

Course Objectives

- Provide insights into supply and demand planning for mid- to long-term independent demand, focusing on the following processes:
 - demand management
 - sales and operations planning (S&OP)
 - distribution planning
 - master scheduling
- Provide a basis for further study leading to APICS Certified in Production and Inventory Management (CPIM) certification.

Course Overview

Since 1973, the Certified in Production and Inventory Management (CPIM) program has been recognized as the international standard for individual assessment in the field of production and inventory management. The CPIM program provides a common basis for individuals and organizations to evaluate their knowledge of this evolving field.

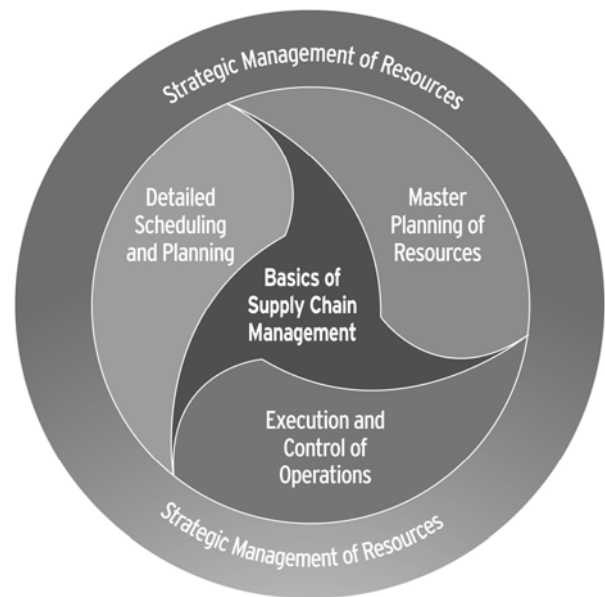
The mission of CPIM is to educate the CPIM target audience in the concepts, tools, topics, terminology, and integration of operations issues. The CPIM program is designed to test candidates' in-depth knowledge of a variety of subjects specific to production and inventory management. APICS ensures that CPIM exams are consistently reliable, and uses the highest professional standards when developing and administering the program. APICS maintains a reputation that is second to none.

The CPIM program incorporates a business-process orientation rather than individual techniques. The individual modules are integrated and follow a progression of increased understanding:

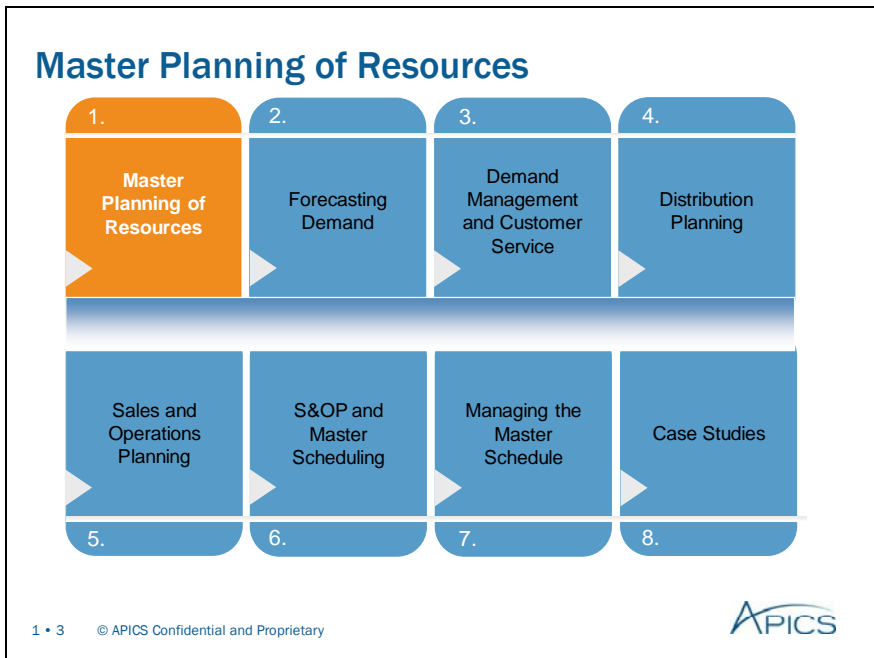
Entry module—BSCM covers terminology and basic concepts related to managing the complete flow of materials from suppliers to customers.

Business process modules—Three modules—MPR, DSP, and ECO—cover methodologies and techniques to drive these business processes, plus the application of these techniques.

