Concepts in Enterprise Resource Planning

Chapter 2

The Development of Enterprise Resource Planning Systems

Chapter Objectives

- Identify the factors that led to the development of Enterprise Resource Planning (ERP) systems

- Describe the distinguishing modular characteristics of ERP software

- Discuss the pros and cons of implementing an ERP system

- Summarize ongoing developments in ERP

Introduction

- Increasing the efficiency of information systems can result in more efficient business processes, making a company more competitive

- Integrating information systems across functional areas is a relatively recent phenomenon

- Lack of integration can lead to costly inefficiencies
  - Errors from keying in the same data more than once
  - Lack of timely data due to periodic updating between systems
  - Problems with data being defined differently in different systems

Introduction

- ERP systems can integrate a company's operations by providing a company-wide computing environment that:
  - Includes a single database shared by all functions
  - Can deliver consistent data to all business functions in real-time
- ERP systems can dramatically reduce costs and increase operational efficiency
- With ERP, IBM Storage Systems division
  - Reprices inventory in 5 minutes instead of 5 days
  - Ships a replacement part in 3 days instead of 22
  - Checks customer credit in 3 seconds instead of 20 minutes

Evolution of Information Systems

- Using integrated software to manage all functional areas of a business seems obvious today, but it was not technically feasible until the 1990s

- Three factors contributed to the development of ERP systems:

  - Advancement of computer hardware and software

    - Computing power, memory and communications

  - Development of a vision of integrated information systems

  - Reengineering of companies to shift from a functional focus to a managerial focus

Computer Hardware and Software

- Computer systems began as mainframe computers
  - One large computer shared by many users who communicated with the system by paper-punched cards or paper tapes
  - Terminals—primarily a monitor and keyboard with no computing capability—were later used to communicate with the mainframe computer
- The personal computer (PC) allowed individuals more control over their computing
- Unique applications like word processing, spreadsheets and presentation software were developed for the PC
- Sharing expensive peripheral equipment let to the development of computer networks

Computer Hardware and Software

- Sharing and managing important corporate data became an even more important issue as PCs became more common

- **Client-server** systems were developed to manage data sharing. A central computer (**server**) managed the storage and sharing of common data

Computer Hardware and Software

- A common database (holding a very large amount of data) is a key component of an ERP system
- Relational database systems were introduced in the 1970s
  - These systems allowed for more efficient storage and retrieval of data
  - To support ERP systems, relational databases needed to be able to find specific data quickly from a large, complex database
- By the 1990s, the hardware, networks and database software were in place to make large scale ERP systems feasible

Manufacturing Roots of ERP

- Materials Requirements Planning (MRP) software was developed in the 1960s and '70s

- MRP software allowed firms to start with a sales forecast and develop production plan and raw material plan

  - For companies with many products, raw materials and shared production resources, MRP was not possible without a computer

  - Electronic Data Interchange (EDI) allowed a company to communicate its purchase requirements electronically

  - Sharing long-range production schedules between manufacturers and suppliers was the beginning of supply chain management (SCM)

Functional Business Model

- Alfred P. Sloan developed the functional organizational model in the 1930s as chairman of General Motors

- The functional model was very successful for decades, but foreign competition in the 1980s highlighted problems with the model:

  - Flexibility and rapid decision-making were not possible

  - Organizations had become overstaffed and top-heavy

  - Ability to respond to change was limited

Business Process Model

- In a process-oriented company, the flow of information and management activity are "horizontal"—across functions

- The "horizontal" flow promotes flexibility and rapid decision-making

- Michael Hammer's *Reengineering the Corporation* encouraged managers to take a "horizontal" business process view of their companies

SAP

- *Systemanalyse und Programmentwicklung* (SAP) was formed in Mannheim, Germany, in 1972 by five former IBM systems analysts

- SAP's goal was to develop a standard business software product that could be configured to meet the needs of a company

- SAP's founders wanted
  - Data to be available in real time
  - Users to work on a computer screen, not with paper

