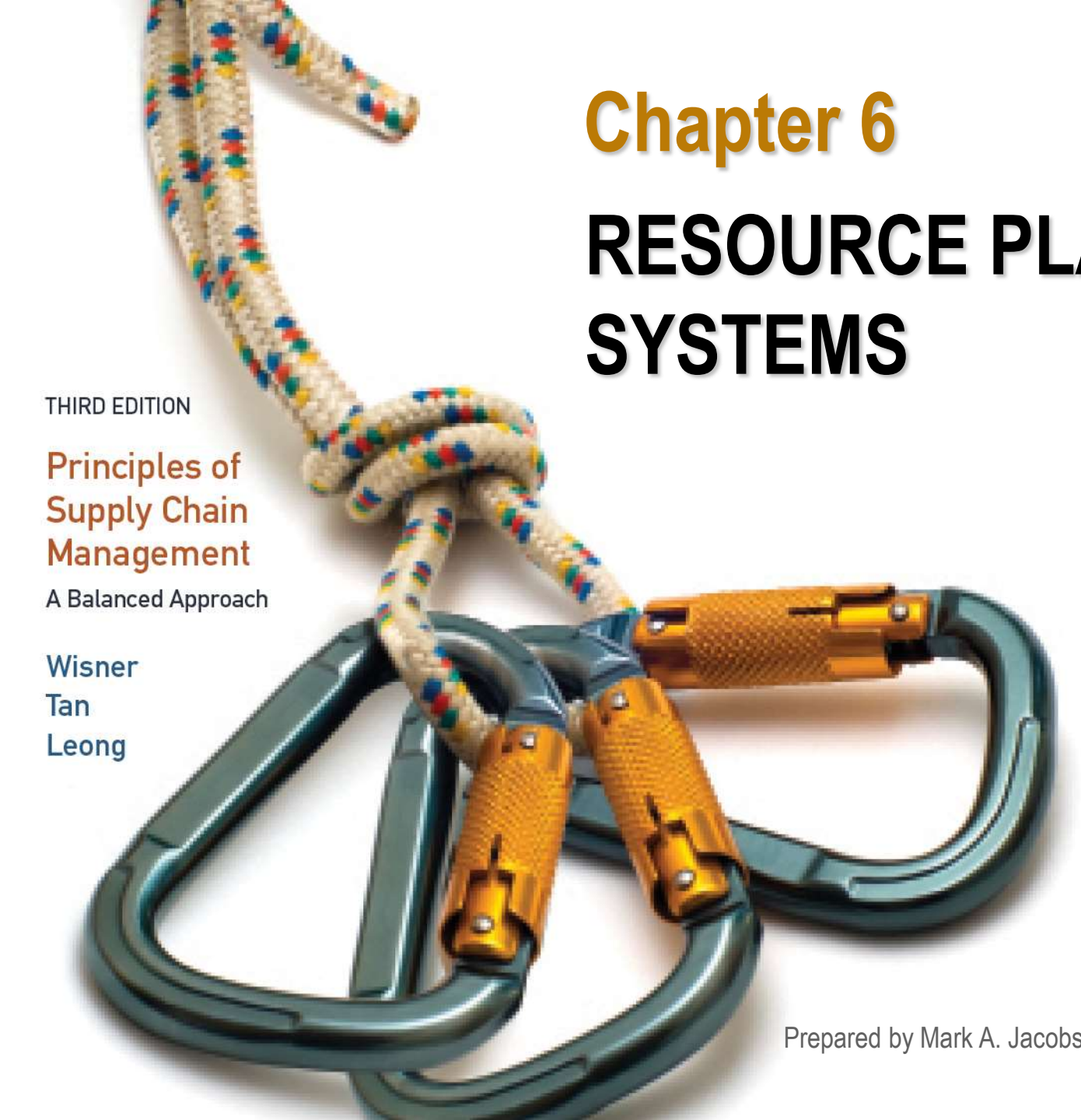

Chapter 6

RESOURCE PLANNING SYSTEMS

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LEARNING OBJECTIVES

You should be able to:

- Describe the hierarchical operations planning process in terms of materials planning (APP, MPS, MRP) and capacity planning (RRP, RCCP, CRP).
- Describe MRP, closed-loop MRP, MRP-II, DRP, ERP, and their relationships.
- Understand the terms used in MRP computations.
- Know how to compute available-to-promise quantities, MRP explosions, and DRP implosions.
- Understand the limitations of legacy MRP systems.