Capstone module—SMR builds upon the entry and business process modules named above. It places the concepts learned in those modules into a strategic context. SMR encourages higher-level thinking about the relationship between strategic business planning and the development and execution of a competitive operations strategy.



The Master Planning of Resources module encompasses the processes for quantifying actual and projected customer demand, translating that demand into realistic supply plans that are consistent with resource constraints, business policies, and business objectives of the organization, and developing and validating a master schedule. This module includes the explanation of the business processes required to translate actual and projected demand into realistic and executable production schedules and distribution plans. The module highlights the need for different types of supply plans, how they are constructed in a range of business environments, and alternative approaches to developing and evaluating such plans.



Session 1: Master Planning of Resources

Purpose

This session presents a top-down view of manufacturing planning and control (MPC) and an overview of a major MPC business process, master planning of resources (MPR).

The first section of the session

- ◆ reviews the importance of strategic direction setting for manufacturing planning
- ◆ walks through the MPC hierarchy
- ◆ explains the influence of different manufacturing environments, enterprise resource planning (ERP) software, and changes in the competitive environment on the design of MPC processes.

The final section of this session presents an overview of the MPR process. It also introduces important concepts that will be covered in the following sessions in this course.

Learning Objectives



- ***The Manufacturing Planning and Control System***
 - Explain the conflicting objectives of manufacturing planning and control (MPC).
 - Describe the three major levels of the MPC system.
 - Explain how MPC addresses long-term capital investment needs.
 - Explain the major factors affecting MPC system design.
 - Provide examples of factors that influence the evolution of MPC systems.
 - List the major characteristics of a well-designed MPC system.

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Learning Objectives (cont.)



- ***Master Planning of Resources***
 - Summarize the major processes that constitute master planning of resources (MPR).
 - Describe the key differences in the objectives and outputs of S&OP and master scheduling.
 - List the three subprocesses of demand management.
 - Explain how shortening of lead time lessens the reliance on forecasts.
 - Explain the relationship of distribution planning to S&OP and master scheduling.
 - Describe how orders and knowledge consume the forecast.
 - Define “decoupling point” and its relationship to manufacturing environment.

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Learning Objectives

- ◆ *The Manufacturing Planning and Control System*
 - ◆ Explain the conflicting objectives of MPC.
 - ◆ Describe the three major levels of the MPC system.
 - ◆ Explain how MPC addresses long-term capital investment needs.
 - ◆ Explain the major factors affecting MPC system design.
 - ◆ Provide examples of factors that influence the evolution of MPC systems.
 - ◆ List the major characteristics of a well-designed MPC system.
- ◆ *Master Planning of Resources*
 - ◆ Summarize the major processes that constitute MPR.
 - ◆ Describe the key differences in the objectives and outputs of sales and operations planning (S&OP) and master scheduling.
 - ◆ List the three subprocesses of demand management.
 - ◆ Explain how shortening of lead time lessens the reliance on forecasts.
 - ◆ Explain the relationship of distribution planning to S&OP and master scheduling.
 - ◆ Describe how orders and knowledge consume the forecast.
 - ◆ Define “decoupling point” and its relationship to manufacturing environment.

The Manufacturing Planning and Control System

References: Jacobs et al., *Manufacturing Planning and Control for Supply Chain Management*, APICS/CPIM Certification ed., chap. 1, 2, 3, 5, 14; Ross, *Distribution Planning and Control*, 2nd ed., chap. 5, 8 Wallace, *Sales & Operations Planning, The How-To Handbook*, 3rd ed., chap. 1; Wallace, *Master Scheduling in the 21st Century*, 2007, chap. 1.

Manufacturing and Service Industry Objectives

Customer perspective

- The right goods and services
- The right quality
- The right quantity
- The right time
- The right place
- The right price

Supplier perspective

- High levels of customer service
- Efficient use of resources
- Low inventory investment

The Manufacturing Planning and Control System

This session starts with a review of MPC and its role in achieving manufacturing and service objectives, including the use of information technology (IT), such as ERP systems, to support MPC processes.

Manufacturing and Service Industry Objectives

Customer Perspective

This course addresses the planning of resources in manufacturing, but the objectives shown in the visual apply to service industries as well. We have grouped the objectives into customer and supplier perspectives.

