CHAPTER 11

ENTERPRISE RESOURCE PLANNING SYSTEMS

This chapter introduces an approach to information system development that represents the next step on a continuum that began with stand-alone applications, progressed to the development of shared database systems, and now involves highly integrated systems that serve the entire organization. Enterprise Resource Planning (ERP) systems are much more than database systems. Typically these are not developed in house. The chapter examines the key features of generic ERP systems, their various configurations, and implementation issues. Of particular note is the discussion of data warehousing. The Chapter Appendix discusses some of the leading products available today.

The objectives of this chapter are:

● to understand the general functionality and key elements of ERP systems;

● to understand the various aspects of ERP configuration;

● to understand the purpose of data warehousing;

● to understand the risks associated with ERP implementation;

● to be aware of the key considerations related to ERP implementation;

● to understand the internal control and auditing implications associated with ERPs; and

● to be able to identify the leading ERP products and be familiar with their distinguishing features.
I. What is an ERP?

Enterprise resource planning systems are modular software packages designed to integrate the key processes in an organization so that a single system can serve the information needs of all functional areas. This is a big change from the early days of automation when individual functional areas developed free-standing systems for their own use. In those days, there was no data sharing and the individual areas owned their data. In addition to not sharing data, these systems usually did not communicate with each other. Contrast Fig. 11-1 on page 565 with Fig. 11-2 on page 567.

A. ERP Core Applications

ERP systems typically include two groups of applications: core applications and business analysis applications. Core applications are those applications that support the day-to-day activities of the business. They include such functions as sales, distribution, production planning, shop floor control, and logistics. Recall what you learned in your Management Fundamentals course.

B. On-Line Analytical Processing

Besides providing extensive transaction processing capability, an ERP also provides management with extensive support for management decision making. On-line Analytical Processing (OLAP) includes decision support, modeling, information retrieval, ad-hoc reporting/analysis, and what-if capabilities. Some of the commercial packages provide all of these, and others can be modified with third party add-ons, often called bolt-on packages.

A key element necessary for the ERP to provide business analysis is the data warehouse. This is a database designed for quick search, retrieval, query, etc. Typically, an ERP implementation includes both operational and data warehouse databases.

II. ERP System Configuration

A. Server Configuration

This section discusses the structure of an ERP in terms of the network topology that is typically used – the client-server model – in two variants: a two-tier model [see Fig. 11-3 on page 569] and a three-tier
model [see Fig. 11-4 on page 570. Note the differences.

B. OLTP versus OLAP Servers

Two types of data are of value to an organization – current and historical. Current data relates to ongoing business events that are changing (are not yet history!). Historical data can be voluminous. **On-line Transaction Processing (OLTP)** events relate to current activities of the business. OLAP involves online transactions that include large amounts of data used for extensive analysis. OLTP applications support mission-critical tasks. OLAP applications support management-critical tasks through analysis of data in the data warehouses. See Fig. 11-5 on page 571.

OLPA servers support three types of analysis: **consolidation, drill-down, and slicing and dicing.** Read the discussion carefully.

C. Database Configuration

The task of selecting the database tables for use in the ERP is a very complex one. Often companies find it best to reengineer the company’s processes to accommodate the ERP rather than modify the ERP to match the company.

D. Bolt-On Software

The term bolt-on software refers to add-on components provided by third-party vendors to add a function that is not provided by the ERP software.

One type of bolt-on software that is of particular note is supply chain management (SCM) software. Management of the supply chain is being recognized as crucial to the success of businesses. The integration of SCM software into ERP systems is increasing.

III. Data Warehousing

A **data warehouse** is a relational or multi-dimensional database that is huge! The text distinguishes briefly between a **data warehouse** and a **data mart**. The key difference is size. The other issues are the same.

Data warehousing involves extracting, converting, and standardizing an organization’s operational data from both ERP and legacy systems and loading it into a central **archive**.
Once available, data can be queried, analyzed, and mined! Recall that data mining was introduced in Chapter 8.

This section of the chapter describes in great detail the steps in the data warehousing process:

1. Modeling data for the data warehouse;
2. Extracting data from operational databases;
3. Cleansing extracted data;
4. Transforming data into the data warehouse model; and
5. Loading the data into the data warehouse.