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LEARNING OBJECTIVES (*Continued*)

- Describe an ERP system, and understand its advantages and disadvantages.
- Understand why manufacturers and service firms are migrating from legacy MRP systems to integrated ERP systems.
- Describe the various modules of an integrated ERP system, and have a general knowledge of the ERP market.
- Understand best-of-breed versus single integrator ERP implementations.
- Understand why many ERP implementations fail.
- Understand how an integrated ERP system works.

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CHAPTER OUTLINE

- Introduction
- Operations Planning
- The Aggregate Production Plan
- Master Production Scheduling
- The Bill of Materials
- Material Requirements Planning
- Capacity Planning
- Distribution Requirements Planning

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CHAPTER OUTLINE (*Continued*)

- The Legacy Material Requirements Planning Systems
- The development of the Enterprise Resource Planning Systems (ERP)
- Implementing ERP Systems
- ERP Software Applications
- ERP Software Providers

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Introduction

Scheduling & inventory management influence how assets are deployed.

Problem: A missed due date or stock-out may cascade downstream, magnifying the **bullwhip effect**

Operations managers are continuously involved in balancing capacity & output.

Operations Planning

Operations planning is usually hierarchical & can be divided into three broad categories:

- **Long-range – Aggregate Production Plan (APP)** involves the construction of facilities & major equipment purchase
- **Intermediate –** Shows the quantity & timing of end items (i.e., master production schedule – MPS)
- **Short-range -** detailed planning process for components & parts to support the master production schedule (i.e., materials requirement planning – MRP)

Operations Planning (*Continued*)

Computer based “push” resource systems:

- **Closed-loop MRP -** incorporates the aggregate production plan, the master production schedule material requirements plan, & capacity requirements plan.
- **Manufacturing resource planning (MRP II) -** incorporates the business & sales plans with the closed-loop MRP system.
- **Enterprise requirements planning (ERP) -** is an extension of MRP-II
- **Distribution requirement planning (DRP) -** describes the time-phased net requirements from warehouses & distribution centers customer demand minus any on hand in-transit inventories.

Aggregate Production Plan

Hierarchical planning - process that translates annual business & marketing plans & demand forecasts into a production plan for a product family (products that share similar characteristics) in a plant or facility leading to the Aggregate Production Plan (APP)

- Planning horizon of APP is at least one year & is usually rolled forward by three months every quarter
- Includes costs relevant to the aggregate planning decision include inventory, setup, machine operation, hiring, firing, training, & overtime costs

Aggregate Production Plan (*Continued*)