- ◆ The right goods and services—Customer service requires designing and making products that meet or exceed customer expectations. Meeting this objective depends on how well sales and marketing identify and select products and services that customers want to buy.
- ◆ The right quality—There are two aspects to quality: conformance and specification. Conformance quality, as in pharmaceuticals, addresses the requirement that products and services meet regulatory standards. Specification quality relates to the need to design, manufacture, and deliver products and services that provide the requisite functionality, aesthetics, and value customers want.
- ◆ The right quantity—The right quantity depends on the integration and execution of purchasing, order management, production, and logistics such that materials in the right quantity are available for delivery.
- ◆ The right time—Speed, quality, flexibility, and dependability of production and distribution are essential to meeting the on-time delivery requirements of customers.
- ◆ The right place—Delivering products to the right place depends on a company's sales channels and distribution channels. Sales channels are the internal functions and external parties (wholesaler distributors and retailers) that support the marketing, promotion, and sale of products and services to customers in the supply chain. Distribution channels determine the physical flow of goods and services to customers at required delivery points.
- ◆ The right price—We mentioned earlier the importance of four generic performance objectives in meeting on-time delivery requirements: *speed, quality, flexibility* and *dependability* of production and distribution processes. These are all related to a fifth performance measure, *cost*. Together these enable companies to meet customer requirements for the right price.

Supplier Perspective

From an internal manufacturing or service supplier perspective, there are three major objectives as shown in Visual 1-7. We will discuss these in the Role of Manufacturing Planning and Control section.

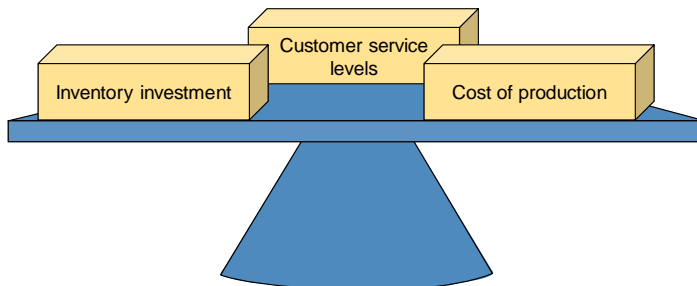
Key Manufacturing Planning Issues

- Material flow from suppliers to customer delivery channels
- Customer lead time requirements
- Deployment and use of production resources
- Relationship with suppliers and customers

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Balancing Conflicting Business Objectives



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Role of Manufacturing Planning and Control

Key Manufacturing Planning and Control Issues

Manufacturing planning plays a key role in achieving manufacturing objectives. It addresses the following key issues in order to meet customer demand:

- ◆ flow of raw materials from suppliers, work in process (WIP) through production, and finished product and delivery channels to customers
- ◆ delivery lead time customers are willing to accept
- ◆ deployment and use of production resources: labor, equipment, technology, and plant infrastructure
- ◆ appropriate relationships with other organizations in the supply chain, including outsourcing, arm's length relationships, partnerships, alliances, and vertical integration

Balancing Conflicting Business Objectives

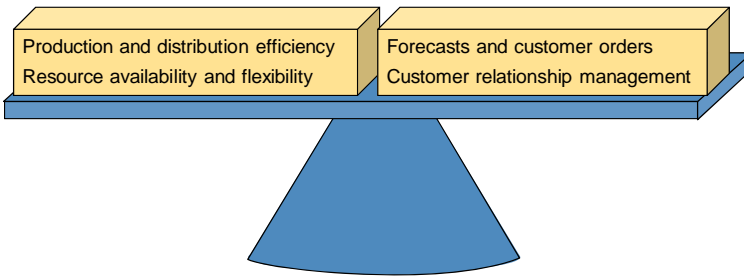
Through tactical planning processes such as S&OP and master scheduling, MPC plays a key role in balancing conflicting objectives. As shown in Visual 1-9 the conflicting objectives fall into three categories:

- ◆ customer service levels
 - ◆ acceptable lead times
 - ◆ shipped complete, arrives on time
 - ◆ right quality and price
- ◆ inventory investment
 - ◆ low WIP
 - ◆ high turnover
 - ◆ faster throughput
- ◆ costs of production
 - ◆ minimizing of setups
 - ◆ longer production runs and high utilization
 - ◆ low cost of materials

For example, high utilization achieved by long production runs might lower the per-unit cost of production, but it often builds up finished goods inventory and increases inventory investment. Low cost of materials achieved through volume discounts for buying in large lot sizes and buying low-quality components also will increase inventory levels and lead to quality problems and delays in fulfilling customer orders.

In many instances, the deployment of lean and theory of constraints manufacturing practices mitigates the inherent conflict among the three objectives. These practices use a systems approach to achieving the five generic performance objectives of speed, quality, dependability, flexibility, and cost in order to fulfill customer demand in a cost-efficient manner.

