Accounting Information Systems

A Collection

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Chapter 1: Accounting Information System: An Overview

Introduction

Unlike many other accounting subjects, such as intermediate accounting, accounting information systems (AIS) lacks a well-defined body of knowledge. Much controversy exists among college faculty as to what should and should not be covered in the AIS course. To some extent, however, the controversy is being resolved through recent legislation. The Sarbanes-Oxley Act (SOX) of 2002 established new corporate governance regulations and standards for public companies registered with the Securities and Exchange Commission (SEC). This wide sweeping legislation impacts public companies, their management, and their auditors. Of particular importance to AIS students is the impact of SOX on internal control standards and related auditing procedures. Whereas SOX does not define the entire content of the AIS course, it does identify critical areas of study that need to be included for accountants.

The purpose of this chapter is to place the subject of AIS in perspective for accountants. Toward this end, the chapter is divided into four major sections, each dealing with a different aspect of information systems. The first section explores the information environment of the firm. It introduces basic systems concepts, identifies the types of information used in business, and describes the flows of information through an organization. This section also presents a framework for viewing AIS in relation to other information systems components. The second section of the chapter deals with the impact of organizational structure on AIS. Here we examine the business organization as a system of functional areas. The accounting function plays

an important role as the purveyor of financial information for the rest of the organization. The third section reviews the evolution of information systems. Over the years, AIS has been represented by a number of different approaches or models. Five AIS models are examined. The final section discusses the role of accountants as users, designers, and auditors of AIS.

The Information Environment

We begin the study of AIS with the recognition that information is a business resource. Like the other business resources of raw materials, capital, and labor, information is vital to the survival of the contemporary business organization. Every business day, vast quantities of information flow to decision makers and other users to meet a variety of internal needs. In addition, information flows out from the organization to external users, such as customers, suppliers, and stakeholders who have an interest in the firm. Figure 1-1 presents an overview of these internal and external information flows. The pyramid in Figure 1-1 shows the business organization divided horizontally into several levels of activity. Business operations form the base of the pyramid. These activities consist of the product-oriented work of the organization, such as manufacturing, sales, and distribution. Above the base level, the organization is divided into three management tiers: operations management, middle management, and top management. Operations management is directly responsible for controlling day-to-day operations. Middle management is accountable for the short-term planning and coordination of activities necessary to accomplish organizational objectives. Top management is responsible for longer-term planning and setting organizational objectives. Every individual in the organization, from business operations to top management, needs

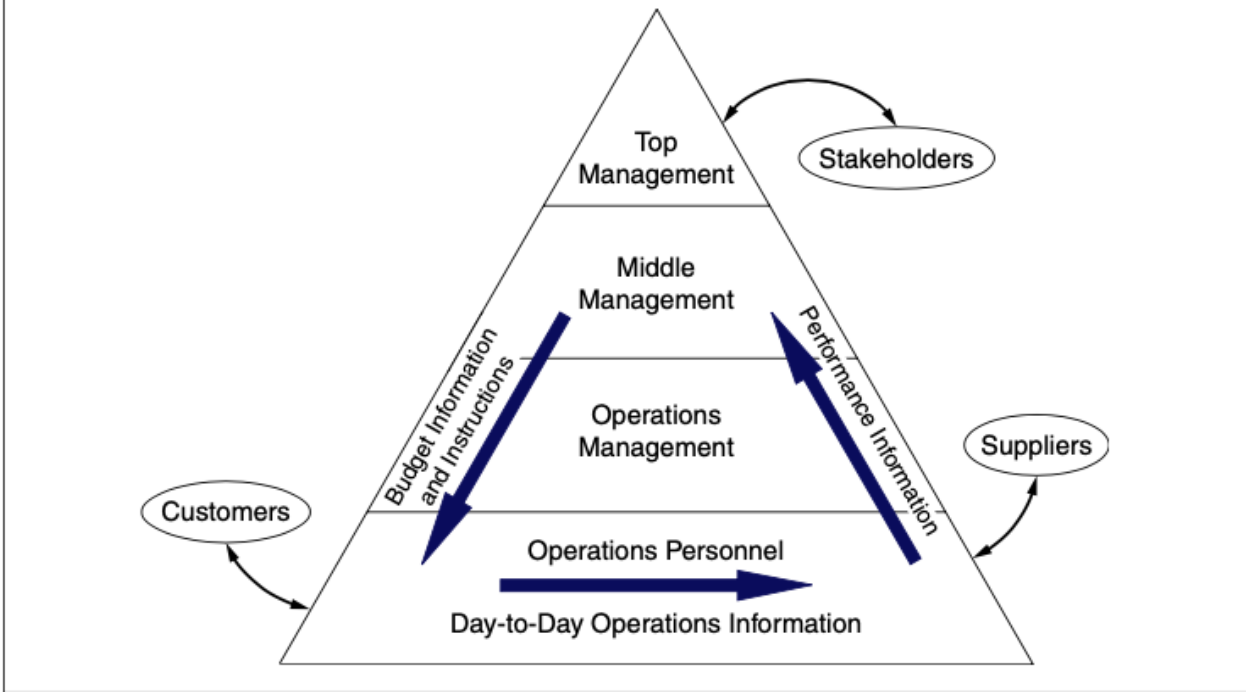
information to accomplish his or her tasks. Notice in Figure 1-1 how information flows in two directions within the organization: horizontally and vertically. The horizontal flow supports operations-level tasks with highly detailed information about the many business transactions affecting the firm. This includes information about events such as the sale and shipment of goods, the use of labor and materials in the production process, and internal transfers of resources from one department to another. The vertical flow distributes information downward from senior managers to junior managers and operations personnel in the form of instructions, quotas, and budgets. In addition, summarized information pertaining to operations and other activities flows upward to managers at all levels. Management uses this information to support its various planning and control functions.

A third flow of information depicted in Figure 1-1 represents exchanges between the organization and users in the external environment. External users fall into two groups: trading partners and stakeholders. Exchanges with trading partners include customer sales and billing information, purchase information for suppliers, and inventory receipts information. Stakeholders are entities outside (or inside) the organization with a direct or indirect interest in the firm. Stockholders, financial institutions, and government agencies are examples of external stakeholders. Information exchanges with these groups include financial statements, tax returns, and stock transaction information. Inside stakeholders include accountants and internal auditors.

All user groups have unique information requirements. The level of detail and the nature of the information these groups receive differ considerably. For example, managers cannot use the highly detailed information needed by operations personnel. Management information is thus more summarized and oriented toward reporting on overall performance

and problems rather than routine operations. The information must identify potential problems in time for management to take corrective action. External stakeholders, on the other hand, require information very different from that of management and operations users. Their financial statement information, based on generally accepted accounting principles (GAAP), is accrual based and far too aggregated for most internal uses.

FIGURE 1-1 INTERNAL AND EXTERNAL FLOWS OF INFORMATION



WHAT IS A SYSTEM?

For many, the term system generates mental images of computers and programming. In fact, the term has much broader applicability. Some systems are naturally occurring, whereas others are artificial. Natural systems range from the atom—a system of electrons, protons, and neutrons—to the universe—a system of galaxies, stars, and planets. All life

forms, plant and animal, are examples of natural systems. Artificial systems are man-made. These systems include everything from clocks to submarines and social systems to information systems.

Elements of a System

Regardless of their origin, all systems possess some common elements. To specify:

A system is a group of two or more interrelated components or subsystems that serve a common purpose.

Let's analyze the general definition to gain an understanding of how it applies to businesses and information systems.

MULTIPLE COMPONENTS. A system must contain more than one part. For example, a yo-yo carved from a single piece of wood and attached to a string is a system. Without the string, it is not a system.

RELATEDNESS. A common purpose relates the multiple parts of the system. Although each part functions independently of the others, all parts serve a common objective. If a particular component does not contribute to the common goal, then it is not part of the system. For instance, a pair of ice skates and a volleyball net are both components; however, they lack a common purpose, and thus do not form a system.

SYSTEM VERSUS SUBSYSTEM. The distinction between the terms system and subsystem is a matter of perspective. For our purposes, these terms are interchangeable. A system is called a subsystem when it is viewed in relation to the larger system of which it is a part. Likewise, a subsystem is called a

system when it is the focus of attention. Animals, plants, and other life forms are systems. They are also subsystems of the ecosystem in which they exist. From a different perspective, animals are systems composed of many smaller subsystems, such as the circulatory subsystem and the respiratory subsystem.

PURPOSE. A system must serve at least one purpose, but it may serve several. Whether a system provides a measure of time, electrical power, or information, serving a purpose is its fundamental justification. When a system ceases to serve a purpose, it should be replaced.

An Example of an Artificial System

An automobile is an example of an artificial system that is familiar to most of us and that satisfies the definition of a system provided previously. To simplify matters, let's assume that the automobile system serves only one purpose: providing conveyance. To do so requires the harmonious interaction of hundreds or even thousands of subsystems. For simplicity, Figure 1-2 depicts only a few of these.

In the figure, two points are illustrated of particular importance to the study of information systems: system decomposition and subsystem interdependency.

SYSTEM DECOMPOSITION. Decomposition is the process of dividing the system into smaller subsystem parts. This is a convenient way of representing, viewing, and understanding the relationships among subsystems. By decomposing a system, we can present the overall system as a hierarchy and view the relationships between subordinate and higher-

level subsystems. Each subordinate subsystem performs one or more specific functions to help achieve the overall objective of the higher-level system. Figure 1-2 shows an automobile decomposed into four primary subsystems: the fuel subsystem, the propulsion subsystem, the electrical subsystem, and the braking subsystem. Each contributes in a unique way to the system's objective, conveyance. These second-level subsystems are decomposed further into two or more subordinate subsystems at a third level. Each third-level subsystem performs a task in direct support of its second-level system.

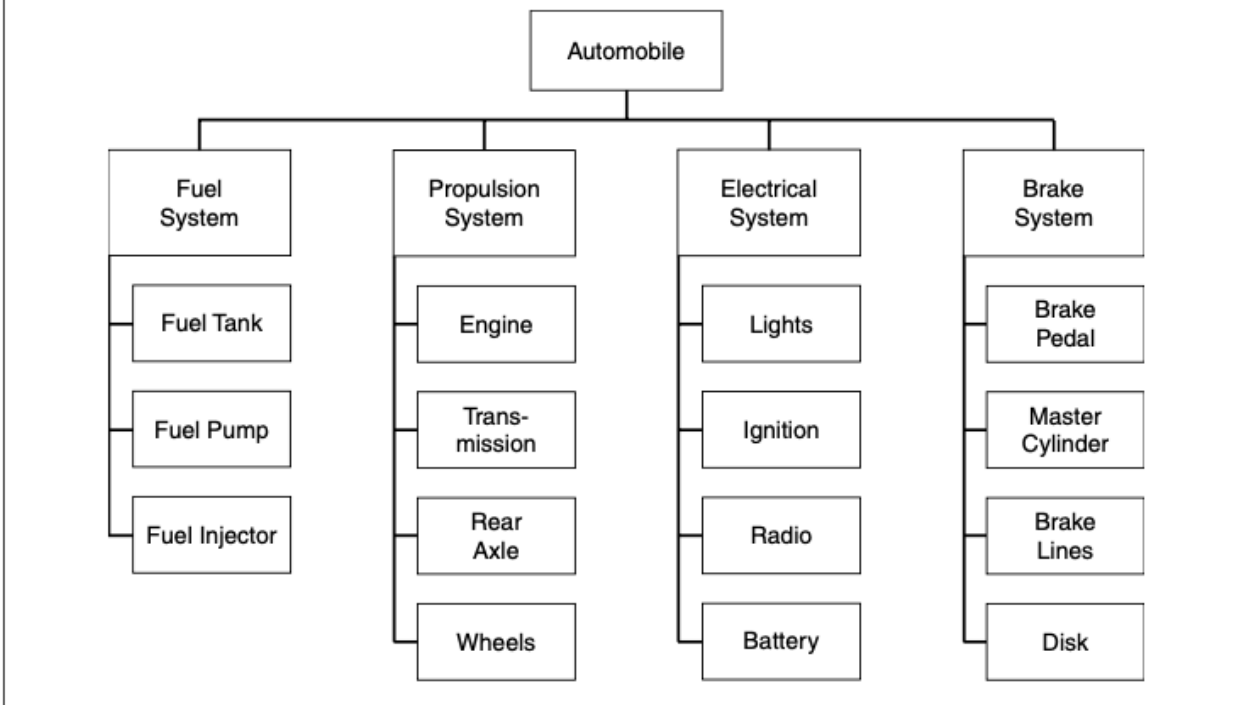
SUBSYSTEM INTERDEPENDENCY. A system's ability to achieve its goal depends on the effective functioning and harmonious interaction of its subsystems. If a vital subsystem fails or becomes defective and can no longer meet its specific objective, the overall system will fail to meet its objective. For example, if the fuel pump (a vital subsystem of the fuel system) fails, then the fuel system fails. With the failure of the fuel system (a vital subsystem of the automobile), the entire system fails. On the other hand, when a nonvital subsystem fails, the primary objective of the overall system can still be met. For instance, if the radio (a subsystem of the electrical system) fails, the automobile can still convey passengers.

Designers of all types of systems need to recognize the consequences of subsystem failure and provide the appropriate level of control. For example, a systems designer may provide control by designing a backup (redundant) subsystem that comes into play when the primary subsystem fails. Control should be provided on a cost-benefit basis. It is neither economical nor necessary to back up every subsystem. Backup is essential, however, when excessive negative consequences result from a subsystem

failure. Hence, virtually every modern automobile has a backup braking system, whereas very few have backup stereo systems.

Like automobile designers, information system designers need to identify critical subsystems, anticipate the risk of their failure, and design cost-effective control procedures to mitigate that risk. Of course, accountants feature prominently in this activity.

FIGURE 1-2 PRIMARY SUBSYSTEM OF AN AUTOMOBILE



AN INFORMATION SYSTEMS FRAMEWORK

The information system is the set of formal procedures by which data are collected, processed into information, and distributed to users.

Figure 1-3 shows the information system of a hypothetical manufacturing firm decomposed into its elemental subsystems. Notice that two broad classes of systems emerge from the decomposition: the

accounting information system (AIS) and the management information system (MIS). We will use this framework to identify the domain of AIS and distinguish it from MIS. Keep in mind that Figure 1-3 is a conceptual view; physical information systems are not typically organized into such discrete packages. More often, MIS and AIS functions are integrated to achieve operational efficiency.

The distinction between AIS and MIS centers on the concept of a transaction, as illustrated by Figure 1-4. The information system accepts input, called transactions, which are converted through various processes into output information that goes to users. Transactions fall into two classes: financial transactions and nonfinancial transactions. Before exploring this distinction, let's first broadly define:

A transaction as an event that affects or is of interest to the organization and is processed by its information system as a unit of work.

This definition encompasses both financial and nonfinancial events. Because financial transactions are of particular importance to the accountant's understanding of information systems, we need a precise definition for this class of transaction:

A financial transaction is an economic event that affects the assets and equities of the organization, is reflected in its accounts, and is measured in monetary terms.

Sales of products to customers, purchases of inventory from vendors, and cash disbursements and receipts are examples of financial transactions. Every business organization is legally bound to correctly process these types of transactions.

Nonfinancial transactions are events that do not meet the narrow definition of a financial transaction. For example, adding a new supplier of raw materials to the list of valid suppliers is an event that may be processed

by the enterprise’s information system as a transaction. Important as this information obviously is, it is not a financial transaction, and the firm has no legal obligation to process it correctly—or at all.

Financial transactions and nonfinancial transactions are closely related and are often processed by the same physical system. For example, consider a financial portfolio management system that collects and tracks stock prices (nonfinancial transactions). When the stocks reach a threshold price, the system places an automatic buy or sell order (financial transaction). Buying high and selling low is not against the law, but it is bad for business. Nevertheless, no law requires company management to design optimal buy and- sell rules into their system. Once the buy-or-sell order is placed, however, the processing of this financial transaction must comply with legal and professional guidelines.

