/targets/standards.
- Vision alternative process(es) incorporating best practice enablers.
- Identify and minimize barriers to change.
- Develop action plans to adapt and implement best practices, make process changes, and achieve goals.
- Implement specific actions and integrate them into the organization.

REVIEW performance and the study

- Monitor the results/improvements.
- Assess outcomes and learnings from the study.
- Review benchmarks.
- Share experiences and best practice learnings from implementation.
- Review relationships with target/partner organizations.
- Identify further opportunities for improving and sustaining performance.

One aspect of benchmarking is to enable organizations to gauge how well they are performing against others who undertake similar tasks and activities. But a more important aspect of best practice benchmarking is gaining an understanding of *how* other organizations achieve superior performance. A good benchmarking study, for example, in customer satisfaction and retention, will provide its participants with data and ideas on how excellent organizations undertake their activities and demonstrate best practices that may be adopted, adapted and used.

This new knowledge will result in the benchmarking team being able to judge the gap between leading and less good performance, as well as planning considered actions to bring about changes to bridge that gap. These changes may be things that can be undertaken quickly, with little adaptation and at a minimum of cost and disruption. Such changes, often brought about by the affected operational team, are often called 'quick wins'. This type of change is incremental and carries low levels of risk but usually lower levels of benefit.

Quick wins will often give temporary or partial relief from the problems associated with poor performance and tend to address symptoms not the underlying 'diseases'. They can have a disproportionately favorable psychological impact upon the organizations. Used well, quick wins should provide a platform from which longer lasting changes may be made, having created a feeling of movement and success. All too often however, once quick wins are implemented there is a tendency to move on to other areas, without either fully measuring the impact of the change or getting to the root cause of a performance issue.

Quick wins are clearly an important weapon in effecting change but must be followed up properly to deliver sustainable business improvement through the adoption of best practice. The changes needed to do this will usually be of a more fundamental nature and require investment in effort and money to implement. Such changes will need to be carefully planned and systematically implemented as a discrete change project or program of projects. They carry substantial risk if not systematically managed and controlled, but they have the potential for significant improvement in performance. These types of change projects are sometimes referred to as 'step change' or 'breakthrough' projects/programs.

Whatever type of change is involved, a key ingredient of success is taking the people along. A first class communication strategy is required throughout and beyond any change activity, as well as the linked activity

NOTES

NOTES

of stakeholder management. The benchmarking efforts need to fit into the change model deployed – such a framework is proposed in figure given below. Many change models exist in diagrammatic form and are often, in both intent and structure, quite similar. Such a model may be considered as a ‘footprint’ that will lead to the chosen destination, in this case the desired performance improvements through adoption of best practice. The footprint in Figure demonstrates where benchmarking activities link into the general flow of change activity leading to better results.

The success and benefits derived from any benchmarking and change-related activity are directly related to the excellence of the preparation. It is necessary to consider both the ‘hard’ and ‘soft’ aspects represented in Figure and to systematically plan to meet and overcome any difficulties and challenges identified.

