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 led 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 upgrade to ERP
Y2K

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

• This lead to a significant shortage of experienced ERP consultants, 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

CO
Controlling

Workflow

QM
Quality Mgmt.

PS
Project System

PM
Plant Maint.

PP
Prod. Planning

SD
Sales & Distrib.

MM
Materials Mgmt.

HR
Human Resources

AM
Asset Mgmt.
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.