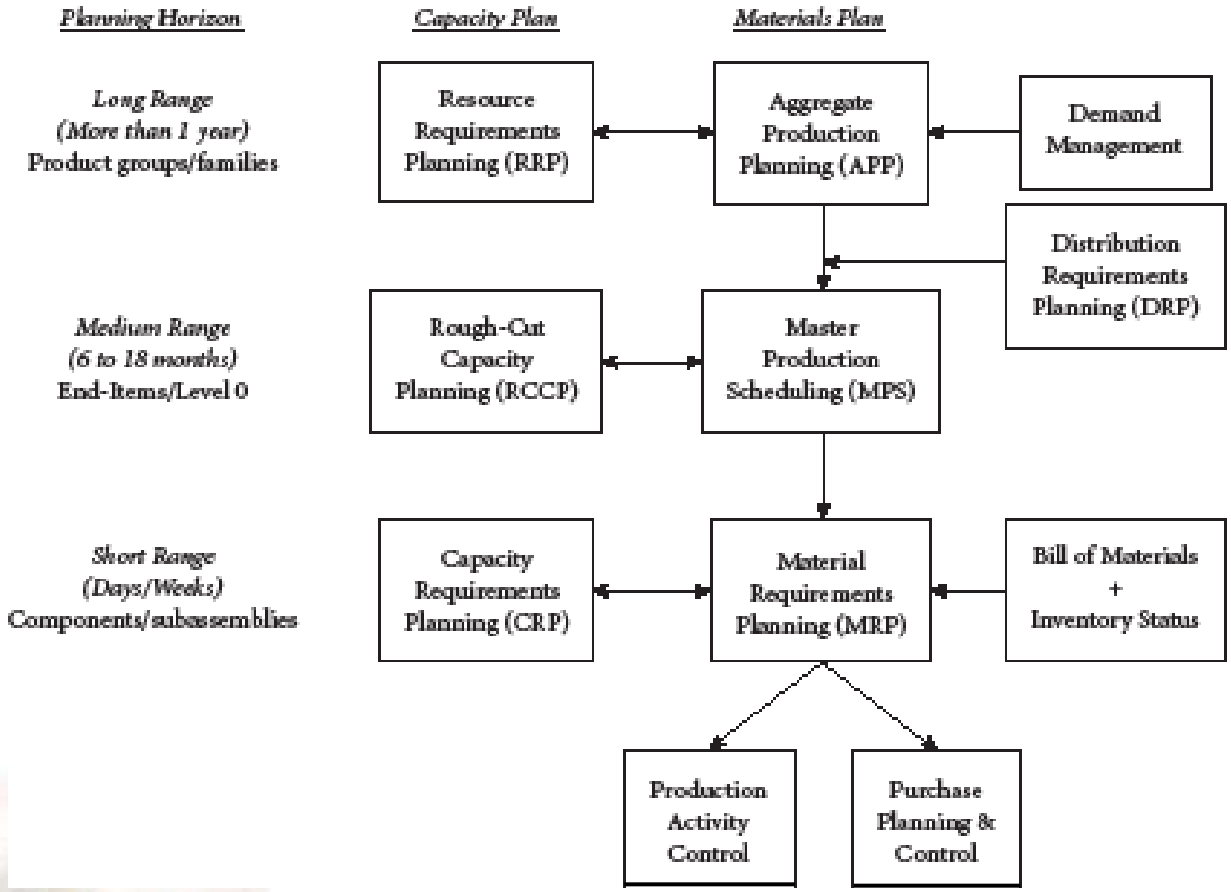


Figure 6.1

Aggregate Production Plan (*Continued*)

Three basic production strategies :

1. **Chase Strategy -** Adjusts capacity to match demand. Firm hires & lays off workers to match demand. Finished goods inventory remains constant. Works well for make-to-order firms

2. **Level Strategy -** Relies on a constant output rate while varying inventory & backlog according to fluctuating demand. Firm relies on fluctuating finished goods & backlogs to meet demand. Works well for make-to-stock firms

3. **Mixed Production Strategy -** Maintains stable core workforce while using other short-term means, such as overtime, subcontracting & part time helpers to manage short-term demand

Master Production Scheduling

Master Production Schedule (MPS) - A detailed disaggregation of the aggregate production plan, listing the exact end items to be produced by a specific period.

- More detailed than APP & easier to plan under stable demand.
- Planning horizon is shorter than APP, but longer than the lead time to produce the item.
- Note: For the service industry, the master production schedule may just be the appointment log or book, where capacity (e.g., skilled labor or professional service) is balanced with demand.