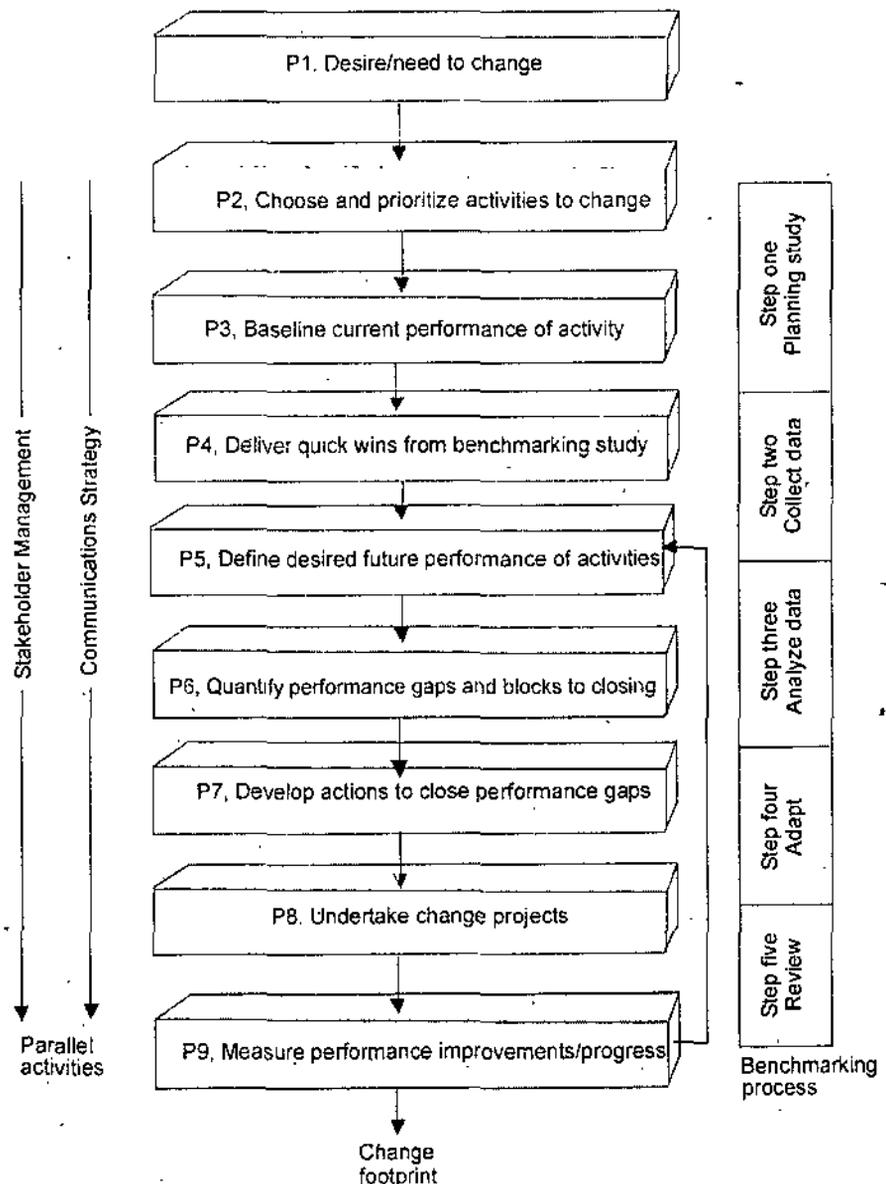


Figure 4.3. The Benchmarking-Change Footprint

4.6 OUTSOURCING

Outsourcing is contracting with another company or person to do a particular function. Almost every organization outsources in some way. Typically, the function being outsourced is considered non-core to the business. An insurance company, for example, might outsource its janitorial and landscaping operations to firms that specialize in those types of work since they are not related to insurance or strategic to the business. The outside firms that are providing the outsourcing services are third-party providers, or as they are more commonly called, service providers. Although outsourcing has been around as long as work specialization has existed, in recent history, companies began employing the outsourcing model to carry out narrow functions, such as payroll, billing and data entry. Those processes could be done more efficiently, and therefore more cost-effectively, by other companies with specialized tools and facilities and specially trained personnel.

Currently, outsourcing takes many forms. Organizations still hire service providers to handle distinct business processes, such as benefits management. But some organizations outsource whole operations. The most common forms are Information Technology Outsourcing (ITO) and Business Process Outsourcing (BPO).

Business process outsourcing encompasses call center outsourcing, Human Resources Outsourcing (HRO), finance and accounting outsourcing, and claims processing outsourcing. These outsourcing deals involve multi-year contracts that can run into hundreds of millions of dollars. Frequently, the people performing the work internally for the client firm are transferred and become employees for the service provider. Dominant outsourcing service providers in the information technology outsourcing and business process outsourcing fields include IBM, EDS, CSC, HP, ACS, Accenture and Capgemini.