FIGURE 1-3 **A Framework for Information Systems**

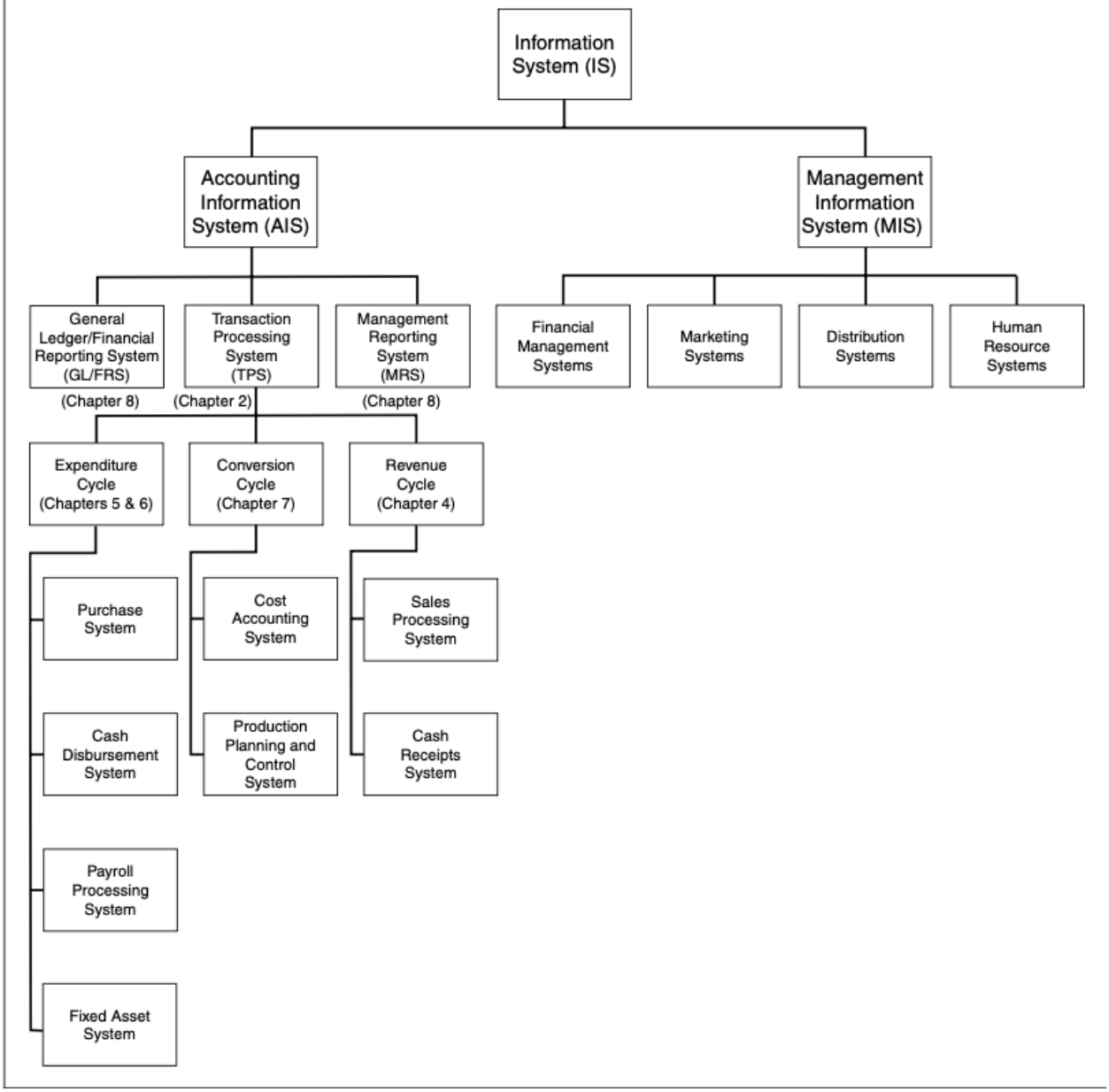
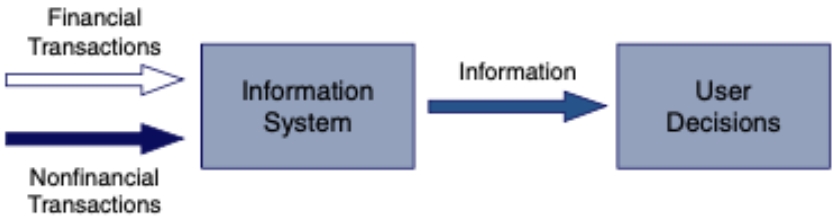


FIGURE 1-4 TRANSACTIONS PROCESSED BY THE INFORMATION SYSTEM



The Accounting Information System

AIS subsystems process financial transactions and nonfinancial transactions that directly affect the processing of financial transactions. For example, changes to customers' names and addresses are processed by the AIS to keep the customer file current. Although not technically financial transactions, these changes provide vital information for processing future sales to the customer.

The AIS is composed of three major subsystems: (1) the transaction processing system (TPS), which supports daily business operations with numerous reports, documents, and messages for users throughout the organization; (2) the general ledger/financial reporting system (GL/FRS), which produces the traditional financial statements, such as the income statement, balance sheet, statement of cash flows, tax returns, and other reports required by law; and (3) the management reporting system (MRS), which provides internal management with special-purpose financial reports and information needed for decision making such as budgets, variance reports, and responsibility reports. We examine each of these subsystems later in this chapter.

The Management Information System

Management often requires information that goes beyond the capability of AIS. As organizations grow in size and complexity, specialized functional areas emerge, requiring additional information for production planning and control, sales forecasting, inventory warehouse planning, market research, and so on. The management information system (MIS) processes nonfinancial transactions that are not normally processed by traditional AIS. Table 1-1 gives examples of typical MIS applications related to functional areas of a firm.

TABLE 1-1 EXAMPLES OF MIS APPLICATIONS IN FUNCTIONAL AREAS

Function	Examples of MIS Applications
Finance	Portfolio management systems Capital budgeting systems
Marketing	Market analysis New product development Product analysis
Distribution	Warehouse organization and scheduling Delivery scheduling Vehicle loading and allocation models
Personnel	Human resource management systems ■ Job skill tracking system ■ Employee benefits system

Why Is It Important to Distinguish between AIS and MIS?

SOX legislation requires that management design and implement internal controls over the entire financial reporting process. This includes the financial reporting system, the general ledger system, and the transaction

processing systems that supply the data for financial reporting. SOX further requires that management certify these controls and that the external auditors express an opinion on control effectiveness. Because of the highly integrative nature of modern information systems, management and auditors need a conceptual view of the information system that distinguishes key processes and areas of risk and legal responsibility from the other (nonlegally binding) aspects of the system. Without such a model, critical management and audit responsibilities under SOX may not be met.

AIS SUBSYSTEMS

At this point, we briefly outline the role of each subsystem depicted in Figure 1-3.

Transaction Processing System

The TPS is central to the overall function of the information system by converting economic events into financial transactions, recording financial transactions in the accounting records (journals and ledgers), and distributing essential financial information to operations personnel to support their daily operations.

The TPS deals with business events that occur frequently. In a given day, a firm may process thousands of transactions. To deal efficiently with such volume, similar types of transactions are grouped together into transaction cycles. The TPS consists of three transaction cycles: the revenue cycle, the expenditure cycle, and the conversion cycle. Each cycle captures and processes different types of financial transactions. Chapter 2 provides an overview of transaction processing. Chapters 3 and 4 examine in detail the revenue and expenditure cycles.

General Ledger/Financial Reporting Systems

The general ledger system (GLS) and the financial reporting system (FRS) are two closely related subsystems. However, because of their operational interdependency, they are generally viewed as a single integrated system—the GL/FRS. The bulk of the input to the GL portion of the system comes from the transaction cycles. Summaries of transaction cycle activity are processed by the GLS to update the general ledger control accounts. Other, less frequent, events such as stock transactions, mergers, and lawsuit settlements, for which there may be no formal processing cycle in place, also enter the GLS through alternate sources.

The FRS measures and reports the status of financial resources and the changes in those resources. The FRS communicates this information primarily to external users. This type of reporting is called nondiscretionary because the organization has few or no choices in the information it provides. Much of this information consists of traditional financial statements, tax returns, and other legal documents.

Management Reporting System

The MRS provides the internal financial information needed to manage a business. Managers must deal immediately with many day-to-day business problems, as well as plan and control their operations. Managers require different information for the various kinds of decisions they must make. Typical reports produced by the MRS include budgets, variance reports, cost-volume-profit analyses, and reports using current (rather than historical) cost data. This type of reporting is called discretionary reporting because the organization can choose what information to report and how to present it.

A GENERAL MODEL FOR AIS

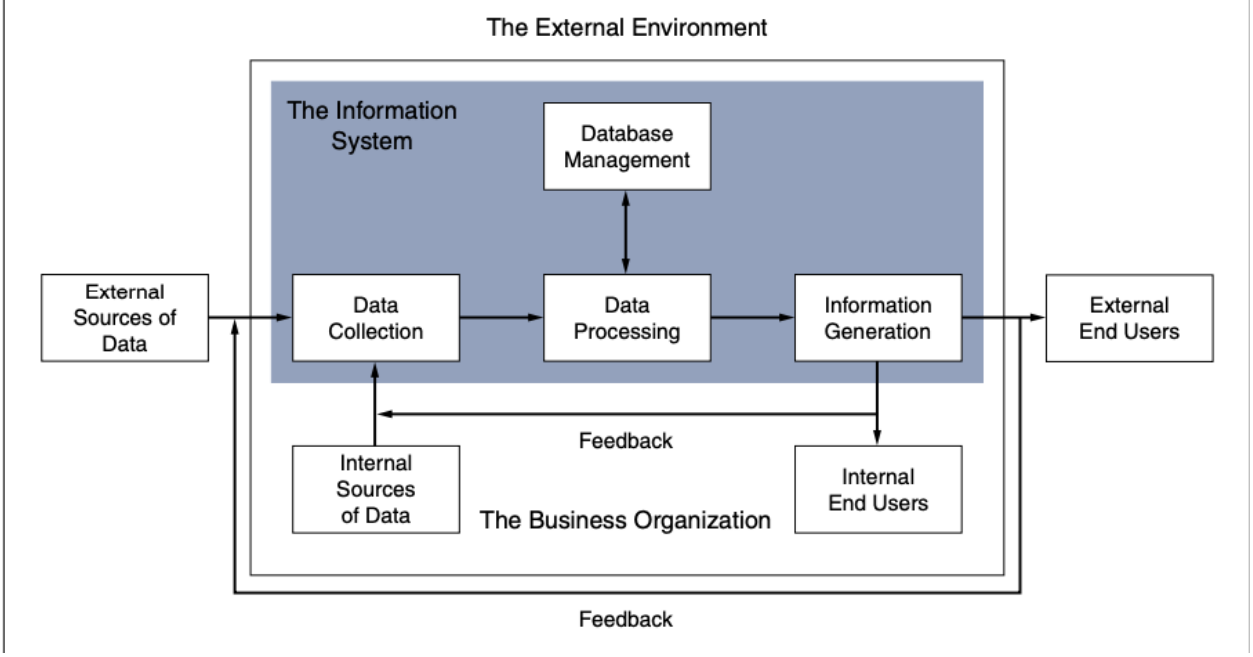
Figure 1-5 presents the general model for viewing AIS applications. This is a general model because it describes all information systems, regardless of their technological architecture. The elements of the general model are end users, data sources, data collection, data processing, database management, information generation, and feedback.

End Users

End users fall into two general groups: external and internal. External users include creditors, stockholders, potential investors, regulatory agencies, tax authorities, suppliers, and customers. Institutional users such as banks, the SEC, and the Internal Revenue Service (IRS) receive information in the form of financial statements, tax returns, and other reports that the firm has a legal obligation to produce. Trading partners (customers and suppliers) receive transaction-oriented information, including purchase orders, billing statements, and shipping documents.

Internal users include management at every level of the organization, as well as operations personnel. In contrast to external reporting, the organization has a great deal of latitude in the way it meets the needs of internal users. Although there are some well-accepted conventions and practices, internal reporting is governed primarily by what gets the job done. System designers, including accountants, must balance the desires of internal users against legal and economic concerns such as adequate control and security, proper accountability, and the cost of providing alternative forms of information. Thus, internal reporting poses a less structured and generally more difficult challenge than external reporting.

FIGURE 1-5 GENERAL MODEL FOR ACCOUNTING INFORMATION SYSTEM



DATA VERSUS INFORMATION. Before discussing the data sources portion of Figure 1-5, we must make an important distinction between the terms data and information. Data are facts, which may or may not be processed (edited, summarized, or refined) and have no direct effect on the user. By contrast, information causes the user to take an action that he or she otherwise could not, or would not, have taken. Information is often defined simply as processed data. This is an inadequate definition. Information is determined by the effect it has on the user, not by its physical form. For example, a purchasing agent receives a daily report listing raw material inventory items that are at low levels. This report causes the agent to place orders for more inventory. The facts in this report have information content for the purchasing agent. However, this same report in the hands of the personnel manager is a mere collection of facts, or data, causing no action and having no information content.

We can see from this example that one person's information is another person's data. Thus, information is not just a set of processed facts arranged in a formal report. Information allows users to take action to resolve conflicts, reduce uncertainty, and make decisions. We should note that action does not necessarily mean a physical act. For instance, a purchasing agent who receives a report showing that inventory levels are adequate will respond by ordering nothing. The agent's action to do nothing is a conscious decision, triggered by information and different from doing nothing because of being uninformed.

The distinction between data and information has pervasive implications for the study of information systems. If output from the information system fails to cause users to act, the system serves no purpose and has failed in its primary objective.

Data Sources

Data sources are financial transactions that enter the information system from both internal and external sources. External financial transactions are the most common source of data for most organizations. These are economic exchanges with other business entities and individuals outside the firm. Examples include the sale of goods and services, the purchase of inventory, the receipt of cash, and the disbursement of cash (including payroll). Internal financial transactions involve the exchange or movement of resources within the organization. Examples include the movement of raw materials into work-in-process (WIP), the application of labor and overhead to WIP, the transfer of WIP into finished goods inventory, and the depreciation of plant and equipment.

Data Collection

Data collection is the first operational stage in the information system. The objective is to ensure that event data entering the system are valid, complete, and free from material errors. In many respects, this is the most important stage in the system. Should transaction errors pass through data collection undetected, the system may process the errors and generate erroneous and unreliable output. This, in turn, could lead to incorrect actions and poor decisions by the users.

Two rules govern the design of data collection procedures: relevance and efficiency. The information system should capture only relevant data. A fundamental task of the system designer is to determine what is and what is not relevant. He or she does so by analyzing the user's needs. Only data that ultimately contribute to information (as defined previously) are relevant. The data collection stage should be designed to filter irrelevant facts from the system.

Efficient data collection procedures are designed to collect data only once. These data can then be made available to multiple users. Capturing the same data more than once leads to data redundancy and inconsistency. Information systems have limited collection, processing, and data storage capacity. Data redundancy overloads facilities and reduces the overall efficiency of the system. Inconsistency among redundant data elements can result in inappropriate actions and bad decisions.

Data Processing

Once collected, data usually require processing to produce information. Tasks in the data processing stage range from simple to complex. Examples include mathematical algorithms (such as linear

programming models) used for production scheduling applications, statistical techniques for sales forecasting, and posting and summarizing procedures used for accounting applications.

Database Management

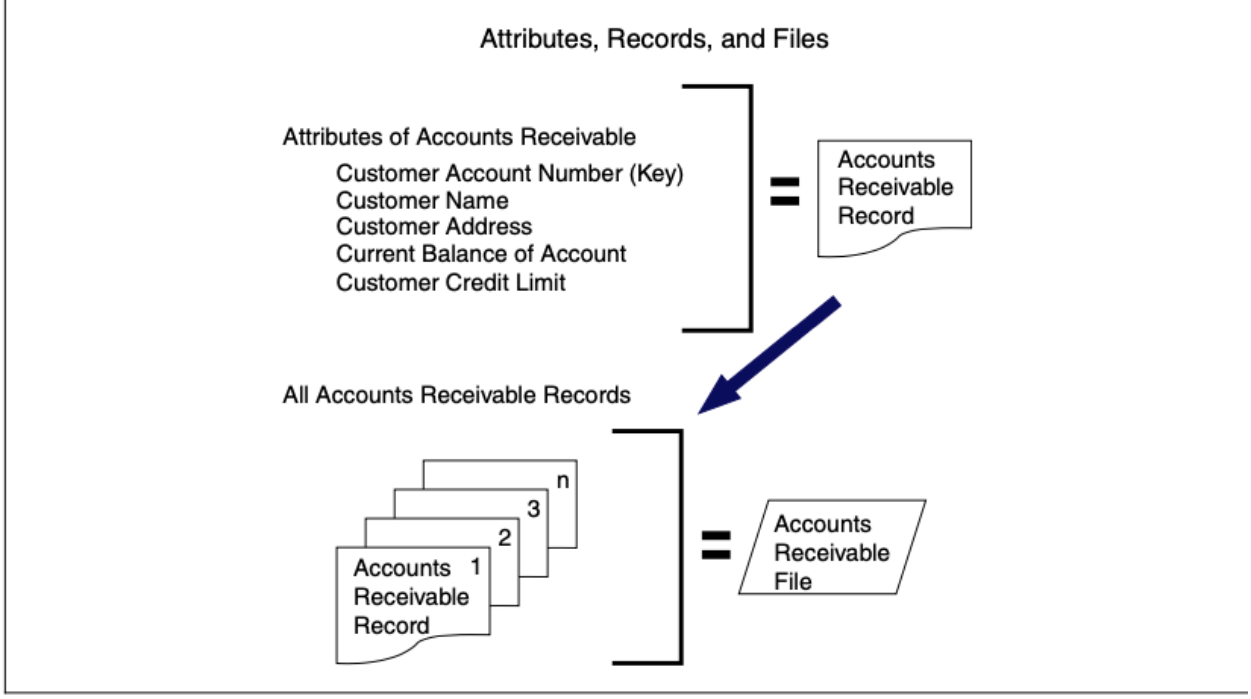
The organization's database is its physical repository for financial and nonfinancial data. We use the term database in the generic sense. It can be a filing cabinet or a computer disk. Regardless of the database's physical form, we can represent its contents in a logical hierarchy. The levels in the data hierarchy— attribute, record, and file—are illustrated in Figure 1-6.

DATA ATTRIBUTE. The data attribute is the most elemental piece of potentially useful data in the database. An attribute is a logical and relevant characteristic of an entity about which the firm captures data. The attributes shown in Figure 1-6 are logical because they all relate sensibly to a common entity— accounts receivable (AR). Each attribute is also relevant because it contributes to the information content of the entire set. As proof of this, the absence of any single relevant attribute diminishes or destroys the information content of the set. The addition of irrelevant or illogical data would not enhance the information content of the set.