Balancing Supply and Demand



- Causes of supply and demand imbalances:
- failure to understand demand
 - long order lead times
 - inability to respond to customer order levels and changes

Balancing Supply and Demand

Another key role for MPC is balancing supply and demand.

- ◆ Demand management consists of demand forecasts, order management, and customer relationship management (CRM).
- ◆ Supply is a function of the efficiency of production and distribution planning and the availability of production resources including materials, labor, equipment, technology, and facilities.

Imbalances are the result of the following:

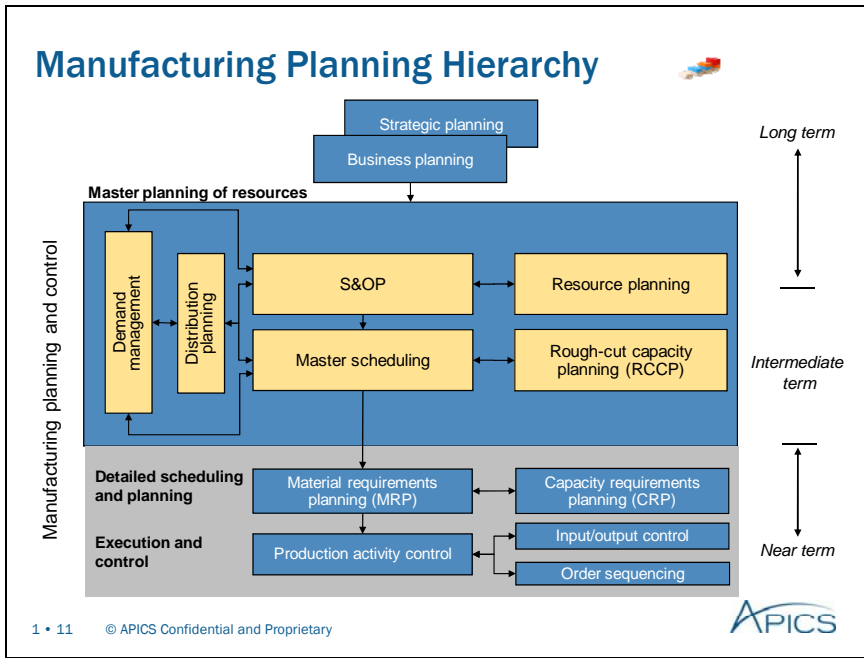
- ◆ failure to understand and forecast demand accurately
- ◆ long order-fulfillment lead times through large-batch production, which increase reliance on forecasts rather than more reliable customer orders in planning production
- ◆ lack of process flexibility to respond to changes in customer orders or market conditions

Imbalances can lead to a number of problems:

- ◆ poor levels of customer service
- ◆ buildup of inventory from large-batch production
- ◆ weakened competitive position

What steps can be taken to prevent imbalances from occurring?

How can shortening total lead time through supply chain management improve the quality of demand estimates used in planning production?



Manufacturing Planning Hierarchy

It is important at this point to review the manufacturing planning hierarchy of which MPR is a major component. The hierarchical relationship of the business processes involved in manufacturing planning is shown in the visual.

Strategic and Business Planning: Direction Setting

These two processes overlap and are closely linked in direction setting for an organization. A formal distinction between the two is not always observable.

- ◆ Strategic planning—This strategic portion of direction setting addresses long-term objectives relating to products, customers, and markets.
- ◆ Business planning—This planning activity also is long-term in focus and much of it is denominated in monetary terms. It is the bridge from strategic planning to tactical or cross-functional planning at the MPR level discussed below.