Some nimble companies that are short on time and money, such as start-up software publishers, apply multisourcing — using both internal and service provider staff — in order to speed up the time to launch. They hire a multitude of outsourcing service providers to handle almost all aspects of a new project, from product design, to software coding, to testing, to localization, and even to marketing and sales.

The process of outsourcing generally encompasses four stages:

1. strategic thinking, to develop the organization's philosophy about the role of outsourcing in its activities;

NOTES

NOTES

2. evaluation and selection, to decide on the appropriate outsourcing projects and potential locations for the work to be done and service providers to do it;
3. contract development, to work out the legal, pricing and Service Level Agreement (SLA) terms; and
4. outsourcing management or governance, to refine the ongoing working relationship between the client and outsourcing service providers.

In all cases, outsourcing success depends on three factors: executive-level support in the client organization for the outsourcing mission; ample communication to affected employees; and the client's ability to manage its service providers. The outsourcing professionals in charge of the work on both the client and provider sides need a combination of skills in such areas as negotiation, communication, project management, the ability to understand the terms and conditions of the contracts and Service Level Agreements (SLAs), and, above all, the willingness to be flexible as business needs change.

The challenges of outsourcing become especially acute when the work is being done in a different country (offshored), since that involves language, cultural and time zone differences.

4.7 VALUE CHAINS VERSUS SUPPLY CHAINS

The Value Chain concept was developed and popularized in 1985 by Michael Porter, in "Competitive Advantage," (1) a seminal work on the implementation of competitive strategy to achieve superior business performance. Porter defined value as the amount buyers are willing to pay for what a firm provides, and he conceived the "value chain" as the combination of nine generic value added activities operating within a firm – activities that work together to provide value to customers. Porter linked up the value chains between firms to form what he called a Value System; however, in the present era of greater outsourcing and collaboration the linkage between multiple firms' value creating processes has more commonly become called the "value chain." As this name implies, the primary focus in value chains is on the benefits that accrue to customers, the interdependent processes that generate value, and the resulting demand and funds flows that are created. Effective value chains generate profits. To bring the concept of value into focus, consider for a moment a person walking in the desert, a person who is dying of thirst. As that person

NOTES

walks they have one thing on their mind, and that is water. At that moment there is little consideration for the form of the water, the container, or who will be providing it. Water has a unique value to that person. When they find water, or they are offered some, money would be of little concern. What is the point of this example? First is that value is a subjective experience that is dependent on context. In the context of a busboy clearing a table, a glass of water sitting there has no value, or even negative value—it's just more work for him. But for the man dying of thirst, that same glass of water is extremely valuable. Second, value occurs when needs are met through the provision of products, resources, or services—usually during some form of transaction or exchange. Finally, value is an experience, and it flows from the person (or institution) that is the recipient of resources—it flows from the customer. This is a key difference between a value chain and a supply chain – they flow in opposite directions. Many views of Value Chains can be created. Examples of Value Chains are:

- One that takes an order from a customer
- One that fulfills a customer requirement
- One that defines a product or service
- And many others.

From this simple example, we see that value, like beauty, is in the eye of the beholder. Value has meaning in a number of contexts, including trading relationships, consumer purchases, and the interests of company shareholders. In "Lean Thinking" (2) by Womack and Jones, the first Lean Principle was "defining value from the customer's perspective." From this come two critical factors that need to be clarified when strategizing the creation of value:

- Who is the customer?
- What do they value?

Most corporate initiatives are really about developing appreciation and awareness of customer needs and values, and then organizing the firm's activities around efficiently providing for those needs—quickly, accurately, and at minimum cost. This is because value occurs when customer needs are satisfied through an exchange of products and/or services for some form of payment. The degree to which the needs that are met exceed the price paid in the exchange is one objective way that value can be measured. That is why paying \$1,000 for a gallon of water in the desert when dying of thirst might seem reasonable if

NOTES

there were no other alternative. A key distinction in defining value is whether the exchange that generates value is between firms – *i.e.*, Business to Business (B2B) – or between a firm and a consumer – *i.e.*, Business to Consumer (B2C).