RECORD. A record is a complete set of attributes for a single occurrence within an entity class. For example, a particular customer's name, address, and account balance is one occurrence (or record) within the AR class. To find a particular record within the database, we must be able to identify it uniquely. Therefore, every record in the database must be unique in at least one attribute.1 This unique identifier attribute is the primary key. Because no

natural attribute (such as customer name) can guarantee uniqueness, we typically assign artificial keys to records. The key for the AR records in Figure 1-6 is the customer account number. This is the only unique identifier in this record class. The other attributes possess values that may also exist in other records. For instance, multiple customers may have the same name, sales amounts, credit limits, and balances. Using any one of these as a key to find a record in a large database would be a difficult task. These nonunique attributes are, however, often used as secondary keys for categorizing data. For example, the account balance attribute can be used to prepare a list of customers with balances greater than $10,000.

FIGURE 1-6 THE DATA HIERARCHY



FILES. A file is a complete set of records of an identical class. For example, all the AR records of the organization constitute the AR file. Similarly, files

are constructed for other classes of records such as inventory, accounts payable, and payroll. The organization's database is the entire collection of such files.

DATABASE MANAGEMENT TASKS. Database management involves three fundamental tasks: storage, retrieval, and deletion. The storage task assigns keys to new records and stores them in their proper location in the database. Retrieval is the task of locating and extracting an existing record from the database for processing. After processing is complete, the storage task restores the updated record to its place in the database. Deletion is the task of permanently removing obsolete or redundant records from the database.

Information Generation

Information generation is the process of compiling, arranging, formatting, and presenting information to users. Information can be an operational document such as a sales order, a structured report, or a message on a computer screen. Regardless of physical form, useful information has the following characteristics: relevance, timeliness, accuracy, completeness, and summarization.

RELEVANCE. The contents of a report or document must serve a purpose. This could be to support a manager's decision or a clerk's task. We have established that only data relevant to a user's action have information content. Therefore, the information system should present only relevant data in its reports. Reports containing irrelevancies waste resources and may be counterproductive to the user. Irrelevancies detract attention from the true message of the report and may result in incorrect decisions or actions.

TIMELINESS. The age of information is a critical factor in determining its usefulness. Information must be no older than the time of the action it supports. For example, if a manager makes decisions daily to purchase inventory from a supplier based on an inventory status report, then the information in the report should be no more than a day old.

ACCURACY. Information must be free from material errors. However, materiality is a difficult concept to quantify. It has no absolute value; it is a problem-specific concept. This means that, in some cases, information must be perfectly accurate. In other instances, the level of accuracy may be lower. Material error exists when the amount of inaccuracy in information causes the user to make poor decisions or to fail to make necessary decisions. We sometimes must sacrifice absolute accuracy to obtain timely information. Often, perfect information is not available within the user's decision time frame. Therefore, in providing information, system designers seek a balance between information that is as accurate as possible, yet timely enough to be useful.

COMPLETENESS. No piece of information essential to a decision or task should be missing. For example, a report should provide all necessary calculations and present its message clearly and unambiguously.

SUMMARIZATION. Information should be aggregated in accordance with the user's needs. Lower level managers tend to need information that is highly detailed. As information flows upward through the organization to top management, it becomes more summarized. We shall look more closely at

the effects that organizational structure and managerial level have on information reporting later in this chapter.

Feedback

Feedback is a form of output that is sent back to the system as a source of data. Feedback may be internal or external and is used to initiate or alter a process. For example, an inventory status report signals the inventory control clerk that items of inventory have fallen to, or below, their minimum allowable levels. Internal feedback from this information will initiate the inventory ordering process to replenish the inventories. Similarly, external feedback about the level of uncollected customer accounts can be used to adjust the organization's credit-granting policies.

Information System Objectives

Each organization must tailor its information system to the needs of its users. Therefore, specific information system objectives may differ from firm to firm. Three fundamental objectives are, however, common to all systems:

1. To support the stewardship function of management. Stewardship refers to management's responsibility to properly manage the resources of the firm. The information system provides information about resource utilization to external users via traditional financial statements and other mandated reports. Internally, management receives stewardship information from various responsibility reports.

2. To support management decision making. The information system supplies managers with the information they need to carry out their decision-making responsibilities.

3. To support the firm's day-to-day operations. The information system provides information to operations personnel to assist them in the efficient and effective discharge of their daily tasks.

ACQUISITION OF INFORMATION SYSTEMS

We conclude this section with a brief discussion of how organizations obtain information systems. Usually, they do so in two ways: (1) they develop customized systems from scratch through in-house systems development activities, and (2) they purchase preprogrammed commercial systems from software vendors. Larger organizations with unique and frequently changing needs engage in in-house development. The formal process by which this is accomplished is called the system development life cycle. Smaller companies and larger firms that have standardized information needs are the primary market for commercial software. Three basic types of commercial software are turnkey systems, backbone systems, and vendor-supported systems.

Turnkey systems are completely finished and tested systems that are ready for implementation. Typically, they are general-purpose systems or systems customized to a specific industry. In either case, the end user must have standard business practices that permit the use of canned or off-the-shelf systems. The better turnkey systems have built-in software options that allow the user to customize input, output, and processing through menu choices. However, configuring the systems to meet user needs can be a formidable task.

Backbone systems consist of a basic system structure on which to build. The primary processing logic is preprogrammed, and the vendor then designs the user interfaces to suit the client's unique needs. A backbone system is a compromise between a custom system and a turnkey system. This approach can produce satisfactory results, but customizing the system is costly.

Vendor-supported systems are custom (or customized) systems that client organizations purchase commercially rather than develop in-house. Under this approach, the software vendor designs, implements, and maintains the system for its client. This is a popular option with health care and legal services organizations that have complex systems requirements but are not of sufficient magnitude to justify retaining an in-house systems development staff. Indeed, this has become a popular option for many organizations that traditionally have relied on in-house development but have chosen to outsource these activities. In recent years, public accounting firms have expanded their involvement in the vendor supported market.

Organizational Structure

The structure of an organization reflects the distribution of responsibility, authority, and accountability throughout the organization. These flows are illustrated in Figure 1-7. Firms achieve their overall objectives by establishing measurable financial goals for their operational units. For example, budget information flows downward. This is the mechanism by which senior management conveys to their subordinates the standards against which they will be measured for the coming period. The results of the subordinates' actions, in the form of performance information, flow upward to senior management. Understanding the distribution pattern

of responsibility, authority, and accountability is essential for assessing user information needs.

BUSINESS SEGMENTS

Business organizations consist of functional units or segments. Firms organize into segments to promote internal efficiencies through the specialization of labor and cost-effective resource allocations. Managers within a segment can focus their attention on narrow areas of responsibility to achieve higher levels of operating efficiency. Three of the most common approaches include segmentation by:

1. Geographic Location. Many organizations have operations dispersed across the country and around the world. They do this to gain access to resources, markets, or lines of distribution. A convenient way to manage such operations is to organize the management of the firm around each geographic segment as a quasi-autonomous entity.

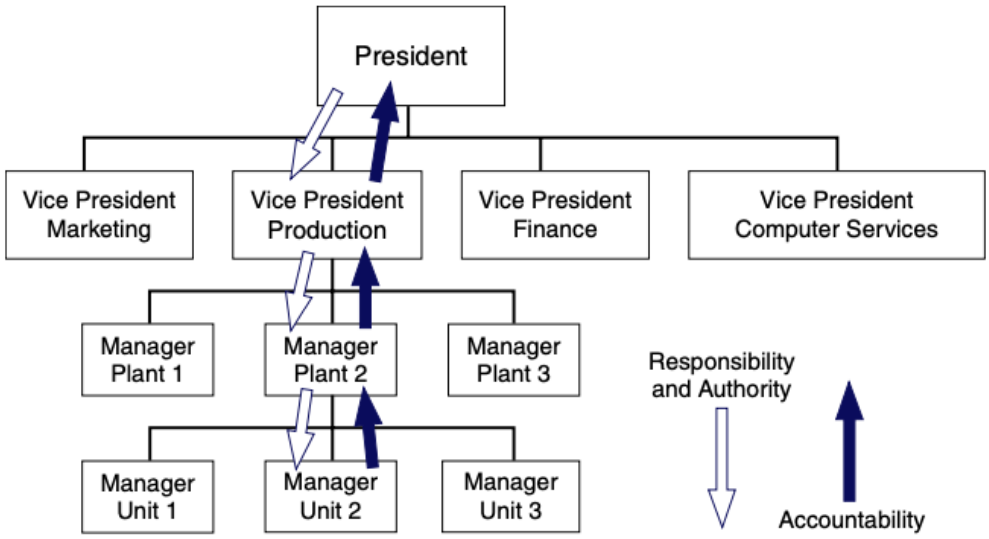
2. Product Line. Companies that produce highly diversified products often organize around product lines, creating separate divisions for each. Product segmentation allows the organization to devote specialized management, labor, and resources to segments separately, almost as if they were separate firms.

3. Business Function. Functional segmentation divides the organization into areas of specialized responsibility based on tasks. The functional areas are determined according to the flow of primary resources through the firm. Examples of business function segments are marketing, production, finance, and accounting.

Some firms use more than one method of segmentation. For instance, an international conglomerate may segment its operations first

geographically, then by product within each geographic region, and then functionally within each product segment.

FIGURE 1-7 THE FLOWS OF RESPONSIBILITY, AUTHORITY, AND ACCOUNTABILITY THROUGH THE ORGANIZATION



FUNCTIONAL SEGMENTATION

Segmentation by business function is the most common method of organizing. To illustrate it, we will assume a manufacturing firm that uses these resources: materials, labor, financial capital, and information. Table 1-2 shows the relationship between functional segments and these resources.

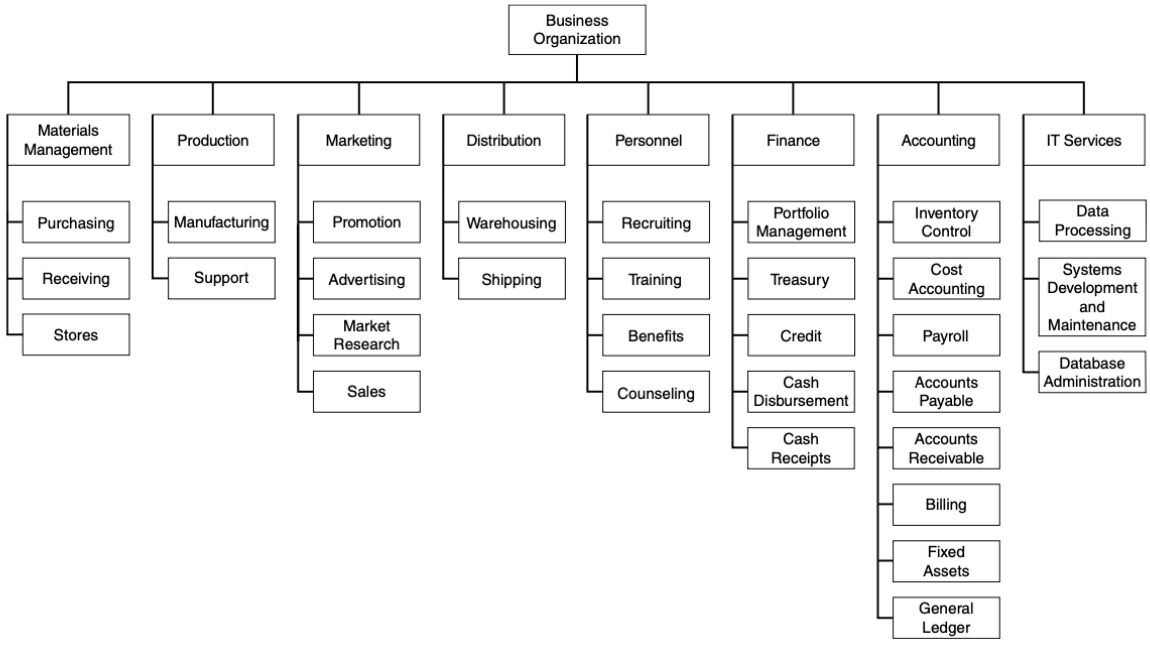
The titles of functions and even the functions themselves will vary greatly among organizations, depending on their size and line of business. A public utility may have little in the way of a marketing function compared with an automobile manufacturer. A service organization may have no formal production function and little in the way of inventory to manage. One firm may call its labor resource personnel, whereas another uses the term human resources. Keeping in mind these variations, we will briefly discuss the

functional areas of the hypothetical firm shown in Figure 1-8. Because of their special importance to the study of information systems, the accounting and information technology (IT) functions are given separate and more detailed treatment.

TABLE 1-2 FUNCTIONS FROM RESOURCES

Resource	Business Function
Materials	Inventory management
	Production
	Marketing
	Distribution
Labor	Personnel
Financial Capital	Finance
Information	Accounting
	Information technology

FIGURE 1-8 FUNCTIONAL AREAS OF A FIRM



Materials Management

The objective of materials management is to plan and control the materials inventory of the company. A manufacturing firm must have sufficient inventories on hand to meet its production needs and yet avoid excessive inventory levels. Every dollar invested in inventory is a dollar that is not earning a return. Furthermore, idle inventory can become obsolete, lost, or stolen. Ideally, a firm would coordinate inventory arrivals from suppliers such that they move directly into the production process. As a practical matter, however, most organizations maintain safety stocks to carry them through the lead time between placing the order for inventory and its arrival. We see from Figure 1-8 that materials management has three subfunctions:

1. Purchasing is responsible for ordering inventory from vendors when inventory levels fall to their reorder points. The nature of this task varies among organizations. In some cases, purchasing is no more than sending a purchase order to a designated vendor. In other cases, this task involves soliciting bids from a number of competing vendors. The nature of the business and the type of inventory determine the extent of the purchasing function.

2. Receiving is the task of accepting the inventory previously ordered by purchasing. Receiving activities include counting and checking the physical condition of these items. This is an organization’s first, and perhaps only, opportunity to detect incomplete deliveries and damaged merchandise before they move into the production process.

3. Stores takes physical custody of the inventory received and releases these resources into the production process as needed.

Production

Production activities occur in the conversion cycle in which raw materials, labor, and plant assets are used to create finished products. The specific activities are determined by the nature of the products being manufactured. In general they fall into two broad classes: (1) primary manufacturing activities and (2) production support activities. Primary manufacturing activities shape and assemble raw materials into finished products. Production support activities ensure that primary manufacturing activities operate efficiently and effectively. These include, but are not limited to, the following types of activities:

Production planning involves scheduling the flow of materials, labor, and machinery to efficiently meet production needs. This requires information about the status of sales orders, raw materials inventory, finished goods inventory, and machine and labor availability.

Quality control monitors the manufacturing process at various points to ensure that the finished products meet the firm's quality standards. Effective quality control detects problems early to facilitate corrective action. Failure to do so may result in excessive waste of materials and labor.

Maintenance keeps the firm's machinery and other manufacturing facilities in running order. The manufacturing process relies on its plant and equipment and cannot tolerate breakdowns during peak production periods. Therefore, the key to maintenance is prevention—the scheduled removal of equipment from operations for cleaning, servicing, and repairs. Many manufacturers have elaborate preventive maintenance programs. To plan and coordinate these activities, maintenance engineers need extensive information about the history of equipment usage and future scheduled production.

Marketing

The marketplace needs to know about, and have access to, a firm's products. The marketing function deals with the strategic problems of product promotion, advertising, and market research. On an operational level, marketing performs such daily activities as sales order entry.

Distribution

Distribution is the activity of getting the product to the customer after the sale. This is a critical step. Much can go wrong before the customer takes possession of the product. Excessive lags between the taking and filling of orders, incorrect shipments, or damaged merchandise can result in customer dissatisfaction and lost sales. Ultimately, success depends on filling orders accurately in the warehouse, packaging goods correctly, and shipping them quickly to the customer.

Personnel

Competent and reliable employees are a valuable resource to a business. The objective of the personnel function is to effectively manage this resource. A well-developed personnel function includes recruiting, training, continuing education, counseling, evaluating, labor relations, and compensation administration.

Finance

The finance function manages the financial resources of the firm through banking and treasury activities, portfolio management, credit evaluation, cash disbursements, and cash receipts. Because of the cyclical nature of business, many firms swing between positions of excess funds and

cash deficits. In response to these cash flow patterns, financial planners seek lucrative investments in stocks and other assets and low-cost lines of credit from banks. The finance function also administers the daily flow of cash in and out of the firm.

THE ACCOUNTING FUNCTION

The accounting function manages the financial information resource of the firm. In this regard, it plays two important roles in transaction processing. First, accounting captures and records the financial effects of the firm's transactions. These include events such as the movement of raw materials from the warehouse into production, shipments of the finished products to customers, cash flows into the firm and deposits in the bank, the acquisition of inventory, and the discharge of financial obligations.

Second, the accounting function distributes transaction information to operations personnel to coordinate many of their key tasks. Accounting activities that contribute directly to business operations include inventory control, cost accounting, payroll, accounts payable, accounts receivable, billing, fixed asset accounting, and the general ledger. For the moment, however, we need to maintain a broad view of accounting to understand its functional role in the organization.