SAP

- SAP's founders had to develop their first software package at night on their first customer's computer
  - Computers were not commonly available in 1972
- The first software package was referred to by various names, including R, RF and R/1
- Between 1978 and 1982, SAP developed a more integrated software package, called R/2
  - R/2 was still a mainframe computer package
- By 1988, SAP had developed R/2 into an international software program and had sold 1,000 systems

SAP R/3

- SAP R/3 was developed from 1988 to 1992
  - R/3 is a client/server software package that could operate on a number of computer systems, including Windows NT and Unix
  - Because it was a client/server system, it could easily be scaled up as a company grew by adding additional computers (servers) to the system
  - R/3 was also an **open architecture** system
    - Allows other software companies to develop compatible products/add-on software products
    - Makes integrating hardware like bar code scanners, PDAs, cell phones, etc., easier

Y2K

- Most business software programs written in the 1960s and '70s saved storage space by using only 2 digits to store the year

  - For example, 10/29/75 rather than 10/29/1975

- With dates after 12/31/99, computer calculations were likely to be in error

  - 10/29/2001 might be interpreted as 10/29/1901 by a program that only stored the date as 10/29/01

- Companies faced a choice as the new millennium approached:

  - Rewrite old software to store year data correctly

  - Use problem as an opportunity to <u>upgrade to ERP</u>

Y2K

- The Y2K problem created explosive sales growth for Y2K-compliant ERP systems

- This lead to a significant <u>shortage of experienced ERP consultants</u>, leading many companies to have problems with their sometimes-rushed implementations

- The high demand for experienced ERP consultants prior to Y2K was followed by an abrupt drop off by the middle of 1999

  - By middle 1999, companies had decided how they were going to handle the Y2K problem, so new ERP sales dropped significantly

PeopleSoft

- PeopleSoft was founded by David Duffield, a former IBM employee who, like SAP's founders

- PeopleSoft started with software for Human Resources and Payroll Accounting, and achieved considerable success

- PeopleSoft's success caused SAP to make significant development to its Human Resources module

ERP Vendors

- Consolidation is currently taking place in the ERP software business

  - PeopleSoft purchased ERP vendor J.D. Edwards in 2003

  - Oracle, after a long battle, acquired PeopleSoft in 2005

  - SAP and Oracle are now the two largest ERP vendors

  - Microsoft is challenging SAP and Oracle to sell ERP systems to small- and medium-sized businesses

SAP R/3 Enterprise

- SAP's R/3 lastest software version is called release 4.7 or Enterprise

- The system allows data to be entered once and then used throughout the organization.

- R/3 Enterprise uses a central database to share data between the primary functional areas of:

  - Marketing and Sales

  - Production and Materials Management

  - Human Resources

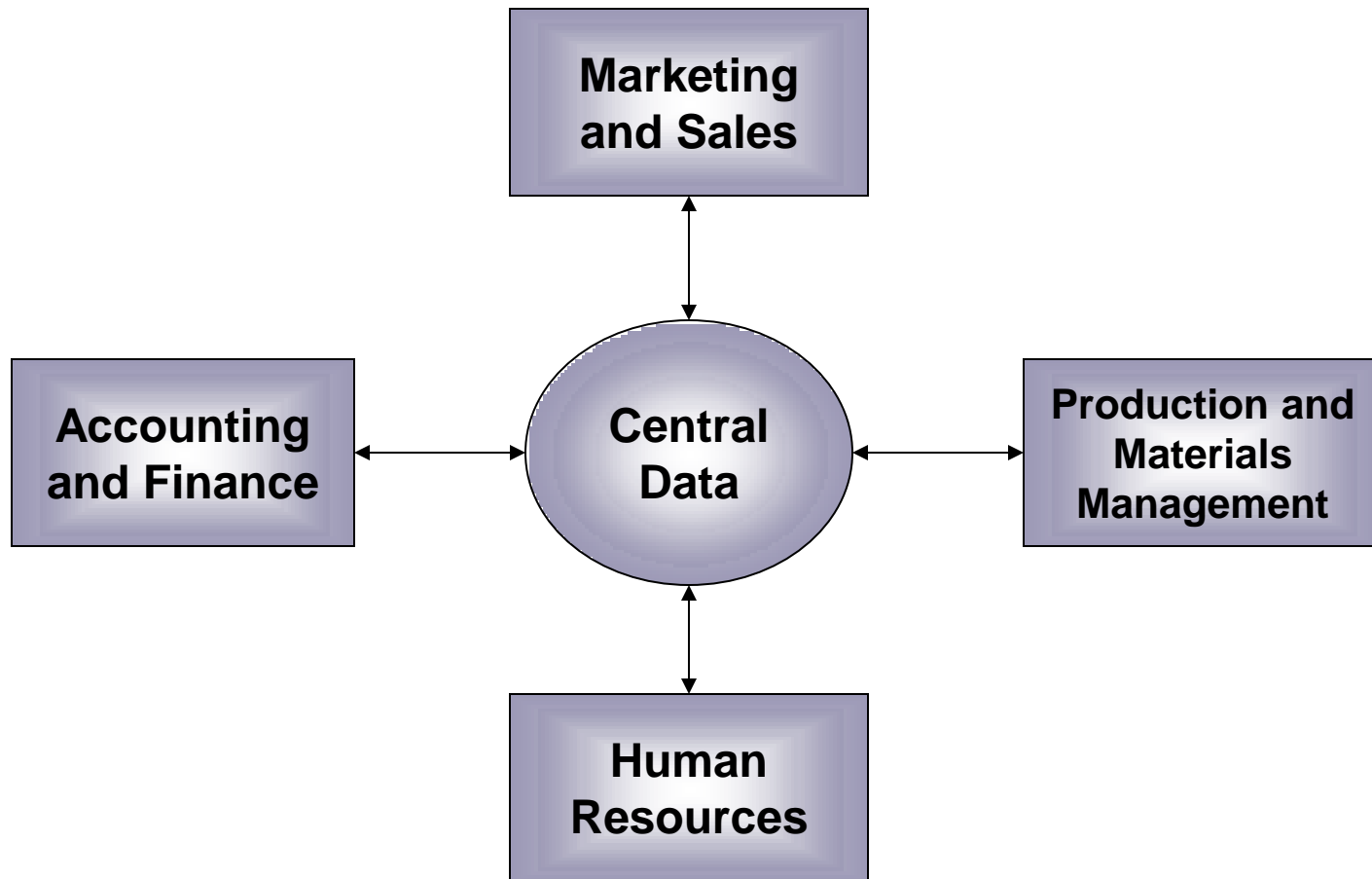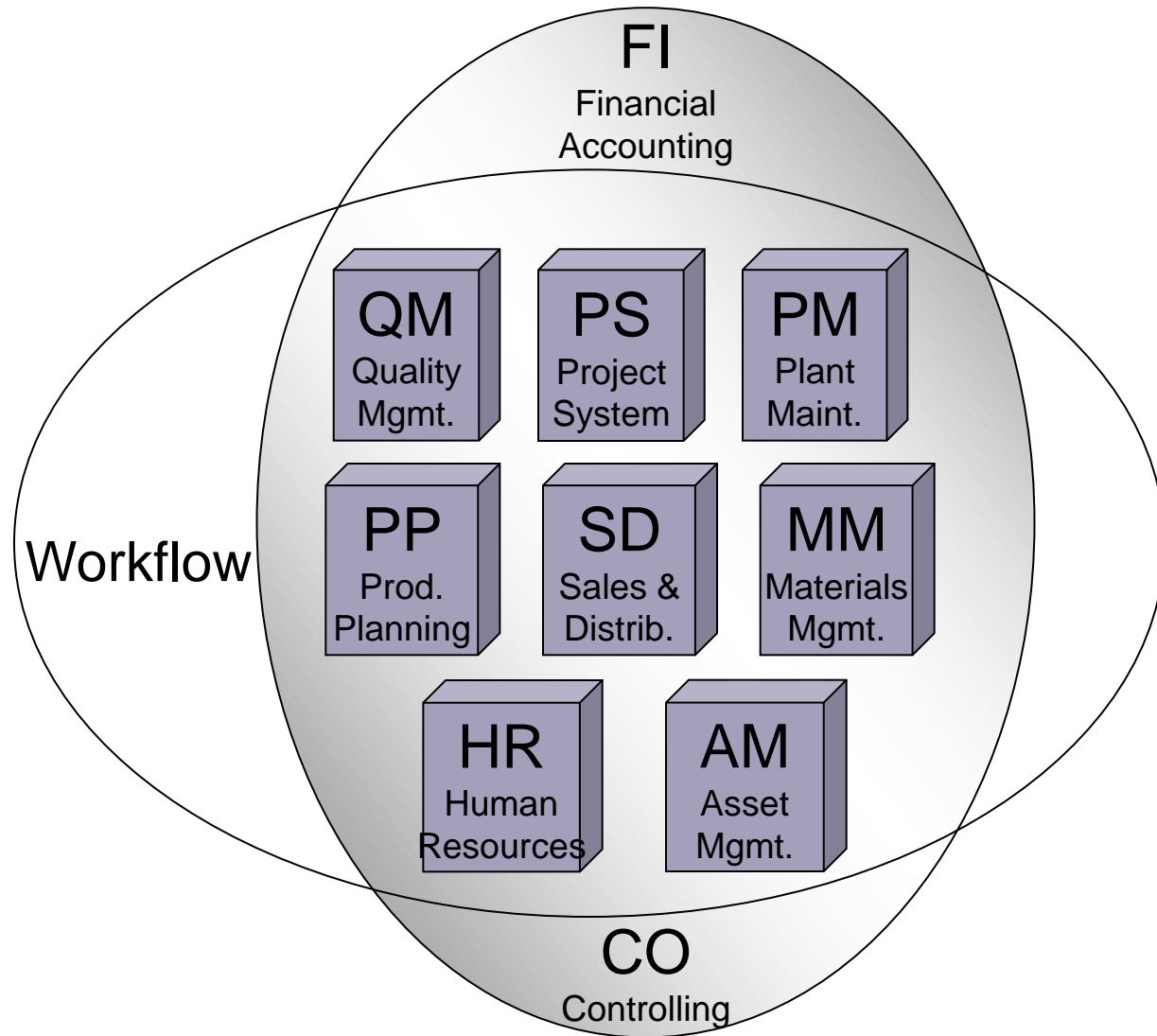 - Accounting and Finance