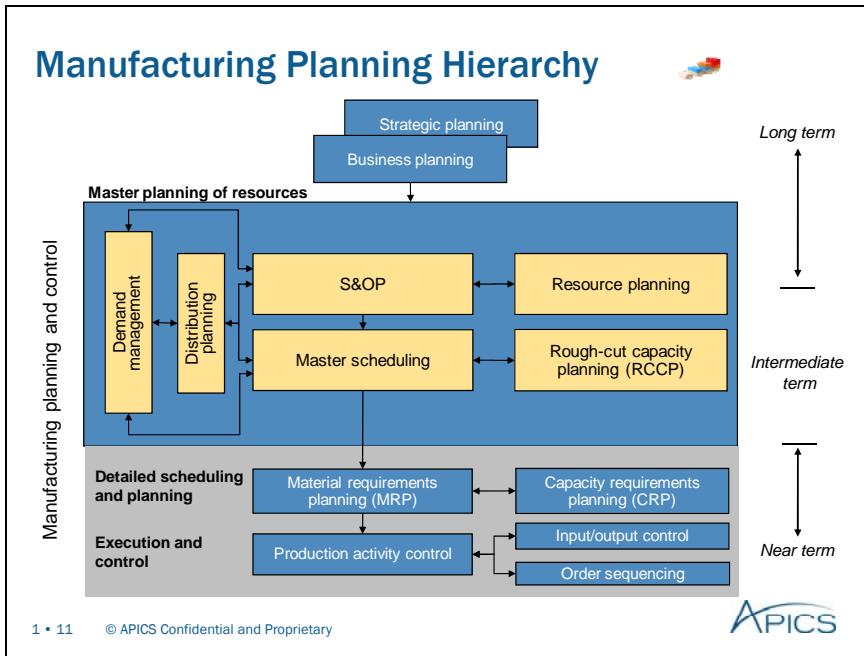
Manufacturing Planning and Control: Tactical and Operations Planning

MPC processes operate within the direction-setting framework of strategic and business planning. MPC consists of short-, intermediate-, and long-term planning activities.

Master planning of resources (intermediate to long-term)

MPR consists of cross-functional tactical plans that are implemented by operational planning activities discussed below under detailed scheduling and planning (DSP) and execution and control of operations (ECO).

- ◆ S&OP and resource planning—S&OP is responsible for
 - ◆ processing inputs from the business plan, demand forecasts, production resource planning, and logistics resource requirements planning, which is part of distribution planning
 - ◆ translating these inputs into intermediate- to long-term sales, production, and distribution plans at the aggregate volume or product family level
 - ◆ validating plans against required production and distribution resources.
- ◆ Master scheduling and rough-cut capacity planning (RCCP)—This process is responsible, in the intermediate term, for
 - ◆ processing inputs on product volumes from production plans at the family level, forecasts and customer orders on hand, RCCP, and logistics requirements planning that is part of distribution planning
 - ◆ disaggregating product family volume data from the production plan into a master production schedule (MPS) for individual end items
 - ◆ validating the MPS against required production and distribution resources.
- ◆ Demand management—In MPC, this process
 - ◆ recognizes demand for products and services through forecasts, customer order management or order servicing by sales, marketing, and customer service, and CRM
 - ◆ provides inputs on demand for goods at the product family level to S&OP and at the end-item level for master scheduling.



Master planning of resources (cont.)

- ◆ Distribution planning—This process provides two types of support to S&OP and master scheduling in the long and intermediate terms:
 - ◆ planning of inventory levels at distributed stocking points at the product family and end item levels based on local demand forecasts, customer orders, and disaggregated demand data from the central supply point
 - ◆ providing inputs on distribution resources necessary to support the S&OP and MPS through a subprocess called logistics resource requirements planning

DSP and ECO (near-term)

- ◆ Material requirements planning (MRP) and capacity requirements planning (CRP)—These processes with a near-term planning horizon also are known as *DSP*.
 - ◆ Their objective is to determine the material, labor, and equipment capacity required to support the MPS for individual end items.
 - ◆ They determine the following:
 - ◆ end item and component quantities needed to make or buy to fulfill the MPS
 - ◆ when these items and quantities will be needed
 - ◆ how many now are in stock
 - ◆ which are on order
 - ◆ the sufficiency of workers and equipment
- ◆ Production activity control—Also known as *ECO*, this process has the following objectives:
 - ◆ prioritizing and sequencing work to be performed
 - ◆ executing plans, implementing factory floor controls, and reporting activity results
 - ◆ performance reporting and feedback so that preceding MPC processes can make necessary adjustments for shortages or overages in the production process

Problem 1.1 Planning Hierarchy



Strategic and manufacturing planning and control issues	Planning horizon	Process
Annual corporate budgets and projected sales		
Appropriate mix of human resources and technology		
Availability of materials and equipment for planned order releases		
Balancing of supply (capacity) and demand at the individual product (mix) level		
Capacity needed to meet aggregate market demand and customer requirements		
Communication with suppliers and customers on annual requirements		
Decisions on inventory stocking locations for make-to-stock items		
Forecasts at the product family (volume) level in physical units		
Labor, overtime, and subcontracting needs		
Reporting of work or service order completion		
Scheduling and tracking the use of resources to meet production requirements		
Time-phased plans for component parts and raw materials		