The Value of Information

The value of information to a user is determined by its reliability. We saw earlier that the purpose of information is to lead the user to a desired action. For this to happen, information must possess certain attributes—relevance, accuracy, completeness, summarization, and timeliness. When these attributes are consistently present, information has reliability and

provides value to the user. Unreliable information has no value. At best, it is a waste of resources; at worst, it can lead to dysfunctional decisions. Consider the following example:

A marketing manager signed a contract with a customer to supply a large quantity of product by a certain deadline. He made this decision based on information about finished goods inventory levels. However, because of faulty record keeping, the information was incorrect. The actual inventory levels of the product were insufficient to meet the order, and the necessary quantities could not be manufactured by the deadline. Failure to comply with the terms of the contract may result in litigation.

This poor sales decision was a result of flawed information. Effective decisions require information that has a high degree of reliability.

Accounting Independence

Information reliability rests heavily on the concept of accounting independence. Simply stated, accounting activities must be separate and independent of the functional areas that maintain custody of physical resources. For example, accounting monitors and records the movement of raw materials into production and the sale of finished goods to customers. Accounting authorizes purchases of raw materials and the disbursement of cash payments to vendors and employees. Accounting supports these functions with information but does not actively participate in the physical activities.

THE INFORMATION TECHNOLOGY FUNCTION

Returning to Figure 1-8, the final area to be discussed is the IT function. Like accounting, the IT function is associated with the information resource. Its activities can be organized in a number of different ways. One extreme structure is the centralized data processing approach; at the other extreme

is the distributed data processing approach. Most organizational structures fall somewhere between these extremes and embody elements of both.

Centralized Data Processing

Under the centralized data processing model, all data processing is performed by one or more large computers housed at a central site that serve users throughout the organization. Figure 1-9 illustrates this approach in which IT activities are consolidated and managed as a shared organization resource. End users compete for these resources on the basis of need. The IT function is usually treated as a cost center whose operating costs are charged back to the end users. Figure 1-10 shows the IT areas of operation in more detail. These include database administration, data processing, and systems development and maintenance. The key functions of each of these areas are described next.

DATABASE ADMINISTRATION. Centrally organized companies maintain their data resources in a central location that is shared by all end users. In this shared data arrangement, a special independent group—database administration—headed by the database administrator is responsible for the security and integrity of the database.

FIGURE 1-9

CENTRALIZED DATA PROCESSING APPROACH

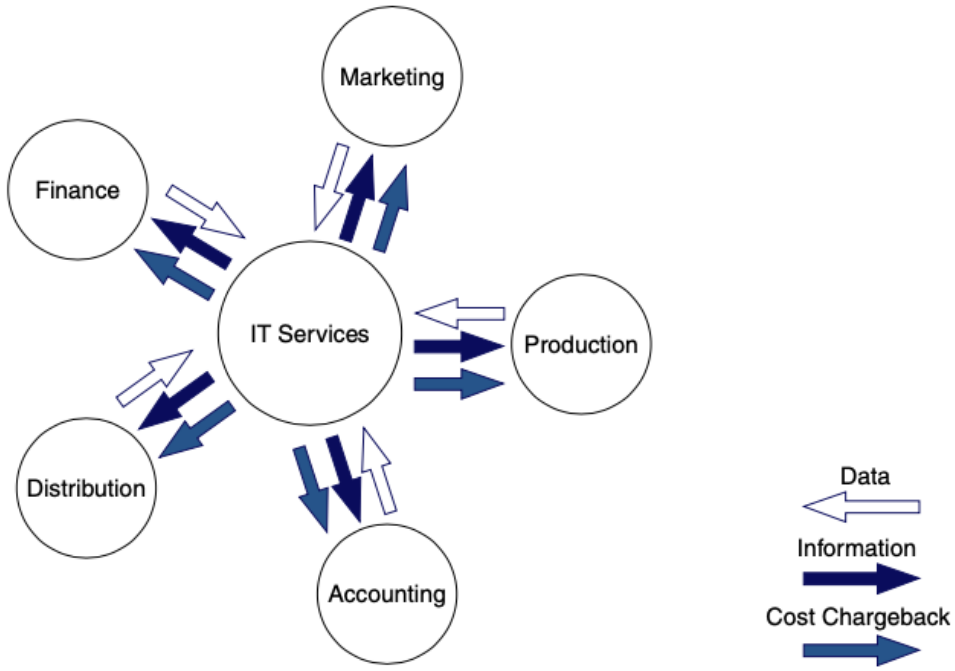
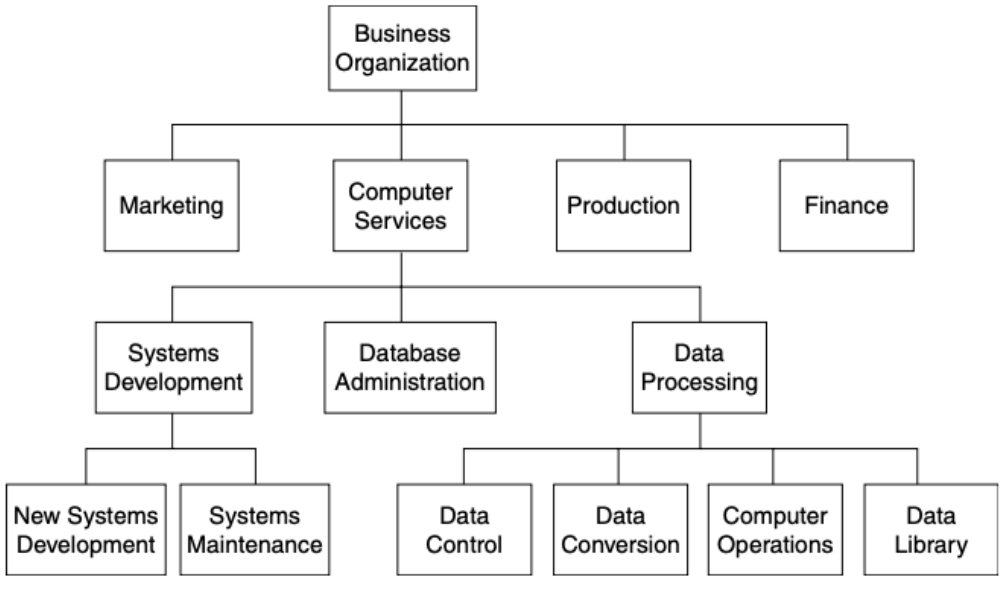


FIGURE 1-10

ORGANIZATION OF IT FUNCTION IN A CENTRALIZED SYSTEM



DATA PROCESSING. The data processing group manages the computer resources used to perform the day-to-day processing of transactions. It may consist of the following functions: data control, data conversion, computer operations, and the data library.

Data control groups have all but disappeared from modern organizations. Traditionally, this function was responsible for receiving batches of transaction documents for processing from end users and then distributing computer output (documents and reports) back to the users. Today this function is usually automated and distributed back to the end users. Some organizations with older legacy systems, however, may still use a data control group as a liaison between the end user and data processing. The data conversion function transcribes transaction data from source (paper) documents to digital media (tape or disk) suitable for computer processing by the central computer, which is managed by the computer operations group. Accounting applications are usually run according to a strict schedule that is controlled by the central computer.

The data library is a room often adjacent to the computer center that provides safe storage for the offline data files, such as magnetic tapes and removable disk packs. A data librarian who is responsible for the receipt, storage, retrieval, and custody of data files controls access to the library. The librarian issues tapes to computer operators and takes custody of files when processing is completed. The move to real time processing and direct access files has reduced or eliminated the role of the data librarian in most organizations.

SYSTEMS DEVELOPMENT AND MAINTENANCE. The information needs of users are met by two related functions: systems development and systems maintenance. The former group is responsible for analyzing user needs and for designing new systems to satisfy those needs. The participants in system development include systems professionals, end users, and stakeholders.

Systems professionals include systems analysts, database designers, and programmers who design and build the system. Systems professionals gather facts about the user's problem, analyze the facts, and formulate a solution. The product of their efforts is a new information system.

End users are those for whom the system is built. They are the managers who receive reports from the system and the operations personnel who work directly with the system as part of their daily responsibilities.

Stakeholders are individuals inside or outside the firm who have an interest in the system but are not end users. They include management, internal auditors, and consultants who oversee systems development.

Once a new system has been designed and implemented, the systems maintenance group assumes responsibility for keeping it current with user needs. Over the course of the system's life (often several years), between 80 and 90 percent of its total cost will be attributable to maintenance activities.

Distributed Data Processing

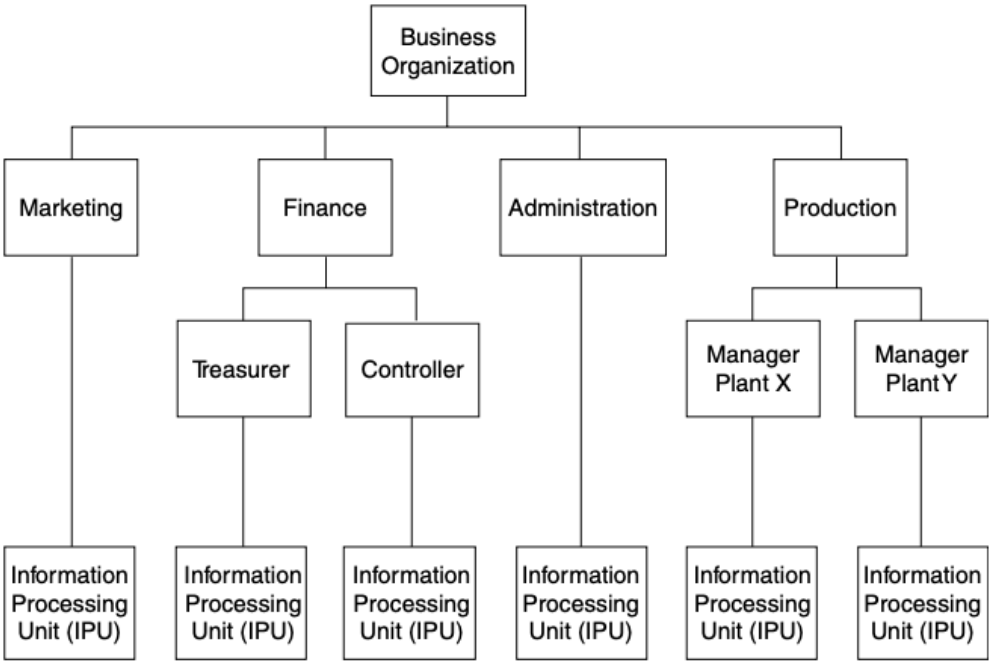
An alternative to the centralized model is the concept of distributed data processing (DDP). The topic of DDP is quite broad, touching on such related topics as end-user computing, commercial software, networking, and office automation. Simply stated, DDP involves reorganizing the IT function into small information processing units (IPUs) that are distributed to end

users and placed under their control. IPUs may be distributed according to business function, geographic location, or both. Any or all of the IT activities represented in Figure 1-10 may be distributed. Figure 1-11 shows a possible new organizational structure following the distribution of all data processing tasks to the end-user areas.

Notice that the central IT function has been eliminated from the organization structure. Individual operational areas now perform this role. In recent years, DDP has become an economic and operational feasibility that has revolutionized business operations. However, DDP is a mixed bag of advantages and disadvantages.

DISADVANTAGES OF DDP. We should bear in mind that the disadvantages of DDP might also be described as the advantages of a centralized approach. The discussion focuses on important issues that carry control implications that accountants should recognize. The loss of control is one of the most serious disadvantages of DDP. Other potential problems include the inefficient use of resources, the destruction of audit trails, inadequate segregation of duties, an increased potential for programming errors and systems failures, and the lack of standards. Specific problems are examined in the following section.

FIGURE 1-11 ORGANIZATIONAL STRUCTURE FOR A DISTRIBUTED PROCESSING SYSTEM



Mismanagement of organization-wide resources. Some argue that when organization-wide resources exceed a threshold amount, say 5 percent of the total operations budget, they should be controlled and monitored centrally. Information processing services (such as computer operations, programming, data conversion, and database management) represent a significant expenditure for many organizations. Those opposed to DDP argue that distributing responsibility for these resources will inevitably lead to their mismanagement and suboptimal utilization.

Hardware and software incompatibility. Distributing the responsibility for hardware and software purchases to user management can result in uncoordinated and poorly conceived decisions. Working independently, decision makers may settle on dissimilar and incompatible operating systems, technology platforms, spreadsheet programs, word processors,

and database packages. Such hardware and software incompatibilities can degrade and disrupt communications between organizational units.

Redundant tasks. Autonomous systems development activities distributed throughout the firm can result in each user area reinventing the wheel. For example, application programs created by one user, which could be used with little or no change by others, will be redesigned from scratch rather than shared. Likewise, data common to many users may be recreated for each IPU, resulting in a high level of data redundancy.

Consolidating incompatible activities. The distribution of the IT function to individual user areas results in the creation of many very small units that may not permit the necessary separation of incompatible functions. For example, within a single IPU, the same person may program applications, perform program maintenance, enter transaction data into the computer, and operate the computer equipment. This situation represents a fundamental violation of internal control.

Hiring qualified professionals. End-user managers may lack the knowledge to evaluate the technical credentials and relevant experience of candidates applying for a position as a computer professional. Also, if the organizational unit into which a new employee is entering is small, the opportunity for personal growth, continuing education, and promotion may be limited. For these reasons, IPU managers sometimes experience difficulty attracting highly qualified personnel, which increases the risk of programming errors and systems failures.

Lack of standards. Because of the distribution of responsibility in the DDP environment, standards for developing and documenting systems, choosing programming languages, acquiring hardware and software, and evaluating performance may be unevenly applied or nonexistent. Opponents

of DDP argue that the risks associated with the design and operation of a data processing system are made tolerable only if such standards are consistently applied. This requires that standards be imposed centrally.

ADVANTAGES OF DDP. The most commonly cited advantages of DDP are related to cost savings, increased user satisfaction, and improved operational efficiency. Specific issues are discussed in the following section.

Cost reductions. In the past, achieving economies of scale was the principal justification for the centralized approach. The economics of data processing favored large, expensive, powerful computers. The wide variety of needs that such centralized systems had to satisfy called for computers that were highly generalized and employed complex operating systems.

Powerful yet inexpensive small-scale computer systems, which can cost-effectively perform specialized functions, have changed the economics of data processing dramatically. In addition, the unit cost of data storage, which was once the justification for consolidating data in a central location, is no longer the prime consideration. Moreover, the move to DDP can reduce costs in two other areas: (1) data can be entered and edited at the IPU, thus eliminating the centralized tasks of data conversion and data control; and (2) application complexity can be reduced, which in turn reduces development and maintenance costs.

Improved cost control responsibility. Managers assume the responsibility for the financial success of their operations. This requires that they be properly empowered with the authority to make decisions about resources that influence their overall success. Therefore, if information-processing capability is critical to the success of a business operation, then should management not be given control over these resources? This

argument counters the argument presented earlier favoring the centralization of organization- wide resources. Proponents of DDP argue that the benefits from improved management attitudes outweigh the additional costs incurred from distributing these resources.

Improved user satisfaction. Perhaps the most often cited benefit of DDP is improved user satisfaction. This derives from three areas of need that too often go unsatisfied in the centralized approach: (1) as previously stated, users desire to control the resources that influence their profitability; (2) users want systems professionals (analysts, programmers, and computer operators) who are responsive to their specific situation; and (3) users want to become more actively involved in developing and implementing their own systems. Proponents of DDP argue that providing more customized support— feasible only in a distributed environment—has direct benefits for user morale and productivity.

Backup. The final argument in favor of DDP is the ability to back up computing facilities to protect against potential disasters such as fires, floods, sabotage, and earthquakes. One solution is to build excess capacity into each IPU. If a disaster destroys a single site, its transactions can be processed by the other IPUs. This requires close coordination between decision makers to ensure that they do not implement incompatible hardware and software at their sites.

The Need for Careful Analysis

DDP carries a certain leading-edge prestige value that, during an analysis of its pros and cons, may overwhelm important considerations of economic benefit and operational feasibility. Some organizations have made the move to DDP without fully considering whether the distributed

organizational structure will better achieve their business objectives. Some DDP initiatives have proven ineffective, and even counterproductive, because decision makers saw in these systems virtues that were more symbolic than real. Before taking such an aggressive step, decision makers should assess the true merits of DDP for their organization. Accountants have an opportunity and an obligation to play an important role in this analysis.

The Evolution of Information System Models

Over the past 50 years, a number of different approaches or models have represented AIS. Each new model evolved because of the shortcomings and limitations of its predecessor. An interesting feature in this evolution is that the newest technique does not immediately replace older models. Thus, at any point in time, various generations of systems exist across different organizations and may even coexist within a single enterprise. The modern auditor needs to be familiar with the operational features of all AIS approaches that he or she is likely to encounter. This book deals extensively with five such models: manual processes, flat-file systems, the database approach, the REA (resources, events, and agents) model, and ERP (enterprise resource planning) systems. Each of these is briefly outlined in the following section.

THE MANUAL PROCESS MODEL

The manual process model is the oldest and most traditional form of accounting systems. Manual systems constitute the physical events, resources, and personnel that characterize many business processes. This includes such tasks as order-taking, warehousing materials, manufacturing

goods for sale, shipping goods to customers, and placing orders with vendors. Traditionally, this model also includes the physical task of record keeping. Often, manual record keeping is used to teach the principles of accounting to business students. However, this approach is simply a training aid. Manual records are never used in practice today.