Data Flow between Functional Areas

Figure 2-4 Data flow within an integrated information system

SAP R/3 Modules

FI
Financial
Accounting

QM
Quality
Mgmt.

PS
Project
System

PM
Plant
Maint.

Workflow

PP
Prod.
Planning

SD
Sales &
Distrib.

MM
Materials
Mgmt.

HR
Human
Resources

AM
Asset
Mgmt.

CO
Controlling

SAP R/3 Modules

- While SAP supports business processes, it is organized around functional modules:
  - **The Sales and Distribution** (SD) module records sales orders and schedules deliveries
    - Information like pricing, how and where to ship products, how the customer is to be billed, etc. is maintained in this module
  - **The Materials Management** (MM) module manages
    - The acquisition of raw materials from suppliers (purchasing)
    - Handling of raw materials inventory
  - **The Production Planning** (PP) module is where production is planned and scheduled, and actual production activities are recorded.

SAP R/3 Modules

- **The Quality Management** (QM) module helps to plan and record quality-control activities, such as product inspections and material certifications

- **The Plant Maintenance** (PM) module allows planning for preventative maintenance of plant machinery and managing maintenance resources

- **The Asset Management** (AM) module helps the company to manage fixed-asset purchases (plant and machinery) and the related depreciation.

- **The Human Resources** (HR) module facilitates employee recruiting, hiring, training, payroll and benefits.