Planning horizon legend: L = long; I = intermediate; N = near
Process legend: SB = strategic/business planning; SOP = S&OP and resource planning; MS/RC = master scheduling; and RCCP; DM = demand management; DP = distribution planning; MRP/CRP = material and capacity requirements planning; PAC = production activity control





Class Problem 1.1: MPC Business Processes and Planning Horizons

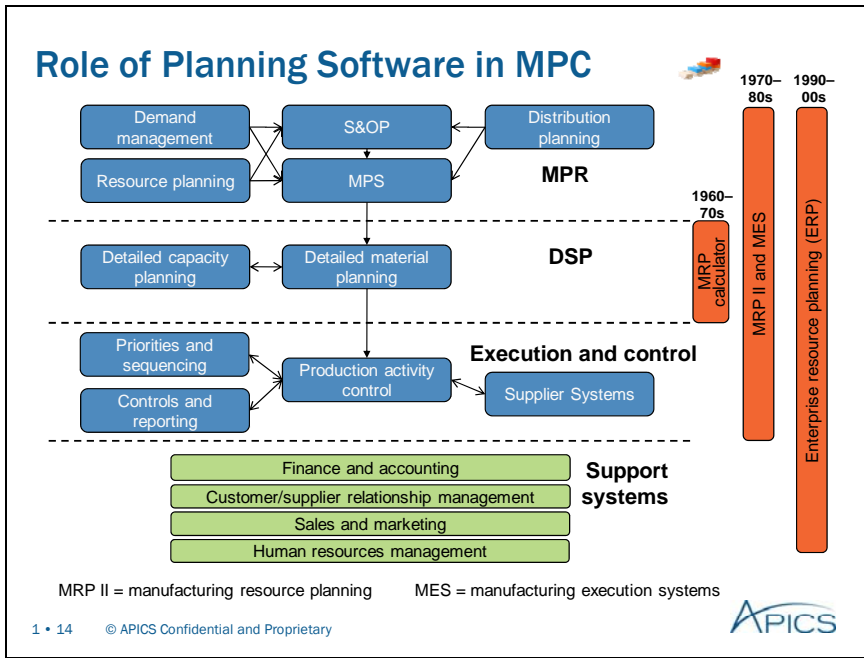
Visual 1-12 summarizes the key issues addressed by the MPC processes mentioned above. The purpose of this instructor-led problem is to

- ◆ sort the issues into long-term, intermediate-term, and near-term planning horizon categories
- ◆ identify the MPC system process that addresses each issue.

Work in groups. Categorize each issue by planning horizon—long (L), intermediate (I), or near (N)—and by MPC process using the worksheet.

Hint: When sorting the issues, first determine as best you can whether the lead-time implications fall into the long-, intermediate-, or near-term.

Strategic and manufacturing planning and control issues	Planning horizon	Process
Annual corporate budgets and projected sales		
Appropriate mix of human resources and technology		
Availability of materials and equipment for planned order releases		
Balancing of supply (capacity) and demand at the individual product (mix) level		
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<p>Planning horizon legend: L = Long; I = Intermediate; N = Near Process legend: SB = strategic/business planning; SOP = S&OP and resource planning; MS/RC = master scheduling; and RCCP; DM = demand management; DP = distribution planning; MRP/CRP = material and capacity requirements planning; PAC = production activity control</p>		



Role of Planning Software in MPC

As a planning system, MPC consists of related business processes as shown in Visual 1-14. This visual subdivides the MPC system into three generic levels of processes for linking suppliers to customers.

The speed, dependability, and flexibility of MPC have improved with the evolution of IT and software-based planning applications.

- ◆ The earliest applications, in the 1960s and 1970s, were MRP calculators with the ability to explode and plan material requirements for the MPS.
- ◆ In the 1970s and 1980s, these were followed by manufacturing resource planning and manufacturing execution systems capable of providing feedback or “closing the loop” from execution and control processes to MPR processes such as S&OP and master scheduling.
- ◆ During the 1990s, there was rapid growth in processing speeds, database storage capabilities, and there also was an emphasis on standardizing supply chain management practices among suppliers and customers across industries. A new breed of MPC support systems called *ERP systems* evolved to cover core MPC processes and to integrate them with value chain support processes such as
 - ◆ finance
 - ◆ customer and supplier relationship management (SRM)
 - ◆ sales and marketing
 - ◆ human resources management.

Today’s MPC systems are heavily dependent on technology and software applications.