Nevertheless, there is merit in studying the manual process model before mastering computer-based systems. First, learning manual systems helps establish an important link between the AIS course and other accounting courses. The AIS course is often the only accounting course in which students see where data originate, how they are collected, and how and where information is used to support day-to-day operations. By examining information flows, key tasks, and the use of traditional accounting records in transaction processing, the students' bookkeeping focus is transformed into a business processes perspective.

Second, the logic of a business process is more easily understood when it is not shrouded by technology. The information needed to trigger and support events such as selling, warehousing, and shipping is fundamental and independent of the technology that underlies the information system. For example, a shipping notice informing the billing process that a product has been shipped serves this purpose whether it is produced and processed manually or digitally. Once students understand what tasks need to be performed, they are better equipped to explore different and better ways of performing these tasks through technology.

Finally, manual procedures facilitate understanding internal control activities, including segregation of functions, supervision, independent verification, audit trails, and access controls. Because human nature lies at

the heart of many internal control issues, we should not overlook the importance of this aspect of the information system.

THE FLAT-FILE MODEL

The flat-file approach is most often associated with so-called legacy systems. These are large mainframe systems that were implemented in the late 1960s through the 1980s. Organizations today still use these systems extensively. Eventually, modern database management systems will replace them, but in the meantime, accountants must continue to deal with legacy system technologies.

The flat-file model describes an environment in which individual data files are not related to other files. End users in this environment own their data files rather than share them with other users. Thus, stand-alone applications rather than integrated systems perform data processing.

When multiple users need the same data for different purposes, they must obtain separate data sets structured to their specific needs. Figure 1-12 illustrates how customer sales data might be presented to three different users in a durable goods retailing organization. The accounting function needs customer sales data organized by account number and structured to show outstanding balances. This is used for customer billing, AR maintenance, and financial statement preparation. Marketing needs customer sales history data organized by demographic keys. They use this for targeting new product promotions and for selling product upgrades. The product services group needs customer sales data organized by products and structured to show scheduled service dates. Such information is used for making after-sales contacts with customers to schedule preventive maintenance and to solicit sales of service agreements.

The data redundancy demonstrated in this example contributes to three significant problems in the flat-file environment: data storage, data updating, and currency of information. These and other problems associated with flat files are discussed in the following sections.

Data Storage

An efficient information system captures and stores data only once and makes this single source available to all users who need it. In the flat-file environment, this is not possible. To meet the private data needs of users, organizations must incur the costs of both multiple collection and multiple storage procedures. Some commonly used data may be duplicated dozens, hundreds, or even thousands of times.

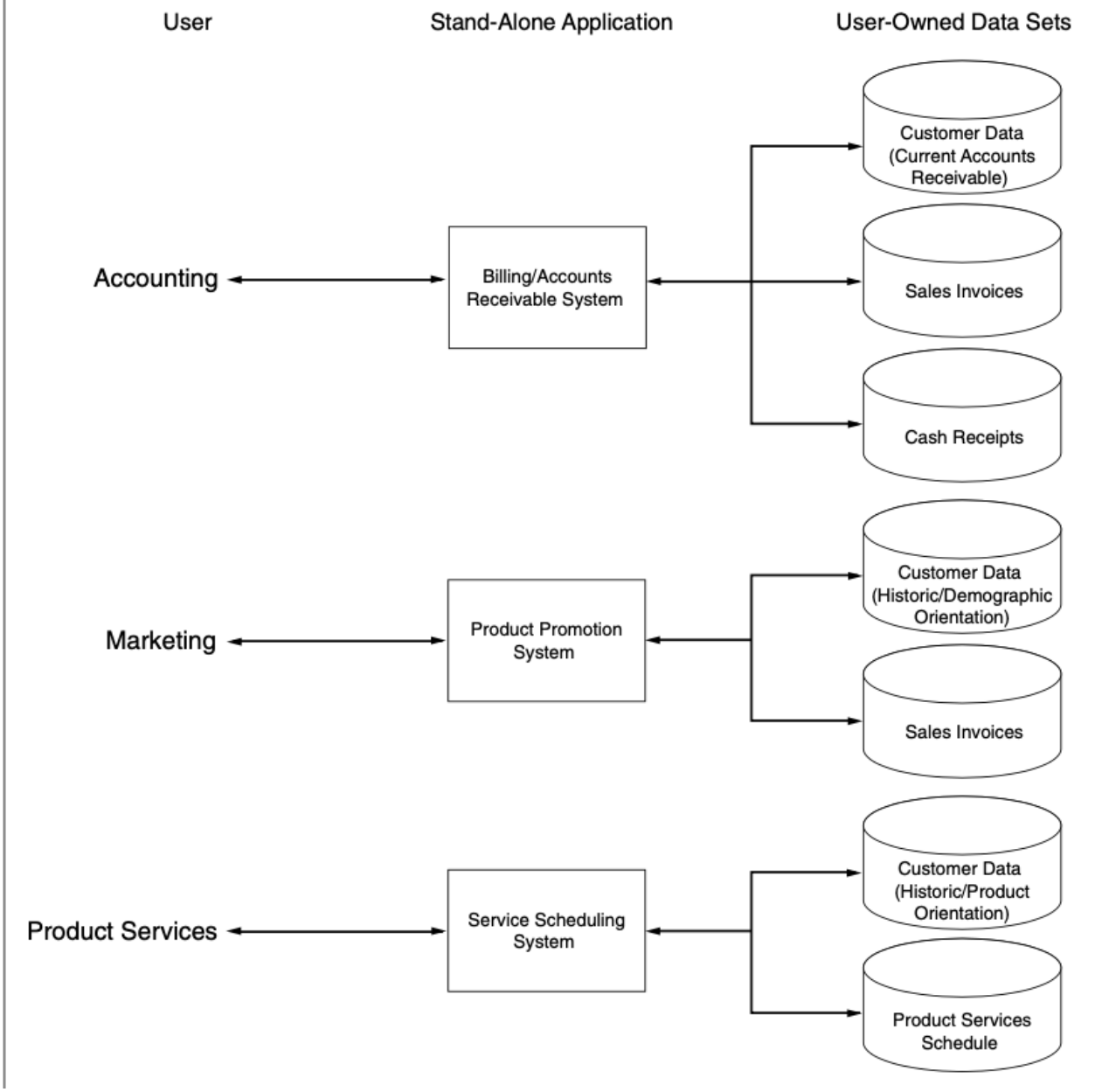
Data Updating

Organizations have a great deal of data stored in files that require periodic updating to reflect changes. For example, a change to a customer's name or address must be reflected in the appropriate master files. When users keep separate files, all changes must be made separately for each user. This adds significantly to the task and the cost of data management.

Currency of Information

In contrast to the problem of performing multiple updates is the problem of failing to update all the user files affected by a change in status. If update information is not properly disseminated, the change will not be reflected in some users' data, resulting in decisions based on outdated information.

FIGURE 1-12 FLAT-FILE MODEL



Task-Data Dependency

Another problem with the flat-file approach is the user's inability to obtain additional information as his or her needs change. This problem is called task-data dependency. The user's information set is constrained by

the data that he or she possesses and controls. Users act independently rather than as members of a user community. In such an environment, it is very difficult to establish a mechanism for the formal sharing of data. Therefore, new information needs tend to be satisfied by procuring new data files. This takes time, inhibits performance, adds to data redundancy, and drives data management costs even higher.

Flat Files Limit Data Integration

The flat-file approach is a single-view model. Files are structured, formatted, and arranged to suit the specific needs of the owner or primary user of the data. Such structuring, however, may exclude data attributes that are useful to other users, thus preventing successful integration of data across the organization. For example, because the accounting function is the primary user of accounting data, these data are often captured, formatted, and stored to accommodate financial reporting and generally accepted accounting principles. This structure, however, may be useless to the organization's other (nonaccounting) users of accounting data (GAAP), such as the marketing, finance, production, and engineering functions. These users are presented with three options: (1) do not use accounting data to support decisions; (2) manipulate and massage the existing data structure to suit their unique needs; or (3) obtain additional private sets of the data and incur the costs and operational problems associated with data redundancy.

In spite of these inherent limitations, many large organizations still use flat files for their general ledger and other financial systems. Most members of the data processing community assumed that the end of the century would see the end of legacy systems. Instead, corporate America invested billions of dollars making these systems year-2000 (Y2K) compliant. Legacy

systems continue to exist because they add value for their users, and they will not be replaced until they cease to add value. Students who may have to work with these systems in practice should be aware of their key features.

THE DATABASE MODEL

An organization can overcome the problems associated with flat files by implementing the database model to data management. Figure 1 13 illustrates how this approach centralizes the organization's data into a common database that is shared by other users. With the organization's data in a central location, all users have access to the data they need to achieve their respective objectives. Access to the data resource is controlled by a database management system (DBMS). The DBMS is a special software system that is programmed to know which data elements each user is authorized to access. The user's program sends requests for data to the DBMS, which validates and authorizes access to the database in accordance with the user's level of authority. If the user requests data that he or she is not authorized to access, the request is denied. Clearly, the organization's procedures for assigning user authority are an important control issue for auditors to consider.

The most striking difference between the database model and the flat-file model is the pooling of data into a common database that all organizational users share. With access to the full domain of entity data, changes in user information needs can be satisfied without obtaining additional private data sets. Users are constrained only by the limitations of the data available to the entity and the legitimacy of their need to access it. Through data sharing, the following traditional problems associated with the flat-file approach may be overcome:

Elimination of data redundancy. Each data element is stored only once, thereby eliminating data redundancy and reducing data collection and storage costs. For example, customer data exist only once, but is shared by accounting, marketing, and product services users. To accomplish this, the data are stored in a generic format that supports multiple users.

Single update. Because each data element exists in only one place, it requires only a single update procedure. This reduces the time and cost of keeping the database current.

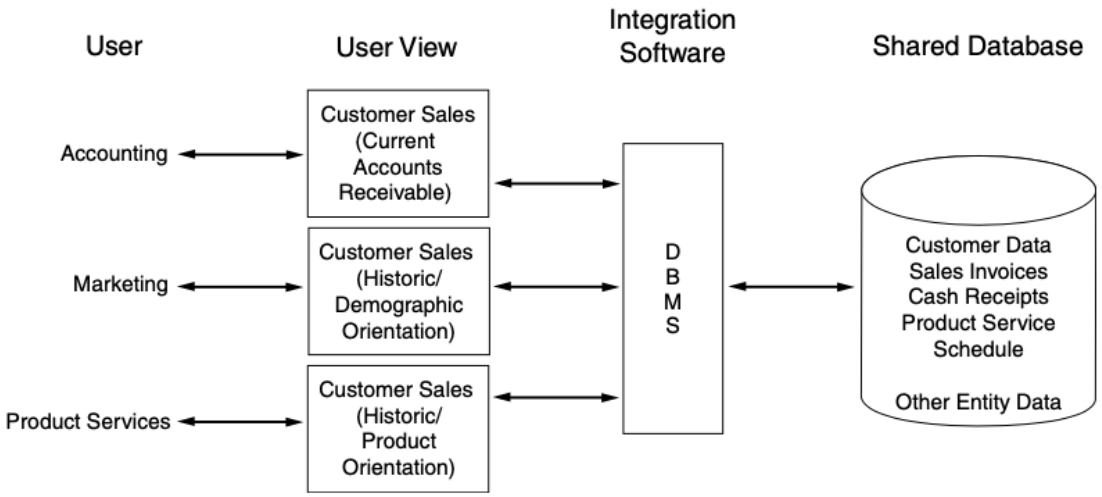
Current values. A single change to a database attribute is automatically made available to all users of the attribute. For example, a customer address change is immediately reflected in the marketing and product services views when the billing clerk enters it.

Flat-file and early database systems are called traditional systems. Within this context, the term traditional means that the organization's information systems applications (its programs) function independently of each other rather than as an integrated whole. Early database management systems were designed to interface directly with existing flat-file programs. Thus, when an organization replaced its flat files with a database, it did not have to spend millions of dollars rewriting its existing programs. Indeed, early database applications performed essentially the same independent functions as their flat-file counterparts.

Another factor that limited integration was the structured database models of the era. These models were inflexible and did not permit the degree of data sharing that is found in modern database systems. Whereas some degree of integration was achieved with this type of database, the primary and immediate advantage to the organization was the reduction in data redundancy.

True integration, however, would not be possible until the arrival of the relational database model. This flexible database approach permits the design of integrated systems applications capable of supporting the information needs of multiple users from a common set of integrated database tables. We should note, however, that the relational database model merely permits integration to occur; integration is not guaranteed. Poor systems design can occur under any model. In fact, most organizations today that employ a relational database run application that are traditional in design and do not make full use of relational technology. The two remaining models to be discussed (REA and ERP) employ relational database technology more effectively.

FIGURE 1-13 DATABASE MODEL



THE REA MODEL

REA is an accounting framework for modeling an organization's critical resources, events, and agents (REA) and the relationships between them. Once specified, both accounting and nonaccounting data about these

phenomena can be identified, captured, and stored in a relational database. From this repository, user views can be constructed that meet the needs of all users in the organization. The availability of multiple views allows flexible use of transaction data and permits the development of AIS that promote, rather than inhibit, integration.

The REA model was proposed in 1982 as a theoretical model for accounting.3 Advances in database technology have focused renewed attention on REA as a practical alternative to the classic accounting framework. The following summarizes the key elements of the REA models.

Resources

Economic resources are the assets of the organization. They are defined as objects that are both scarce and under the control of the enterprise. This definition departs from the traditional model because it does not include AR. An account receivable is an artifact record used simply to store and transmit data. Because it is not an essential element of the system, it does not need to be included in the database. Instead, AR values are derived from the difference between sales to customers and the cash received in payment of sales.

Events

Economic events are phenomena that affect changes in resources. They can result from activities such as production, exchange, consumption, and distribution. Economic events are the critical information elements of the accounting system and should be captured in a highly detailed form to provide a rich database.

Agents

Economic agents are individuals and departments that participate in an economic event. They are parties both inside and outside the organization with discretionary power to use or dispose of economic resources. Examples of agents include salesclerks, production workers, shipping clerks, customers, and vendors. The REA model requires that accounting phenomena be characterized in a manner consistent with the development of multiple user views. Business data must not be preformatted or artificially constrained and should reflect all relevant aspects of the underlying economic events. As such, REA procedures and databases are structured around events rather than accounting artifacts such as journals, ledgers, charts of accounts, and double-entry accounting. Under the REA model, business organizations prepare financial statements directly from the event database. The following sales and cash receipts events for a hypothetical retailer can be used to illustrate the inherent differences between classic and REA accounting:

Sept. 1: Sold 5 units of product X 21 @ $30 per unit and 10 units of product Y33 @ $20 per unit to customer Smith (Total sale ¼ $350). The unit cost of the inventory is $16 and $12, respectively (Total CGS ¼ $200).

Sept. 30: Received $200 cash from customer Smith on account, check number 451.

In flat-file or non-REA database systems, the two events would be recorded in a set of classic accounts like those shown in Figure 1-14. This involves summarizing the events to accommodate the account structure. However, the details of the transactions are not captured under this approach.

An REA accounting system would capture these transactions in a series of relational database tables that emphasize events rather than

accounts. This is illustrated in Figure 1-15. Each table deals with a separate aspect of the transaction. Data pertaining to the customer, the invoice, specific items sold, and so on can thus be captured for multiple uses and users. The tables of the database are linked via common attributes called primary keys (PK) and embedded foreign keys (FK) that permit integration. In contrast, the files in the traditional system are independent of each other and thus cannot accommodate such detailed data gathering. As a result, traditional systems must summarize event data at the loss of potentially important facts.

Traditional accounting records including journals, ledgers, and charts of accounts do not exist as physical files or tables under the REA model. For financial reporting purposes, views or images of traditional accounting records are constructed from the event tables. For example, the amount of Smith's account receivable balance is derived from [total sales (Quant sold * Sale price) less cash received (Amount) ¼ 350 _ 200 ¼ 150]. If necessary or desired, journal entries and general ledger amounts can also be derived from these event tables. For example, the Cost-of-Goods-Sold control account balance is (Quant sold * Unit cost) summed for all transactions for the period.

REA is a conceptual model, not a physical system. Many of its tenets, however, are found within advanced database systems. The most notable application of REA philosophy is seen in the proliferation of ERP systems, which are discussed in the following section.