Follow the discussion carefully. A well-structured data warehouse is an invaluable asset for an organization.

A. Decisions Supported by the Data Warehouse

Although many options made available by a data warehouse are similar to those with any database, there are some significant additional capabilities. In addition to standard reports planned in advance, there is also the ability to conduct multi-dimensional analysis and information visualization.

The most useful data analysis technique associated with data mining is drill-down analysis which focuses on increasing levels of detail. Table 11-1, on page 581, summarizes some applications of data mining in decision support.

B. Supporting Supply Chain Decisions from the Data Warehouse

In the past, data was protected and held internally. Many organizations today feel that the reason to hold data, even in a data warehouse, is to improve, even optimize, business performance. An important focus is the firm’s supply chain. The examples bring home the point.

IV. Risks Associated with ERP Implementation

As you might expect, ERP is not a priceless gift from computer heaven. There are possible problems, and there have been ERP installation failures. Read carefully!

A. Big-Bang versus Phased-In Implementation

There are two basic approaches to implementing an ERP system: all at once (big-bang) or in pieces (phased-in). Because implementation of an ERP system typically involves extensive cultural changes
for the organization, the choice of method must be carefully considered.

The big-bang approach is risky because the entire organization must change at once from older legacy systems with which everyone is familiar to a new strange one that requires significant training and slows things down initially.

The phased-in approach is popular, especially in organizations that have very distinct units that did not share the older systems.

B. Opposition to Changes to the Business Culture

Resistance to change is natural. Resistance to system change can be fatal.

C. Choosing the Wrong ERP

Different ERP systems are prefabricated and have different characteristics. Choosing the right one for an organization is crucial to its success. Of particular importance is choosing a system that supports the firm’s business processes. In addition, it must be determined if the organization can reengineer its business processes around the software.

An additional issue relates to system scalability – its ability to grow with the organization. Four dimensions of scalability are discussed: size, speed, workload, and transaction cost.

D. Choosing the Wrong Consultant

Usually an organization does not have the skills in house to implement an ERP system. Outside consultants are usually hired to coordinate the conversion project. The choice of a consultant is critical to the success of the project.

E. High Cost and Cost Overruns

Total cost of ownership for ERP varies greatly and is very great! This total cost includes hardware, software, consulting, internal personnel costs, installation, upgrades, and maintenance. This total cost can easily be underestimated. Some examples are discussed. Read them and learn.
F. Disruption of Operations

As mentioned above, reengineering of business processes is often required to gain the benefits from conversion to ERP. These changes are the most common cause of problems. Recall the shortage of Hershey chocolate at Halloween 1999? Read how conversion to SAP’s R/3 system contributed.

V. Implications for Internal Control and Auditing

A. Following SAS 78:

1. Transaction authorization continues to be very important. In an ERP, the modules are highly linked. Hence controls must be in place to validate transactions before the data is shared with other modules.

2. Segregation of duties is often bypassed by the structure of the ERP. New security, audit, and control tools are needed.

3. Supervision can be a problem. ERPs are designed to empower employees. Hence, supervisors need high levels of understanding of the new system to maintain oversight.

4. Accounting records are produced by the system from OLTP data without traditional batch totals and audit trails. Data entry controls must be tight.

5. Access control, security, is intended to provide confidentiality, integrity, and availability of necessary information. Security limitations should be imposed based on risk assessment. Control of access to the data warehouse is extremely important even though access is often shared with customers and suppliers. An additional access issue relates to the potential for disaster. Contingency planning must occur.

6. Independent verification in the traditional sense is meaningless. However, it must be focused on the overall system. This puts significant demands on internal auditors.
B. Auditing the Data Warehouse

The data available in a data warehouse can be viewed as a gold mine for auditors. However, the auditor must understand the procedures used to fill the data warehouse.

Review Questions for Chapter 11: 1-24

Discussion Questions for Chapter 11: 1-18

APPENDIX: The chapter appendix reviews the key features of ERPs available from some of the industry’s leading vendors: SAP, J. D. Edwards, Oracle, PeopleSoft, and BAAN. Although these are evolving packages, use the appendix to become familiar with the key features of ERP products.