Master Production Scheduling

(*Continued*)

The MPS - the production quantity to meet demand from all sources & is used for computing the requirements of all time-phased end items

System nervousness - small changes in the upper-level-production plan cause major changes in the lower-level production plan

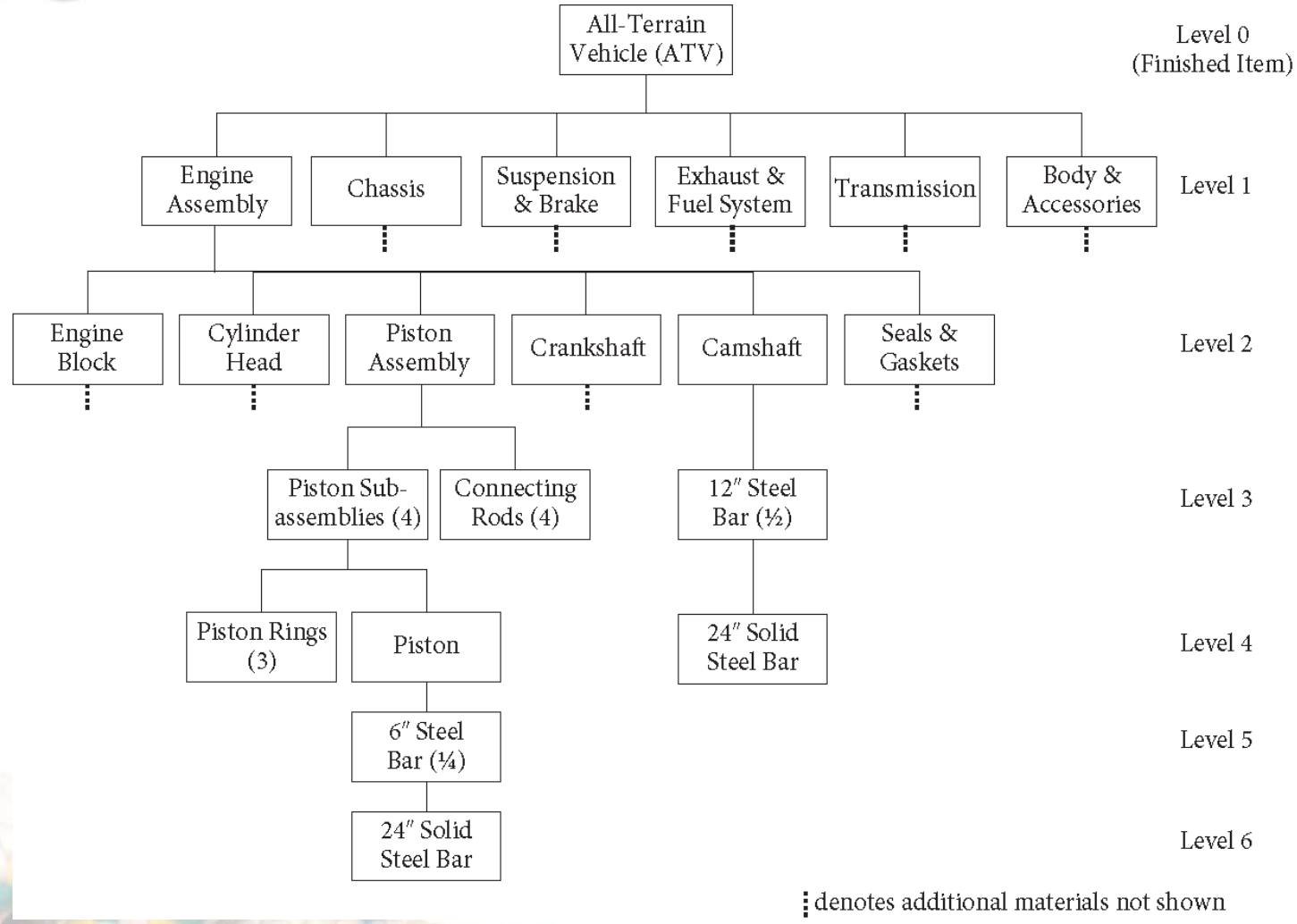
Firms use a time fence to deal with nervousness by separating the planning horizon into –

1. **Firmed Segment (AKA demand time fence)**, from current period to several weeks into future. Can only be altered by senior management
2. **Tentative segment (AKA planning time fence)**, from end of firmed segment to several weeks into the future