FIGURE 1-14 CLASSIC ACCOUNTING RECORDS IN A NON-REA SYSTEM

Accounts Receivable File

Customer Number	Customer Name	Debit	Credit	Balance
23456	Smith	350	200	150

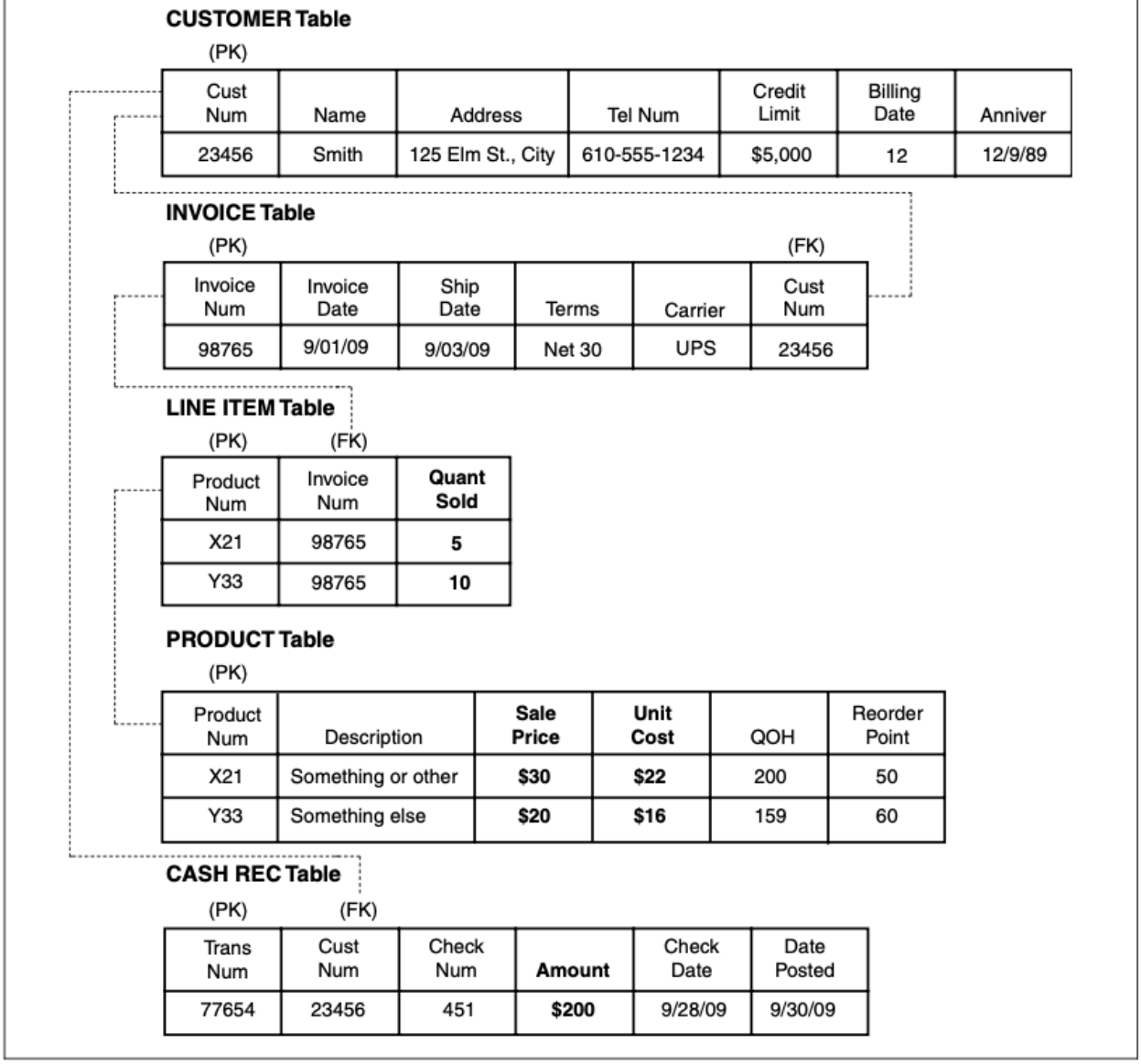
Cost of Goods Sold File

Acct Number	Debit	Credit
5734	270	

Sales File

Acct Number	Credit
4975	350

FIGURE 1-15 EVENT DATABASE IN AN REA SYSTEM



ENTERPRISE RESOURCE PLANNING SYSTEMS

Enterprise resource planning (ERP) is an information system model that enables an organization to automate and integrate its key business processes. ERP breaks down traditional functional barriers by facilitating data sharing, information flows, and the introduction of common business practices among all organizational users. The implementation of an ERP

system can be a massive undertaking that can span several years. Because of the complexity and size of ERPs, few organizations are willing or able to commit the necessary financial and physical resources and incur the risk of developing an ERP system inhouse. Hence, virtually all ERPs are commercial products. The recognized leaders in the market are SAP, Oracle, J.D. Edwards & Co., and PeopleSoft Inc.

ERP packages are sold to client organizations in modules that support standard processes. Some common ERP modules include:

- Asset Management
- Financial Accounting
- Human Resources
- Industry-Specific Solutions
- Plant Maintenance
- Production Planning
- Quality Management
- Sales and Distribution
- Inventory Management

One of the problems with standardized modules is that they may not always meet the organization's exact needs. For example, a textile manufacturer in India implemented an ERP package only to discover that extensive, unexpected, and expensive modifications had to be made to the system. The ERP would not allow the user to assign two different prices to the same bolt of cloth. The manufacturer charged one price for domestic consumption, but another (four times higher) for exported products. That particular ERP system, however, provided no way to assign two prices to the same item while maintaining an accurate inventory count.

Organizations that hope to successfully implement an ERP will need to modify their business processes to suit the ERP, modify the ERP to suit their business, or, more likely, modify both. Often, additional software applications need to be connected to the ERP to handle unique business functions, particularly industry-specific tasks. These applications, often called bolt-ons, are not always designed to communicate with ERP packages. The process of creating a harmonious whole can be quite complex and sometimes fails, resulting in significant losses to the organization. ERP packages are enormously expensive, but the savings in efficiencies should be significant. Organization management should exercise great care in deciding which, if any, ERP is best for them.

The Role of the Accountant

The final section of this chapter deals with the accountant's relationship to the information system. Accountants are primarily involved in three ways: as system users, designers, and auditors.

ACCOUNTANTS AS USERS

In most organizations, the accounting function is the single largest user of IT. All systems that process financial transactions impact the accounting function in some way. As end users, accountants must provide a clear picture of their needs to the professionals who design their systems. For example, the accountant must specify accounting rules and techniques to be used, internal control requirements, and special algorithms such as depreciation models. The accountant's participation in systems development should be active rather than passive. The principal cause of design errors that result in system failure is the absence of user involvement.

ACCOUNTANTS AS SYSTEM DESIGNERS

An appreciation of the accountant's responsibility for system design requires a historic perspective that predates the computer as a business information tool. Traditionally, accountants have been responsible for key aspects of the information system, including assessing the information needs of users, defining the content and format of output reports, specifying sources of data, selecting the appropriate accounting rules, and determining the controls necessary to preserve the integrity and efficiency of the information system.

These traditional systems were physical, observable, and unambiguous. The procedures for processing information were manual, and the medium for transmitting and storing data was paper. With the arrival of the computer, computer programs replaced manual procedures, and paper records were stored digitally. The role accountants would play in this new era became the subject of much controversy. Lacking computer skills, accountants were generally uncertain about their status and unwilling to explore this emerging technology.

Many accountants relinquished their traditional responsibilities to the new generation of computer professionals who were emerging in their organizations. Computer programmers, often with no accounting or business training, assumed full responsibility for the design of AIS. As a result, many systems violated accounting principles and lacked necessary controls. Large system failures and computer frauds marked this period in accounting history. By the mid-1970s, in response to these problems, the accounting profession began to reassess the accountant's professional and legal responsibilities for computer-based systems.

Today, we recognize that the responsibility for systems design is divided between accountants and IT professionals as follows: the accounting function is responsible for the conceptual system, and the IT function is responsible for the physical system. To illustrate the distinction between conceptual and physical systems, consider the following example:

The credit department of a retail business requires information about delinquent accounts from the AR department. This information supports decisions made by the credit manager regarding the creditworthiness of customers.

The design of the conceptual system involves specifying the criteria for identifying delinquent customers and the information that needs to be reported. The accountant determines the nature of the information required, its sources, its destination, and the accounting rules that need to be applied. The physical system is the medium and method for capturing and presenting the information. The computer professionals determine the most economical and effective technology for accomplishing the task. Hence, systems design should be a collaborative effort. Because of the uniqueness of each system and the susceptibility of systems to serious error and even fraud, the accountant's involvement in systems design should be pervasive. Later, we shall see that the active participation of accountants is critical to the system's success.

ACCOUNTANTS AS SYSTEM AUDITORS

Auditing is a form of independent attestation performed by an expert—the auditor—who expresses an opinion about the fairness of a company's financial statements. Public confidence in the reliability of internally produced financial statements rests directly on their being validated by an independent

expert auditor. This service is often referred to as the attest function. Auditors form their opinions based on a systematic process.

Both internal and external auditors conduct audits. External auditing is often called independent auditing because certified public accounting (CPA) firms that are independent of the client organization's management perform them. External auditors represent the interests of third-party stakeholders in the organization, such as stockholders, creditors, and government agencies.

External Auditing

Historically, the external accountant's responsibility as a systems auditor was limited to the attest function described previously. In recent years this role has been expanded by the broader concept of assurance. The Big Four public accounting firms have now renamed their traditional audit functions assurance services.

ASSURANCE. Assurance services are professional services, including the attest function, that are designed to improve the quality of information, both financial and nonfinancial, used by decision makers. For example, a client may contract assurance services to obtain an opinion as to the quality or marketability of a product. Alternatively, a client may need information about the efficiency of a production process or the effectiveness of their network security system. A gray area of overlap exists between assurance and consulting services, which auditors must avoid. They were once allowed to provide consulting services to audit clients. This is now prohibited under SOX legislation.

IT AUDITING. IT auditing is usually performed as part of a broader financial audit. The organizational unit responsible for conducting IT audits may fall under the assurance services group or be independent. Typically, they carry a name such as IT Risk Management, Information Systems Risk Management, or Global Risk Management. The IT auditor attests to the effectiveness of a client's IT controls to establish their degree of compliance with prescribed standards. Because many of the modern organization's internal controls are computerized, the IT audit may be a large portion of the overall audit.

Internal Auditing

Internal auditing is an appraisal function housed within the organization. Internal auditors perform a wide range of activities on behalf of the organization, including conducting financial statement audits, examining an operation's compliance with organizational policies, reviewing the organization's compliance with legal obligations, evaluating operational efficiency, detecting and pursuing fraud within the firm, and conducting IT audits. As you can see, the tasks that external and internal auditors perform are similar. The feature that most clearly distinguishes the two groups is their respective constituencies. External auditors represent third-party outsiders, whereas internal auditors represent the interests of management.

Summary

The first section of this chapter introduced basic systems concepts and presented a framework for distinguishing between accounting information systems and management information systems. This distinction is related to the types of transactions these systems process. AIS applications process financial transactions, and MIS applications process nonfinancial transactions. The section then presented a general model for accounting information systems. The model is composed of four major tasks that exist in all AIS applications: data collection, data processing, database management, and information generation.

The second section examined the relationship between organizational structure and the information system. It focused on functional segmentation as the predominant method of structuring a business and examined the functions of a typical manufacturing firm. The section presented two general methods of organizing the IT function: the centralized approach and the distributed approach.

The third section reviewed the evolution of AIS models. Each new model evolved because of the shortcomings and limitations of its predecessor. As new approaches evolved, however, the predecessor or legacy systems often remained in service. Thus, at any point in time, various generations of systems coexist across different organizations and even within a single enterprise. Five AIS models were examined.

The final section of this chapter examined three roles of accountants as (1) users of AIS, (2) designers of AIS, and (3) auditors of AIS. In most organizations, the accounting function is the single largest user of the AIS. The IT function is responsible for designing the physical system, and the accounting function is responsible for specifying the conceptual system.

Auditing is an independent attestation performed by the auditor, who expresses an opinion about the fairness of a company's financial statements. Both external and internal auditors conduct IT audits. The IT auditor attests to the effectiveness of a client's IT controls to establish their degree of compliance with prescribed standards.

Review Questions

1. What are the four levels of activity in the pyramid representing the business organization? Distinguish between horizontal and vertical flows of information.
2. Distinguish between natural and artificial systems.
3. What are the elements of a system?
4. What is system decomposition and subsystem interdependency? How are they related?
5. What is the relationship among data, information, and an information system?
6. Distinguish between AIS and MIS.
7. What are the three cycles of transaction processing systems?
8. What is discretionary reporting?
9. What are the characteristics of good or useful information?
10. What rules govern data collection?
11. What are the levels of data hierarchy?
12. What are the three fundamental tasks of database management?
13. What is feedback and how is it useful in an information system?
14. What are the fundamental objectives of all information systems?
15. What does stewardship mean and what is its role in an information system?

16. Distinguish between responsibility, authority, and accountability. Which flow upward and which flow downward?

17. Distinguish between turnkey, backbone, and vendor-supported systems.

18. List each of the functional areas and their subfunctions.

19. What are the roles of internal and external auditors?

20. What is the role of a database administrator?

21. Name the three most common ways to segment an organization.

22. What is the role of the accounting function in an organization?

23. Distinguish between the centralized and distributed approaches to organizing the IT function.

24. What is the role of the data control group?

25. What is distributed data processing?

26. What are the advantages and disadvantages of distributed data processing?

27. What types of tasks become redundant in a distributed data processing system?

28. What is a flat-file system?

29. What are the three general problems associated with data redundancy?

30. Define the key elements of the REA model.

31. What is an ERP system?

32. What three roles are played by accountants with respect to the information system?

33. Define the term attest function.

34. Define the term assurance.

35. What is IT auditing?

36. Distinguish between conceptual and physical systems.

Discussion Questions

1. Discuss the differences between internal and external users of information and their needs and demands on an information system. Historically, which type of user has the firm catered to most?
2. Comment on the level of detail necessary for operations management, middle management, and stockholders.
3. Distinguish between financial and nonfinancial transactions. Give three examples of each.
4. Why have re-engineering efforts been made to integrate AIS and MIS?
5. Do you think transaction processing systems differ significantly between service and manufacturing industries? Are they equally important to both sectors?
6. Discuss the difference between the financial reporting system and general ledger system.
7. Examine Figure 1-5 and discuss where and how problems can arise that can cause the resulting information to be bad or ineffective.
8. Discuss how the elements of efficiency, effectiveness, and flexibility are crucial to the design of an information system.
9. Discuss what is meant by the statement, ‘‘The accounting system is a conceptual flow of information that represents the physical flows of personnel, raw materials, machinery, and cash through the organization.’’
10. Discuss the importance of accounting independence in accounting information systems. Give an example of where this concept is important (use an example other than inventory control).
11. Discuss why it is crucial that internal auditors report solely to the uppermost level of management (either to the chief executive officer or the audit committee of the board of directors) and answer to no other group.

12. Contrast centralized data processing with distributed data processing. How do the roles of systems professionals and end users change? What do you think the trend is today?

13. Discuss how conceptual and physical systems differ and which functions are responsible for each of these systems.

14. If accountants are viewed as providers of information, then why are they consulted as system users in the systems development process?

15. Do you agree with the statement, ‘‘The term IT auditor should be considered obsolete because it implies a distinction between regular auditors and auditors who examine computerized AIS’’? Why or why not?

16. What are the primary reasons for segmenting organizations?

17. Why is it important to organizationally separate the accounting function from other functions of the organization?

18. What is the most likely system acquisition method— in-house, turnkey, backbone, or vendor-supported— for each of the following situations?

- A plumbing supply company with 12 employees that sells standard products to wholesale customers in a local community needs a system to manage its affairs.
- A major oil company with diverse holdings, complex oil leases, and esoteric accounting practices needs a system that can coordinate its many enterprises.
- A municipal government needs a system that complies with standard government accounting practices but can be integrated with other existing systems.

19. The REA model is based on the premise that ‘‘business data must not be preformatted or artificially constrained and must reflect all relevant

aspects of the underlying economic events.'' What does this mean and how is it applied?

20. ERP systems are composed of a highly integrated set of standardized modules. Discuss the advantages and potential disadvantages of this approach.

Multiple-Choice Questions

1. Which of the following is NOT a financial transaction?

a. purchase of products

b. cash receipts

c. update valid vendor file

d. sale of inventory

2. The following are subsystems of the Accounting Information System, EXCEPT

a. Transaction Processing System.

b. Human Resources System.

c. General Ledger/Financial Reporting System.

d. Management Reporting System.

3. Which of the following is NOT a purpose of the Transaction Processing System?

a. managing and reporting on the status of financial investments

b. converting economic events into financial transactions

c. distributing essential information to operations personnel to support their daily operations

d. recording financial transactions in the accounting records

4. The objectives of the data collection activity of the general model for Accounting Information Systems are to collect data that are

a. relevant and redundant.

b. efficient and objective.

c. efficient and redundant.

d. efficient and relevant.

5. Which of the following is NOT a characteristic of effective information?

a. relevance

b. accuracy

c. summarization

d. precision

6. Which of the following is NOT a database management task?

a. retrieval

b. storage

c. summarization

d. deletion

7. When viewed from the highest to most elemental level, the data hierarchy is

a. attribute, record, file.

b. record, attribute, key.

c. file, record, attribute.

d. file, record, key.

e. key, record, file.

8. Which is NOT an accountant’s primary role in information systems?

a. system user

b. system auditor

c. system designer

d. system programmer

9. Which of the following is NOT an objective of all information systems?

a. support for the stewardship function of management

b. support for management decision making

c. support for the day-to-day operations of the firm

d. all of the above are objectives

10. Which of the following best describes the activities of the materials management function?

a. purchasing, receiving, and inventory control

b. receiving, sales, distribution, and purchasing

c. receiving, storage, purchasing, and accounts payable

d. purchasing, receiving, and storage

e. purchasing, storage, and distribution

11. Which of the following best describes the activities of the production function?

a. maintenance, inventory control, and production planning

b. production planning, quality control, manufacturing, and cost accounting

c. quality control, production planning, manufacturing, and payroll

d. maintenance, production planning, storage, and quality control

e. manufacturing, quality control, and maintenance

12. Which of the following best describes the activities of the accounting function?

a. inventory control, accounts payable, fixed assets, and payroll

b. fixed assets, accounts payable, cash disbursements, and cost accounting

c. purchasing, cash receipts, accounts payable, cash disbursements, and payroll

d. inventory control, cash receipts, accounts payable, cash disbursements, and payroll

e. inventory control, cost accounting, accounts payable, cash disbursements, and payroll

13. Which statement best describes the issue of distributed data processing (DDP)?

a. The centralized and DDP approaches are mutually exclusive; an organization must choose one approach or the other.

b. The philosophy and objective of the organization’s management will determine the extent of DDP in the firm.

c. In a minimum DDP arrangement, only data input and output are distributed, leaving the tasks of data control, data conversion, database management, and data processing to be centrally managed.

d. The greatest disadvantage of a totally distributed environment is that the distributed information processing unit locations are unable to communicate and coordinate their activities.

e. Although hardware (such as computers, database storage, and input/output terminals) can be effectively distributed, the systems

development and maintenance tasks must remain centralized for better control and efficiency.