There are three forms of value that occur in B2B commercial transactions:

- Technical (resource value);
- Organizational (business context); and
- Personal (career and idiosyncratic).

Technical value: It is intrinsic to the resource being provided and occurs in virtually all exchanges. For the thirsty man, the water has a technical value regardless of the source or any other consideration. The cup can be used or even dirty, the man providing it a criminal, and the water will still have the same technical value.

Organizational value: It is built upon the context of the exchange, and may derive from a range of factors such as ethical standards, prestige, reliability, and association. Brand image may build organizational value, as well as company reputation. When at a fine dining establishment, the label on the water bottle generates value far in excess of the bottle's content.

Personal value: It is derived from the personal experiences and relationships involved in the exchange of resources and the benefits provided. While technical and organizational value accrues to the firms involved in a commercial exchange, personal value accrues to the individual. Manager motivation, preferences, feelings of comfort and trust create value for individuals that engage in trading relationships on behalf of firms, and can be extremely influential in the determination of successful exchange. For example it is a cliché that many corporate IT managers responsible for purchasing computer systems have selected IBM equipment because "no one was ever fired for buying IBM," whether the system was the best choice or not.

Finally, there are competitive forces affecting the *market value* of any exchange of resources when comparisons can be made between competing offers. Competing offers can erode value (and margins) by making the lowest price a deciding factor in evaluating an exchange.

At the consumer level of exchange, value is layered, and has been described by three concentric rings. In the center ring is *product value*, the technical value derived from providing a source of supply. A second ring of *service value* is provided by the services that surround the product such as

personal care and warranty service. The third ring has been called the new service/quality battleground, and was made popular by business thinkers such as Peters and Waterman ("In Search of Excellence"). This third level of value is achieved by providing enhanced service, to "make your customer successful" rather than just satisfied. At this level, the experience surrounding the exchange of resources provides its own unique "wow" value, and the product itself is secondary. Ronald McDonald, happy-meal toys, and playgrounds have added value to McDonald's burgers for years without any nutritional or flavor change in the basic product. For corporations, the capability of providing value to customers generates revenues in excess of costs-creates profit, which in turn generates *shareholder value*. Thus, the exchange of value (or the value created in exchange) is the basic engine that drives our industrial economy. The upstream (value stream) impact of value creation is shareholder value. This is the value generated for the provider of those financial resources that enable value generation, based on a firm's stock price and dividends or a private company's return on investment. Because value is derived from customer needs, activities that do not contribute to meeting these needs are "non-value-added" waste, or "muda" in the parlance of lean thinking. Careful consideration of the tasks and functions that occur in many of the industries we serve shows considerable waste still available for process improvement activities to uncover and reduce or eliminate. By streamlining the processes that generate the goods and services that customers value, fewer resources need to be expended, and the margin between customer value and the cost of delivery increases, improving a firm's profit margin. This is the essence of corporate strategies that focus on operational excellence. In contrast, innovation and marketing strategies focus on improving customer perceptions of the value of goods and services by innovatively improving the perception of what gets delivered. In either strategy, increasing the margin between delivery cost and perceived value is the foundation for improved business performance.

Similarities and Differences Between a Supply Chain and a Value Chain

Supply Chain Management (SCM) emerged in the 1980s as a new, integrative philosophy to manage the total flow of goods from suppliers to the ultimate user and evolved to consider a broad integration of business processes along the chain of supply. Keith Oliver coined the term "supply chain management" in 1982 (7), (8). Oliver, a vice president in Booz

NOTES

NOTES

Allen Hamilton's London office, developed an integrated inventory management process to balance trade-offs between his clients' desired inventory and customer service goals. The original focus was the "management of a chain of supply as though it were a single entity, not a group of disparate functions," with the primary objective of fixing the suboptimal deployment of inventory and capacity caused by conflicts between functional groups within the company.