- **The Financial Accounting** (FI) module records transactions in the general ledger accounts. It is used to generate financial statements for external reporting purposes

SAP R/3 Modules

- **The Controlling** (CO) module is used for internal management purposes.
  - In CO, the company's manufacturing costs are assigned to products and to cost centers, so that the profitability of the company's activities can be analyzed
  - The CO module supports managerial decision- making
- **The Project System** (PS) module allows for planning and control of special projects like Research and Development or Marketing Campaigns or low-volume, highly complex projects like aircraft or ship construction
- **The Workflow** (WF) module is a set of tools that can be used to automate any of the activities in R/3. It can perform task-flow analysis and prompt employees (by e-mail) if they need to take action

ERP Implementation

- For a variety of reasons, many companies choose to implement only certain modules of an ERP system

  - Generally, it is easier to integrate business processes when one ERP vendor supplies all modules

  - Data transfer between different ERP systems or an ERP system and a legacy software system is frequently done with batch programs, which eliminates real-time data accuracy

  - Software upgrades can also be problematic between different systems

- Because of these difficulties, a company that chooses to use multiple systems should make sure it is done for valid reasons

Best Practices

- Before ERP, IS people designed software to reflect a company's business practices
- With ERP software, the software developers have used their experience with a number of companies to develop "best practices"
  - Which means that R/3 designers choose the best, most efficient ways in which business processes should be handled
- The company began to develop models of how certain industries' business process should be managed in a way that was compatible with the R/3 system.
- Best Practices represent the way an ERP company feels a particular business transaction should be carried out to *maximize efficiency*

ERP for Midsize Companies

- By 1998, most Fortune 500 companies had installed ERP systems

- ERP companies began to focus on midsize companies (1,000 or fewer employees)

- Midsize companies in Europe have an estimated $50 billion annual IT budget

  - IT budget for US midsize companies is even larger

- To capture the midsize market, SAP developed Industry Solutions—preconfigured versions of its R/3 software for specific industries such as:

  - Oil and gas, automotive, banking, chemicals, etc.

Implementation Challenges

- A number of companies in the 1990s experienced lengthy and challenging implementations
  - Dell cancelled an SAP implementation
  - Owens-Corning had a lengthy implementation
  - FoxMeyer Drug blamed its bankruptcy, at least in part, on a troubled SAP implementation
- SAP responded by creating Accelerated SAP (ASAP), an implementation methodology and set of tools to aid implementation efforts
- The latest version of ASAP is called Solution Manager

New SAP Products

- Customer Relationship Management (CRM) helps manage customer interactions so that they are coordinated and consistent

  - Also allows for analysis of sales data to identify trends and opportunities

- Advanced Planner and Optimizer (APO) helps coordinate production planning and scheduling between multiple facilities and with suppliers and customers

  - APO works by getting real-time updates from retailers about customer demand

- NetWeaver provides a comprehensive platform to connect R/3 to the Internet

Choosing Consultants and Vendors

- ERP systems are so complex, one person cannot fully understand a single system, much less be able to compare systems effectively

- A team, including external consultants, is probably needed to select the best ERP system for a company

- A team made up of consultants and company experts is needed to determine how to configure ERP software properly

ERP Software Benefits

- Global integration, including currency exchange rates, do data can be integrated across international borders
- Reduced IT maintenance: single system is easier to maintain
- Provides information so that a company can be managed, not just monitored
  - For example, without ERP, getting an answer to "How are we doing?" requires getting data from each business unit and then putting the data together for a comprehensive, integrated picture.
  - The ERP system already has all the data, allowing the manager to focus on improving processes.
  - This focus enhances management of the company as a whole, and makes the organization more adaptable when change is required.

ERP System Costs

- The cost of an ERP system:
  - Depends on the size and complexity of the software package, which is a function of the size of the firm
  - Includes new hardware required to run the system
  - Includes consultant and business analyst fees
  - Includes the time required for implementation (disruption of business)
  - Includes training costs (cost to develop and deploy training plus employees' time away from their job)
- A large company, with over 1,000 employees, can spend from $50 million to $500 million on a complex implementation

Is ERP for everyone?