The Bill of Materials

- **Bill of Materials (BOM) -** document that shows an inclusive listing of all component parts & assemblies making up the final product
  - **Dependent Demand -** the internal demand for parts based on the demand of the final product in which the parts are used (e.g., subassemblies)
  - **Independent Demand -** demand for final products affected by trends, seasonal patterns, & general market conditions
  - **Multilevel Bill of Materials -** shows the parent-component relationships & the specific units of components known as the planning factor. Often presented as an indented bill of materials
  - **Super Bill of Materials (AKA planning BOM, pseudo BOM, phantom BOM, or family BOM)** enables the firm to forecast the total demand end products

The Bill of Materials (*Continued*)



(Fig. 6.4)

Material Requirements Planning

MRP -

A computer-based materials management system that calculates the exact quantities, need dates, & planned order releases for subassemblies & materials required to manufacture a final product. MRP requires –

- The independent demand information
- Parent-component relationships from the BOM
- Inventory status of final product & components.
- Planned order releases (the output of the MRP system)

Advantage of MRP - provides planning information

Disadvantage of MRP - loss of visibility, especially acute for products with a deep BOM, & ignores capacity & shop floor conditions.

Material Requirements Planning

(*Continued*)

Terms used in MRP:

- Parent - Item generating demand for lower-level components.
- Components - parts demanded by a parent.
- Gross requirement - A time-phased requirement prior to netting out on-hand inventory & lead-time
- Net requirement - The unsatisfied item requirement for a specific time period. Gross requirement for period minus current on-hand inventory.
- Scheduled receipt - A committed order awaiting delivery for a specific period.
- Projected on-hand inventory - Projected closing inventory at end of period. Beginning inventory minus gross requirement, plus scheduled receipt & planned receipt & planned receipt from planned order releases.
- Planned order release - Specific order to be released to the shop or to the supplier.

Material Requirements Planning

(*Continued*)

- Time bucket - Time period used on the MRP. Days or weeks
- Explosion - Process of converting a parent item's planned order releases into component gross requirements
- Planning factor - Number of components needed to produce a unit of the parent item
- Firmed planned order - Planned order that the MRP computer logic system does not automatically change when conditions change to prevent system nervousness
- Pegging - Relates gross requirements for a part to the planned order releases
- Low-level coding - assigns the lowest level on BOM to all common components to avoid duplicate MRP computations
- Lot size - order size for MRP logic
- Safety Stock - Protects against uncertainties in demand supply, quality, & lead time