SCM evolved quickly in the 1990s with the advent of rapid response initiatives in textile and grocery industries, and was refined by large retailer Wal-Mart who used point-of-sale data to enable continuous replenishment. Supply chain is a term "now commonly used internationally — to encompass every effort involved in producing and delivering a final product or service, from the supplier's supplier to the customer's customer". As the name implies, the primary focus in supply chains is on the costs and efficiencies of supply, and the flow of materials from their various sources to their final destinations. Efficient supply chains reduce costs. In common parlance, a supply chain and a value chain are complementary views of an extended enterprise with integrated business processes enabling the flows of products and services in one direction, and of value as represented by demand and cash flow in the other.

Both chains overlay the same network of companies. Both are made up of companies that interact to provide goods and services. When we talk about supply chains, however, we usually talk about a downstream flow of goods and supplies from the source to the customer. Value flows the other way. The customer is the source of value, and value flows from the customer, in the form of demand, to the supplier. That flow of demand, sometimes referred to as a "demand chain", is manifested in the flows of orders and cash that parallel the flow of value, and flow in the opposite direction to the flow of supply. Thus, the primary difference between a supply chain and a value chain is a fundamental shift in focus from the supply base to the customer. Supply chains focus upstream on integrating supplier and producer processes, improving efficiency and reducing waste, while value chains focus downstream, on creating value in the eyes of the customer. This distinction is often lost in the language used in the business and research literature.

For example, in 1998, the Global Supply Chain Forum (GSCF) defined supply chain management as "the integration of key business processes from end user through original suppliers that provides products, services, and information that **add value** for customers and other stakeholders", thereby adding the notion that supply chain processes must "add value"

and blurring the distinction between a supply chain and a value chain. In a recent conference, Mike Eskew, Chairman and CEO of UPS, described supply chain management that seeks to optimize costs as second generation supply chains (SCM 2.0), and went further to describe the third generation supply chain management as being focused on customer intimacy, and being a synchronized supply chain where consumers have the power to pull value. This description reflects the evolution of supply chains that synchronize the flows of value and supply.

A recent survey of the main usages of the term "value" in the economics, marketing, strategy, and operations fields indicates that the notion of a value chain may actually be a misnomer, although a widely used one. According to this analysis, only resources move along the chain of linkages between firms—supplies going one way and money going the other, while value is a metaphysical perceived quality associated with the benefits that occur at the various points of exchange along the resource chain. According to this analysis, value surrounds the movement of resources—is perceptual—and accrues to both parties in a transaction, suppliers and customers.

Therefore, value chains can be thought to operate in *both* directions, with suppliers accruing value from the financial resources, payment terms, stability, and future order cover that their customers provide, while customers derive value from the delivered products and services.

Misnomer or not, the value chain concept has become a staple idea in the management and research literature, and is the focus for evolving strategies, enterprise models, and numerous efforts at improving business performance. Creating a profitable value chain therefore requires alignment between what the customer wants, i.e., the demand chain, and what is produced via the supply chain. And while supply chains focus primarily on reducing costs and attaining operational excellence, value chains focus more on innovation in product development and marketing.

Why Value Chains Now?

The growing interest in value chains began with Porter's seminal work, "Competitive Advantage," and has increased ever since. Researchers in business and economics have been concerned with the notion of value since the early work of Adam Smith distinguished between use-value and exchange-value. At the time of this writing, a Google search on the term "value chain" produces nearly 4 million hits, while an ABI/Informs search of articles produces a total of 1673 documents including

NOTES

NOTES

675 from scholarly journals over the last 20 years and 26 Ph.D. dissertations produced over the 6 years between 1997 and 2003. Clearly, the interest in value chains is not new. In Industrial Engineering, however, the primary focus has been on achieving operational efficiency—leading to a focus on production operations and supply chains. There are a number of significant trends that are now driving the need for operations oriented analysis from a value chain perspective. These include:

- Increasing competition and an increasing focus on innovation as an element of strategy
- Evolving governance models for the extended enterprise
- The trend towards globalization of supply and production
- Benefits already wrung out of manufacturing and the supply chain
- Trends in Management Discourse.