- A business must analyze its own business strategy, organization, culture and operations before choosing an ERP approach

- A company may not be ready to implement ERP
  - The company's business processes may not be well defined or managed
  - If a company is not prepared to make its processes more efficient, then it will not gain the benefits an ERP system can provide

Is ERP software inflexible

- ERP software is designed around best practices, so companies are encouraged to adapt their processes to the way ERP software works
- With SAP, companies can customize the software by creating custom capabilities using its Advanced Business Application Programming (ABAP) language
  - SAP is an open-source product, meaning that the customer has access to the software's source code

Returns from the ERP Investment

- ERP eliminates redundant effort and duplicated data, resulting in reduced personnel needs
- ERP systems can help produce goods and services more quickly, resulting in increased sales volume
- An ERP system may be required to compete with competitors who have effectively implemented ERP systems
- ERP systems can reduce frustration resulting from the inability to get accurate and timely data
- More accurate and timely data can improve external customer relations
  - Better communication can improve the customer relationship and increase sales

Implementation Problems

- Some executives naively hope ERP systems will cure fundamental business problems (that are not curable by any software)
- Some executives and IT managers don't take enough time for proper analysis and planning for implementation
- Some executives and IT managers skimp on education and training
- Sometimes the ownership of the implementation project is not given to the employees who will use the system
- Top executive support is not always given
- The organizational change process is not managed well

Evolution of ERP Systems

- ERP systems have only been in common use since the 1990s
  - ERP is still a young technology, and future developments are hard to predict
- Additional capabilities are being added to core ERP applications
  - Customer Relationship Management (CRM)
    - ✓increase the efficiency of the sales force
  - Supply Chain Management (SCM)
    - ✓help to translate customer demand into production plans more efficiently

Evolution of ERP Systems (cont.)

- Strategic Enterprise Management (SEM)
  - ✓Help a company translate corporate-level goals (such as profit and market share targets) into operational decisions (such as production plans).
- Internet connectivity
  - ✓ERP vendors continue to improve software and Internet connections that integrate a business' internal operations, while also integrating the business with its dealers, vendors, and customers.

ERP and the Internet

- ERP developers continue to include Internet connectivity into their ERP applications
- SAP's latest Internet initiative is NetWeaver, a development system to simplify the integration of the Internet with the R/3 system
- ERP systems, in combination with the Internet, have lead to the development of e-commerce (the conduct of business over the Internet)
  - The Internet has become an important way to sell goods and services
  - Companies will have a continuing need to take orders electronically and to pass them seamlessly to the company's database

Maximizing ERP Value

- To maximize the value of their ERP systems, companies should:

  - Integrate: ERP systems must be integrated throughout the company to share data effectively

  - Optimize: Many implementations were rushed to avoid the Y2K problem. Companies can gain value by using their ERP systems to improve their business processes

  - Informate *(the process of translating data into useable information)*: Hard work is required to effectively use the rich information provided by ERP systems

Summary

- Factors that led to ERP development
  - Exponentially increasing speed and power of computing hardware
  - Early client-server architecture that provided the framework for multiple users sharing common data
  - Increasingly sophisticated software facilitated integration, especially between Accounting and Finance (A/F) and manufacturing resource planning
  - Growth of business size, complexity and competition required more efficient information systems

Summary

- SAP AGs R/3 enterprise software can integrate a company's processes using a common database and real-time data sharing

- SAP R/3 is modular, offering a number of modules including Sales and Distribution, Materials Management, Human Resources, Financial Accounting, Controlling, Production Planning, etc.

Summary

- ERP software is expensive to purchase, time consuming to implement and requires significant employee training

- Payoff from ERP software implementation can be significant, but determining the return on investment (ROI) may not be immediate or easy to calculate

- Experts predict future ERP developments will be focused on managing customer relationships, improving planning and decision-making, and linking operations to the Internet.