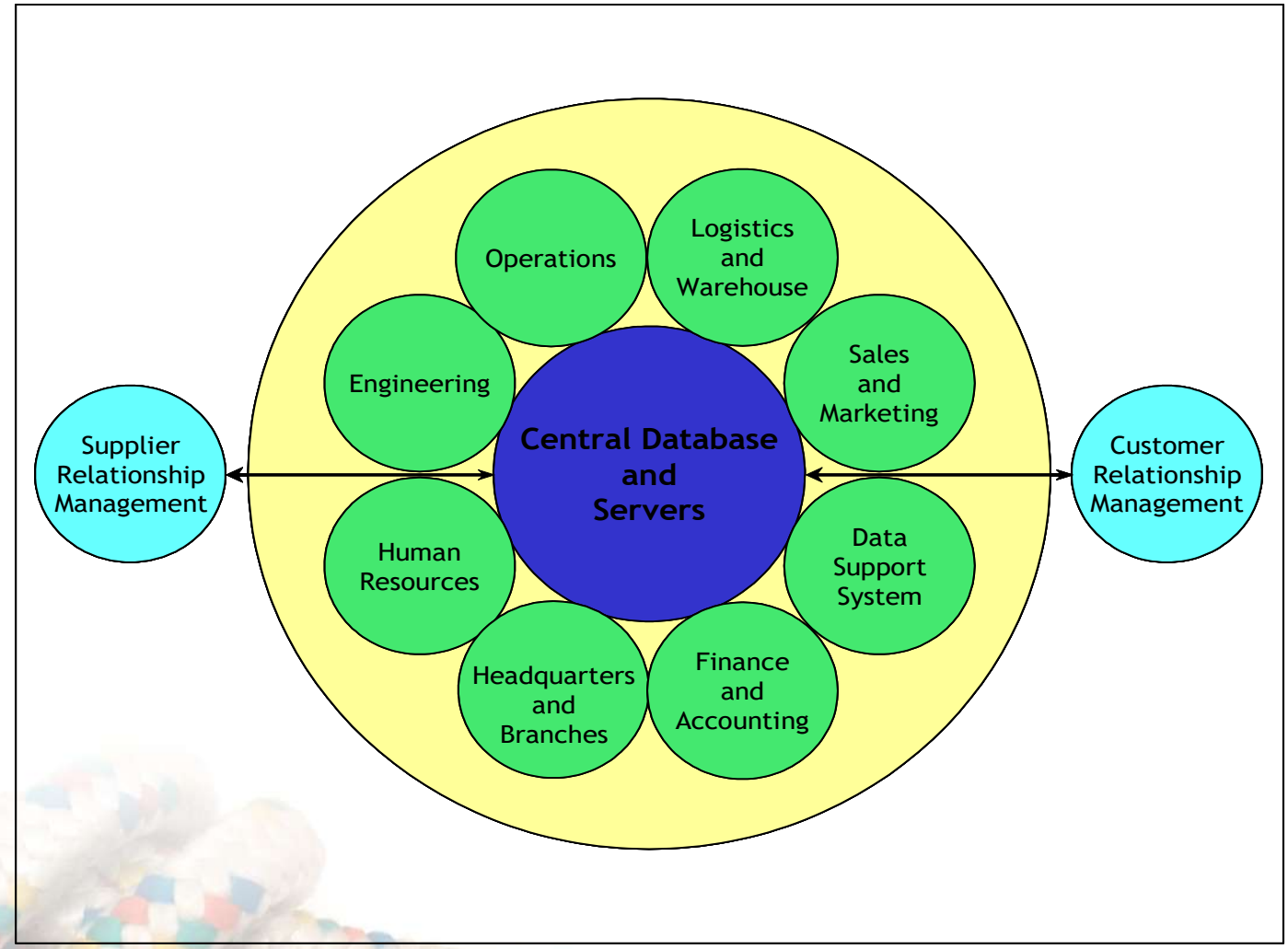
Development of ERP Systems

Enterprise Resource Planning Systems (ERP) - information system connecting all functional areas & operations of an organization &, in some cases, suppliers and customers via common software infrastructure and database

- ERP provides means for supply chain members to share information so that scarce resources can be fully utilized to meet demand, while minimizing supply chain inventories

Development of ERP Systems

(*Continued*)



(Fig. 6.6)

Implementing ERP Systems

Two types of ERP implementation

1. **Best-of-breed** - pick the best application for each individual function. Disadvantage- software may not integrate well but this may not be a major issue in future
2. **Single integrator solution** - pick all the desired applications from a single vendor

Implementation Problems:

- Lack of top management commitment
- Lack of adequate resources
- Lack of proper training
- Lack of communication
- Incompatible system environment

Advantages & Disadvantages Of ERP Systems

Advantages

- Added visibility reduce supply chain inventories
- Helps to standardize manufacturing processes
- Measure performance & communicate via a standardized method

Disadvantages

- Substantial time & capital investment
- Complexity
- Firms adapt processes to meet ERP system

ERP Software Applications

Major ERP applications include –

- Accounting and finance
- Customer relationship management
- Human resource management
- Manufacturing
- Supplier relationship management
- Supply chain management:

ERP Software Providers

The 3 major ERP providers are now –

- **Oracle**
- **SAP**
- **Microsoft**

Other small software firms provide applications (e.g., Sage's MAS 90) as well as full ERP solutions but lack applistructure - the merger of enterprise application and infrastructure technology