14. Which of the following is a disadvantage of distributed data processing?

a. End-user involvement in systems operation is decreased.

b. Disruptions due to mainframe failures are increased.

c. The potential for hardware and software incompatibility across the organization is increased.

d. The time between project request and completion is increased.

e. All of the above are disadvantages.

Problems

1. USERS OF INFORMATION

Classify the following users of information as either:

I—internal user

T—external user: trading partner

S—external user: stakeholder

a. Internal Revenue Service

b. Inventory control manager

c. Board of directors

d. Customers

e. Lending institutions

f. Securities and Exchange Commission

g. Stockholders

h. Chief executive officer

i. Suppliers

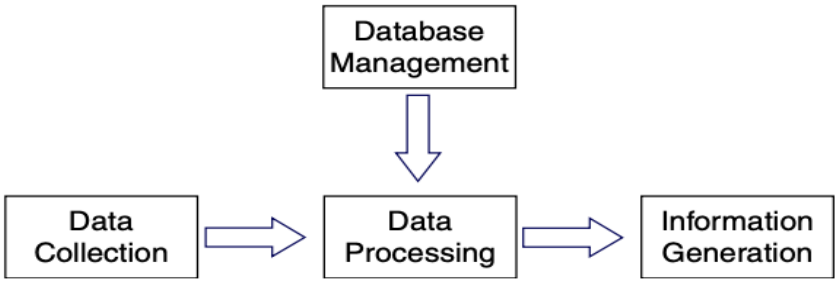
j. Bondholders

2. SUBSYSTEMS

Use the human body system to illustrate the concepts of system decomposition and subsystem interdependency. Draw a hierarchical chart similar to the one in Figure 1-2 and discuss the interdependencies.

3. ACCOUNTING INFORMATION SYSTEM MODEL

Examine the diagram below and determine what essential mechanism is missing. Once you have identified the missing element, discuss its importance



4. ACCOUNTING INFORMATION SYSTEM & MANAGEMENT INFORMATION SYSTEM FEATURES

List some AIS and MIS information from which salespeople may benefit. Clearly indicate whether the information item would be an output of a traditional AIS or MIS system. Finally, discuss the benefits of integrating this information.

5. INFORMATION SYSTEM CATEGORIZATION

Classify the following items as either:

TPS—transaction processing system

FRS—financial reporting system

MRS—management reporting system

a. Variance reports

b. Sales order capture

c. Balance sheet

d. Budgets

e. Purchase order preparation

f. Tax returns

g. Sales summary by product line

h. Cash disbursements preparation

i. Annual report preparation

j. Invoice preparation

k. Cost-volume-profit analysis

6. FLAT-FILE VERSUS DATABASE MODEL

Outline the traditional problems associated with the flat file model that are resolved by the database model.

7. ORGANIZATION FUNCTIONS

Based on Figure 1-8, draw a diagram of functional segments for an oil company that has the following operations:

a. A head office in New York City responsible for international and national marketing, acquisition of leases and contracts, and corporate reporting.

b. Two autonomous regional facilities in Tulsa, Oklahoma, and New Orleans, Louisiana. These facilities are responsible for oil exploration, drilling, refining, storage, and the distribution of petroleum products to corporate service stations throughout the country and abroad.

8. ORGANIZATION FUNCTIONS

Based on Figure 1-8, draw a diagram of functional segments for a manufacturer of diversified products. The general characteristics of the firm are as follows:

a. The organization produces three unrelated products: lawn and garden furniture for sale in home improvement centers and department stores; plastic packaging products for the electronics and medical supply industries; and paper products (for example, plates, cups, and napkins) for the fast food industry.

b. Although the manufacturing facilities are located within a single complex, none of the three products shares the same suppliers, customers, or physical production lines.

c. The organization's functional activities include design, production, distribution, marketing, finance, human resources, and accounting.

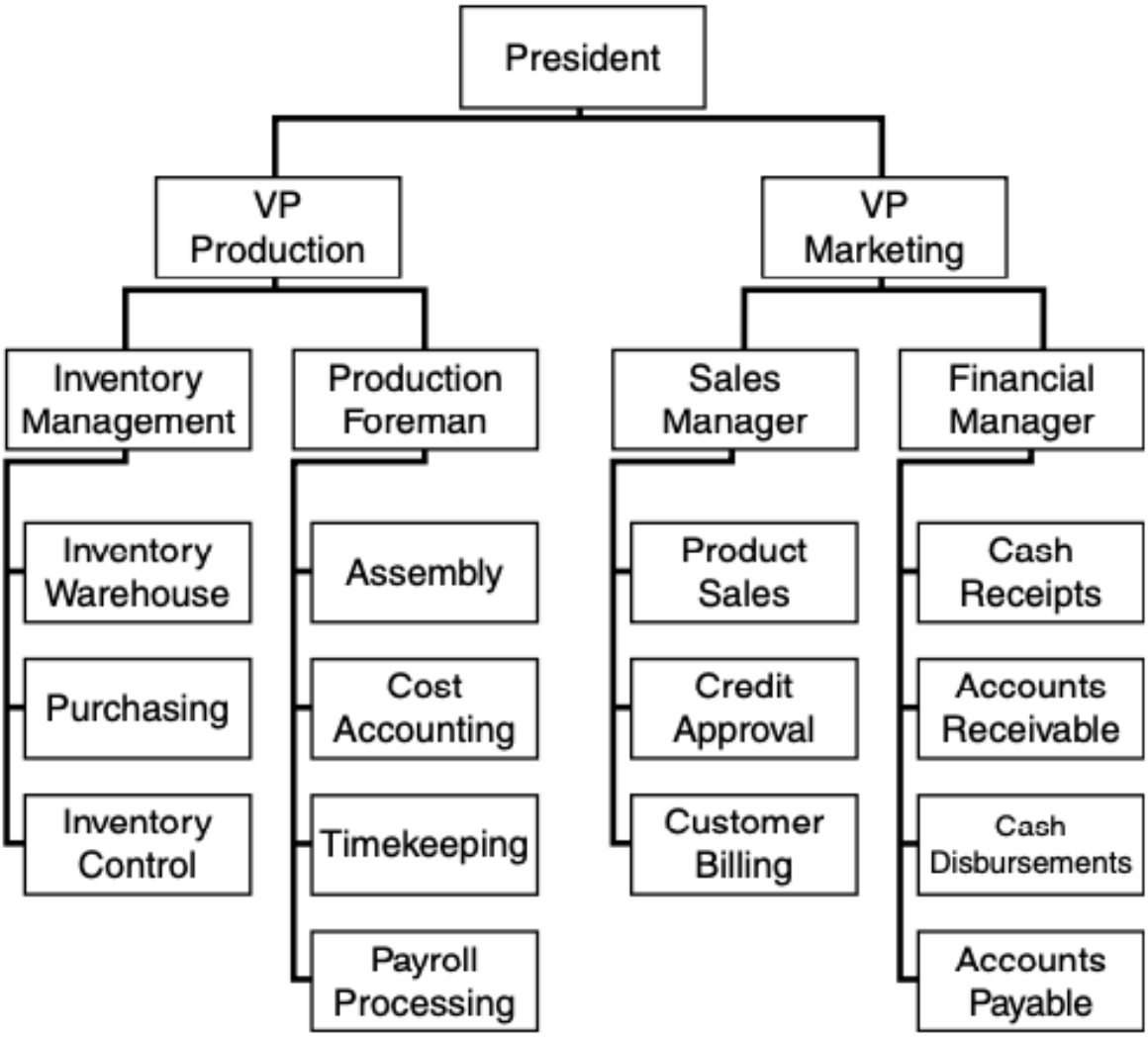
9. FUNCTIONAL SEGMENTATION

The current organization structure of Blue Sky Company, a manufacturer of small sailboats, is presented below.

Required

a. What operational problems (for example, inefficiency, errors, fraud) do you think Blue Sky could experience because of this structure?

b. Draw a new diagram reflecting an improved structure that solves the problems you identified. If necessary, you may add up to two new positions.



10. COMMUNICATIONS

Before the mid-1970s, systems programmers and businesspeople (including accountants) did not communicate well with one another. The programmers were criticized for using too much jargon, and the businesspeople were criticized for not adequately expressing their needs. Efforts have been made

to overcome this communication gap, but room for improvement still exists. What problems do you think resulted from this communication gap? What do you think you can do to help close the gap even more when you enter the workforce?

11. CHARACTERISTICS OF USEFUL INFORMATION

All records in a file must be uniquely identifiable in at least one attribute, which is its primary key. Drawing on your general knowledge of accounting, identify the primary key for the following types of accounting records. To illustrate, the first record is done for you.

Record Type	Primary Key
• Accounts Receivable	Customer Number
• Accounts Payable	
• Inventory	
• Customer Sales Orders	
• Purchase Orders to vendors	
• Cash Receipts (checks) from customers	
• Cash Disbursements (checks) to vendors	
• Employee Payroll Earnings Records	

12. DATA ATTRIBUTES

Drawing from your basic accounting knowledge, list the relevant data attributes that constitute the record types below. Identify which attribute is the primary key for the record.

- Accounts Payable record
- Inventory record

- Customer Sales Orders record
- Purchase Orders to vendors
- Cash Receipts (checks) from customers
- Employee Payroll Earnings records

13. DISTRIBUTED DATA PROCESSING

Explain why an organization would choose to install a distributed instead of a centralized computer environment.

Chapter 2: Introduction to Transaction Processing

Introduction

Chapter 1 introduced the transaction processing system (TPS) as an activity consisting of three major subsystems called cycles: the revenue cycle, the expenditure cycle, and the conversion cycle. Even though each cycle performs different specific tasks and supports different objectives, they share common characteristics. For example, all three TPS cycles capture financial transactions, record the effects of transactions in accounting records, and provide information about transactions to users in support of their day-to-day activities. In addition, transaction cycles produce much of the raw data from which management reports and financial statements are derived. Because of their financial impact on the firm, transaction cycles command much of the accountant's professional attention.

The purpose of this chapter is to present some preliminary topics that are common to all three transaction processing cycles. In subsequent chapters, we will draw heavily from this material as we examine the individual subsystems of each cycle in detail. This chapter is organized into five major sections. The first is an overview of transaction processing. This section defines the broad objective of the three transaction cycles and specifies the roles of their individual subsystems. The second section describes the relationship among accounting records in forming an audit trail in both manual and computer-based systems. The third section examines documentation techniques used to represent systems. This section presents several documentation techniques for manual and computer-based systems. The fourth section addresses computer-based systems. It reviews the

fundamental features of batch and real-time technologies and their implication for transaction processing. The final section examines data coding schemes and their role in transaction processing.

An Overview of Transaction Processing

TPS applications process financial transactions. A financial transaction was defined in Chapter 1 as

An economic event that affects the assets and equities of the firm, is reflected in its accounts, and is measured in monetary terms.

The most common financial transactions are economic exchanges with external parties. These include the sale of goods or services, the purchase of inventory, the discharge of financial obligations, and the receipt of cash on account from customers. Financial transactions also include certain internal events such as the depreciation of fixed assets; the application of labor, raw materials, and overhead to the production process; and the transfer of inventory from one department to another.

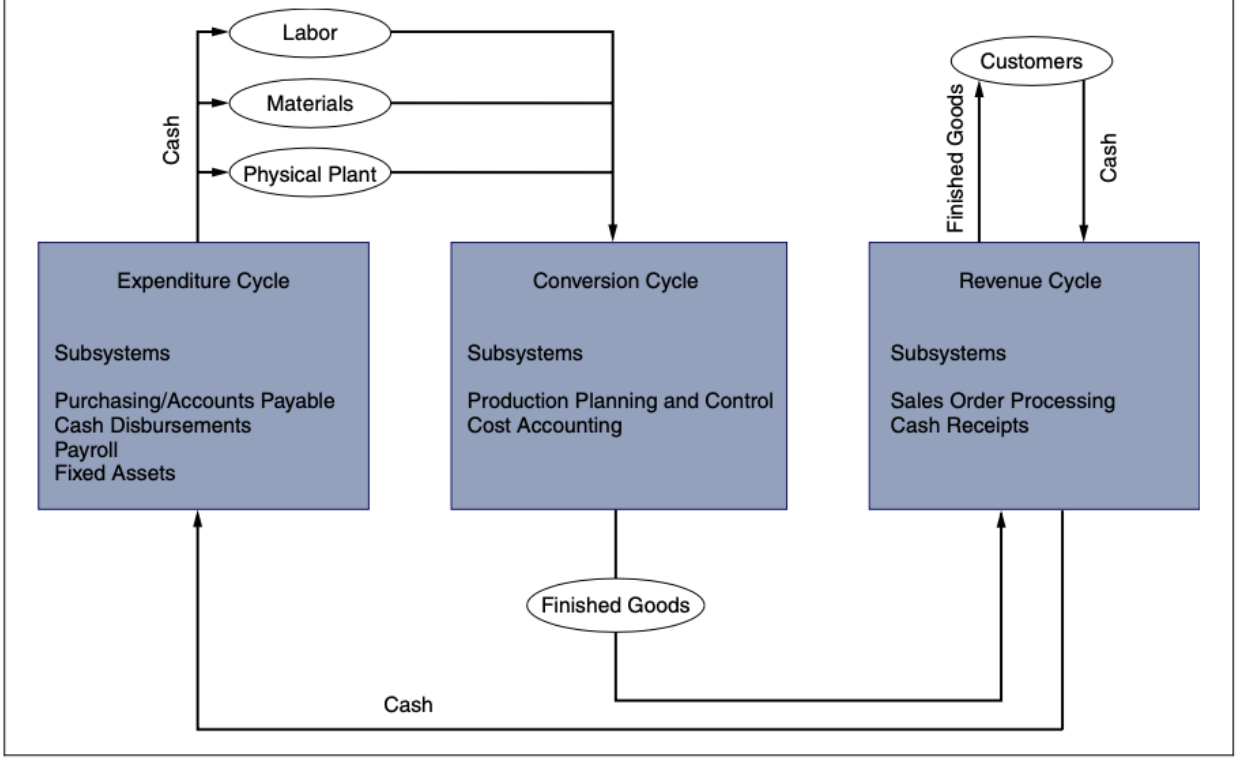
Financial transactions are common business events that occur regularly. For instance, thousands of transactions of a particular type (sales to customers) may occur daily. To deal efficiently with such volume, business firms group similar types of transactions into transaction cycles.

TRANSACTION CYCLES

Three transaction cycles process most of the firm's economic activity: the expenditure cycle, the conversion cycle, and the revenue cycle. These cycles exist in all types of businesses—both profit-seeking and not-for-profit types. For instance, every business (1) incurs expenditures in exchange for resources (expenditure cycle), (2) provides value added through its products

or services (conversion cycle), and (3) receives revenue from outside sources (revenue cycle). Figure 2-1 shows the relationship of these cycles and the resource flows between them.

FIGURE 2-1 RELATIONSHIP BETWEEN TRANSACTION CYCLES



The Expenditure Cycle

Business activities begin with the acquisition of materials, property, and labor in exchange for cash—the expenditure cycle. Figure 2-1 shows the flow of cash from the organization to the various providers of these resources. Most expenditure transactions are based on a credit relationship between the trading parties. The actual disbursement of cash takes place at some point after the receipt of the goods or services. Days or even weeks may pass between these two events. Thus, from a systems perspective, this

transaction has two parts: a physical component (the acquisition of the goods) and a financial component (the cash disbursement to the supplier). A separate subsystem of the cycle processes each component. The major subsystems of the expenditure cycle are outlined here.

Purchases/accounts payable system. This system recognizes the need to acquire physical inventory (such as raw materials) and places an order with the vendor. When the goods are received, the purchases system records the event by increasing inventory and establishing an account payable to be paid at a later date.

Cash disbursements system. When the obligation created in the purchases system is due, the cash disbursements system authorizes the payment, disburses the funds to the vendor, and records the transaction by reducing the cash and accounts payable accounts.

Payroll system. The payroll system collects labor usage data for each employee, computes the payroll, and disburses paychecks to the employees. Conceptually, payroll is a special-case purchases and cash disbursements system. Because of accounting complexities associated with payroll, most firms have a separate system for payroll processing.

Fixed asset system. A firm's fixed asset system processes transactions pertaining to the acquisition, maintenance, and disposal of its fixed assets. These are relatively permanent items that collectively often represent the organization's largest financial investment. Examples of fixed assets include land, buildings, furniture, machinery, and motor vehicles.