Increasing competition and the primacy of strategy: The value chain is first and foremost a strategic concept, arising from a strategic theory of firm competition. As companies struggle to compete in an environment of globalization and intense competition, the focus shifts to alternative means to remain competitive. This creates an increasing interest in Value Chains as a tool to model the extended enterprise and formulate strategies for how to remain competitive.

Evolving governance models for the extended enterprise: The information era spurred on by the recent focus of capital investment on internet technologies and “dot-com” business models has increased general business and research interest in alternative value chain and business models. This has been promoted in the research literature by the focus on Core Competencies and the Resource Based View (RBV) of the firm. This growth in modular/virtual collaborative enterprise business models has increased interest in the Value Chain as a primary construction for analysis of new models for business governance.

Globalization of supply and production: The growth in global sourcing and supply has begun a long-term process of leveling the playing field for adding value world wide. This leads to the need to model global value chains as the predominant mode of business in many industries.

Many benefits already wrung out of manufacturing and the supply chain: The Industrial Engineering and Operations Management disciplines, combined with management and operations improvement initiatives such as lean manufacturing, TQM, and Six Sigma, have been improving the efficiency of manufacturing and supply chain operations for many years.

While there is still considerable work to do in the field, academic theoreticians and practitioners at many of the more advanced firms are beginning to turn to a broader view of the enterprise to continue making a contribution to improving competitive stance. Improving the operational capability of other value added activities in the enterprise, such as product development, requires shifting perspective from the supply chain to the value chain.

Trends in management discourse: A final reason for the growing interest in Value Chains may simply be the nature of management fashion trends in academic and management discourse. A life cycle process revealing how management knowledge entrepreneurs participate in the creation of trends in discourse was described in a study of Quality Circles by Abrahamson and Fairchild (1999). This study derived two propositions that are relevant:

1. Management fashions tend to have a lifecycle characterized by a long latency phase followed by a wave-like, often asymmetrical and ephemeral popularity curve.
2. Three conditions occurring in conjunction trigger a management fashion within a niche: (a) a fashion in that niche must collapse; (b) there must be a widespread performance gap that a latency-phase replacement fashion in that niche can believably address; and (c) discourse must have brought this gap to the attention of many management-fashion consumers. The collapsing wave of interest in supply chain management associated with the dot-com era bubble bursting may qualify for condition (a), while the growing global competition in business certainly creates a performance gap – condition (b). Value chains have had a long latency period since the mid-1980s, are an accepted terminology in academic discourse, and are believably positioned to address many of the concerns that business practitioners have in industry – condition (c). Value chain discourse has come on as a strong contender in the past several years to fill the operations and supply management niche in management fashion, and may be ready for a continuing rise in popularity. Strategically, it is being positioned as a dynamic differentiator.

NOTES

NOTES

SUMMARY

- As supply chains continue to develop and mature, a move toward more intense collaboration between customers and suppliers has occurred.
- Supply Chain Management (SCM) is concerned with the flow of products and information between supply chain members' organizations.
- Bar code scanners are most visible in the check out counter of super market. This code specifies name of product and its manufacturer.
- Data warehouse is a consolidated database maintained separately from an organization's production system database.
- CRM and SCM are both different management concepts: one focusing on concepts used by companies to manage relationship with their customers while the other focuses on planning, implementing and controlling the operations of supply chain.

REVIEW QUESTIONS

1. Write short notes on recent trends in SCM?
2. What are the advantages of computer and IT in SCM?
3. What is CSM?
4. What is bench marking? What are the purposes and advantages of bench marking?

FURTHER READINGS

Supply Chain Management: Edited by Jayashree Dubey and ML Sai Kumar, New Century, 2007.

Supply Chain Management: J. Paul Sundar Kirubakaran, Serials Pub, 2008.

Supply Chain Management: Edited by John T Mentzer, Response Books, 2001.

Supply Chain Management: Edited by John T Mentzer, Response Books, 2001.

Supply Chain Management: N.H. Mullick and Mohd. Altaf Khan, Enkay, 2011.