The Conversion Cycle

The conversion cycle is composed of two major subsystems: the production system and the cost accounting system. The production system

involves the planning, scheduling, and control of the physical product through the manufacturing process. This includes determining raw material requirements, authorizing the work to be performed and the release of raw materials into production, and directing the movement of the work-in-process through its various stages of manufacturing. The cost accounting system monitors the flow of cost information related to production. Information this system produces is used for inventory valuation, budgeting, cost control, performance reporting, and management decisions, such as make or- buy decisions.

Manufacturing firms convert raw materials into finished products through formal conversion cycle operations. The conversion cycle is not usually formal and observable in service and retailing establishments. Nevertheless, these firms still engage in conversion cycle activities that culminate in the development of a salable product or service. These activities include the readying of products and services for market and the allocation of resources such as depreciation, building amortization, and prepaid expenses to the proper accounting period. However, unlike manufacturing firms, merchandising companies do not process these activities through formal conversion cycle subsystems.

The Revenue Cycle

Firms sell their finished goods to customers through the revenue cycle, which involves processing cash sales, credit sales, and the receipt of cash following a credit sale. Revenue cycle transactions also have a physical and a financial component, which are processed separately. The primary subsystems of the revenue cycle are briefly outlined below.

Sales order processing. The majority of business sales are made on credit and involve tasks such as preparing sales orders, granting credit, shipping products (or rendering of a service) to the customer, billing customers, and recording the transaction in the accounts (accounts receivable, inventory, expenses, and sales).

Cash receipts. For credit sales, some period of time (days or weeks) passes between the point of sale and the receipt of cash. Cash receipts processing includes collecting cash, depositing cash in the bank, and recording these events in the accounts (accounts receivable and cash).

Accounting Records

MANUAL SYSTEMS

This section describes the purpose of each type of accounting record used in transaction cycles. We begin with traditional records used in manual systems (documents, journals, and ledgers) and then examine their magnetic counterparts in computer-based systems.

Documents

A document provides evidence of an economic event and may be used to initiate transaction processing. Some documents are a result of transaction processing. In this section, we discuss three types of documents: source documents, product documents, and turnaround documents.

SOURCE DOCUMENTS. Economic events result in some documents being created at the beginning (the source) of the transaction. These are called source documents. Source documents are used to capture and formalize

transaction data that the transaction cycle needs for processing. Figure 2-2 shows the creation of a source document.

The economic event (the sale) causes the salesclerk to prepare a multipart sales order, which is formal evidence that a sale occurred. Copies of this source document enter the sales system and are used to convey information to various functions, such as billing, shipping, and AR. The information in the sales order triggers specific activities in each of these departments.

FIGURE 2-2 CREATION OF A SOURCE DOCUMENT

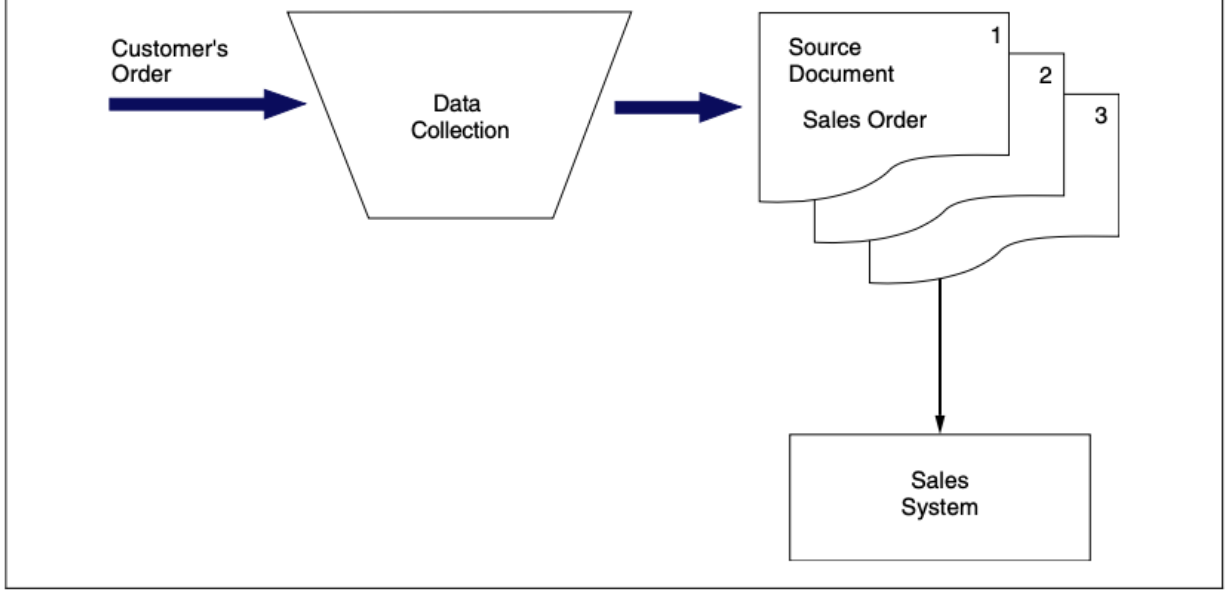
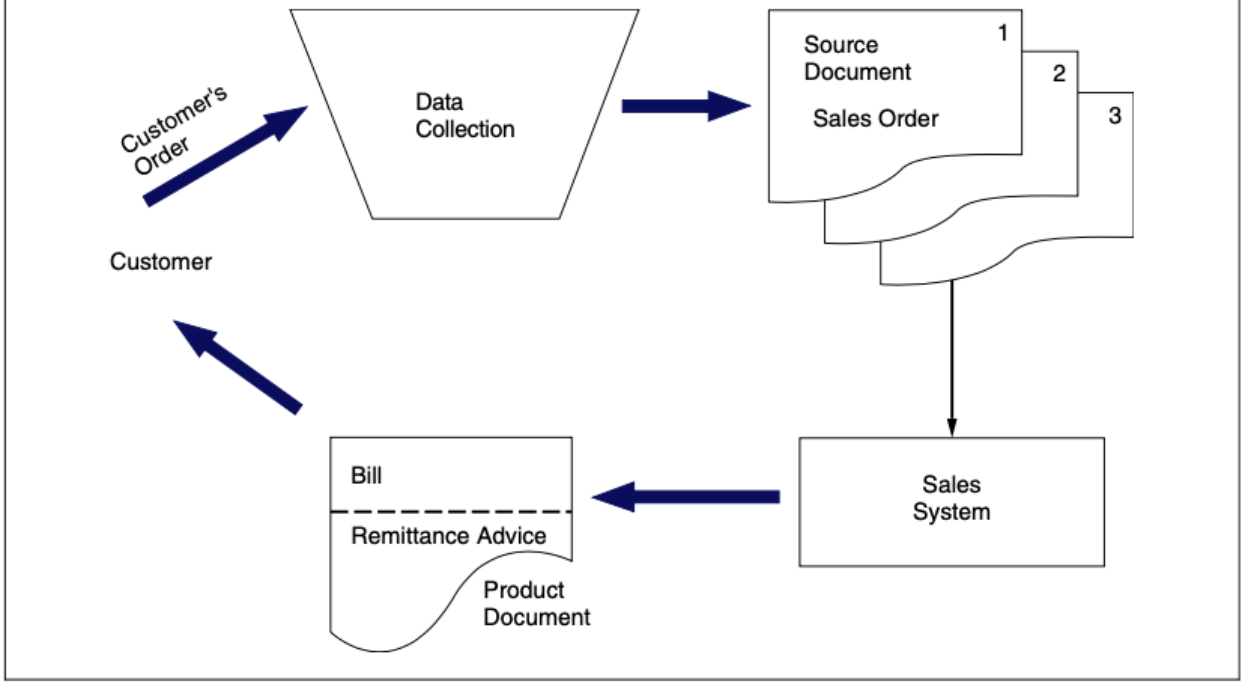


FIGURE 2-3 A PRODUCT DOCUMENT



PRODUCT DOCUMENTS. Product documents are the result of transaction processing rather than the triggering mechanism for the process. For example, a payroll check to an employee is a product document of the payroll system. Figure 2-3 extends the example in Figure 2-2 to illustrate that the customer's bill is a product document of the sales system.

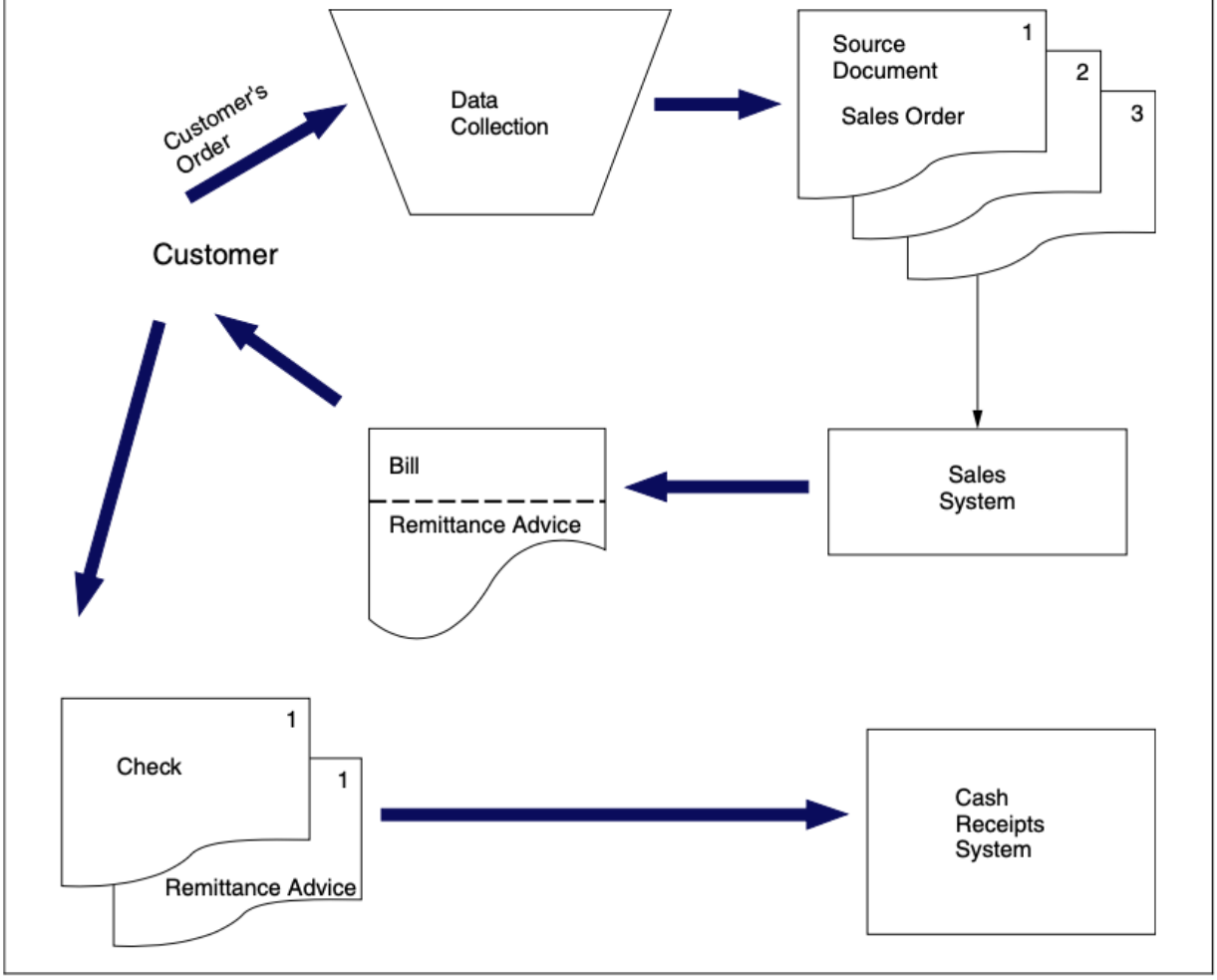
TURNAROUND DOCUMENTS. Turnaround documents are product documents of one system that become source documents for another system. This is illustrated in Figure 2-4. The customer receives a perforated two-part bill or statement. The top portion is the actual bill, and the bottom portion is the remittance advice. Customers remove the remittance advice and return it to the company along with their payment (typically a check). A turnaround document contains important information about a customer's account to help the cash receipts system process the payment. One of the

problems designers of cash receipts systems face is matching customer payments to the correct customer accounts. Providing this needed information as a product of the sales system ensures accuracy when the cash receipts system processes it.

Journals

A journal is a record of a chronological entry. At some point in the transaction process, when all relevant facts about the transaction are known, the event is recorded in a journal in chronological order. Documents are the primary source of data for journals. Figure 2-5 shows a sales order being recorded in the sales journal (see the following discussion on special journals). Each transaction requires a separate journal entry, reflecting the accounts affected and the amounts to be debited and credited. There is often a time lag between initiating a transaction and recording it in the accounts. The journal holds a complete record of transactions and thus provides a means for posting to accounts. There are two primary types of journals: special journals and general journals.

FIGURE 2-4 A TURNAROUND DOCUMENT



SPECIAL JOURNALS. Special journals are used to record specific classes of transactions that occur in high volume. Such transactions can be grouped together in a special journal and processed more efficiently than a general journal permits. Figure 2-6 shows a special journal for recording sales transactions.

As you can see, the sales journal provides a specialized format for recording only sales transactions. At the end of the processing period (month, week, or day), a clerk posts the amounts in the columns to the ledger accounts indicated. For example, the total sales will be posted to account

number 401. Most organizations use several other special journals, including the cash receipts journal, cash disbursements journal, purchases journal, and the payroll journal.

FIGURE 2-5 SALES ORDER RECORDED IN SALES JOURNAL

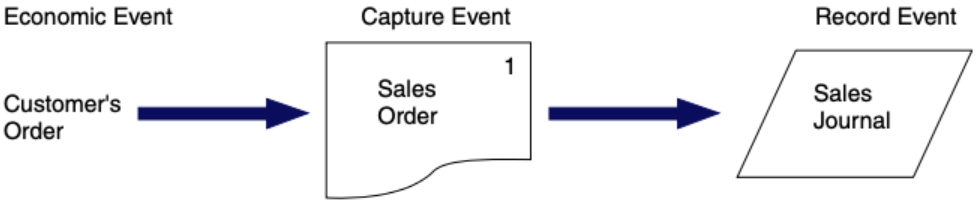


FIGURE 2-6 SALES JOURNAL

Date	Customer	Invoice Num.	Acct. Num.	Post	Debit Acct. Rec. #102	Credit Sales #401
Sept. 1	Hewitt Co.	4523	1120		3300	3300
15	Acme Drilling	8821	1298		6825	6825
Oct. 3	Buell Corp.	22987	1030		4000	4000
10	Check Ltd.	66734	1110		8500	8500

REGISTER. The term register is often used to denote certain types of special journals. For example, the payroll journal is often called the payroll register.

We also use the term register, however, to denote a log. For example, a receiving register is a log of all receipts of raw materials or merchandise ordered from vendors. Similarly, a shipping register is a log that records all shipments to customers.

GENERAL JOURNALS. Firms use the general journal to record nonrecurring, infrequent, and dissimilar transactions. For example, we usually record periodic depreciation and closing entries in the general journal. Figure 2-7 shows one page from a general journal. Note that the columns are nonspecific, allowing any type of transaction to be recorded. The entries are recorded chronologically.

As a practical matter, most organizations have replaced their general journal with a journal voucher system. A journal voucher is actually a special source document that contains a single journal entry specifying the general ledger accounts that are affected. Journal vouchers are used to record summaries of routine transactions, nonroutine transactions, adjusting entries, and closing entries. The total of journal vouchers processed is equivalent to the general journal.

Ledgers

A ledger is a book of accounts that reflects the financial effects of the firm's transactions after they are posted from the various journals. Whereas journals show the chronological effect of business activity, ledgers show activity by account type. A ledger indicates the increases, decreases, and current balance of each account. Organizations use this information to prepare financial statements, support daily operations, and prepare internal

reports. Figure 2-8 shows the flow of financial information from the source documents to the journal and into the ledgers.

There are two basic types of ledgers: (1) general ledgers, which contain the firm's account information in the form of highly summarized control accounts, and (2) subsidiary ledgers, which contain the details of the individual accounts that constitute a particular control account.

FIGURE 2-7 GENERAL JOURNAL

GENERAL JOURNAL PAGE

	DATE	DESCRIPTION	POST. REF.	DEBIT	CREDIT	
1	Sept. 1, 2009	Depreciation Expense	520	500		1
2		Accumulated Depreciation	210		5000	2
3						3
4	Sept. 2, 2009	Insurance Expense	525	1200		4
5		Prepaid Insurance	180		1200	5
6						6
7	Sept. 3, 2009	Cash	101	11000		7
8		Capital Stock	310		11000	8
9						9
10						10
11						11
12						12

GENERAL LEDGERS. The general ledger (GL) summarizes the activity for each of the organization's accounts. The general ledger department updates these records from journal vouchers prepared from special journals and

other sources located throughout the organization. The general ledger presented in Figure 2-9 shows the beginning balances, the changes, and the ending balances as of a particular date for several different accounts.

The general ledger provides a single value for each control account, such as accounts payable, accounts receivable, and inventory. This highly summarized information is sufficient for financial reporting, but it is not useful for supporting daily business operations. For example, for financial reporting purposes, the firm's total accounts receivable value must be presented as a single figure in the balance sheet. This value is obtained from the accounts receivable control account in the general ledger. To actually collect the cash this asset represents, however, the firm must have certain detailed information about the customers that this summary figure does not provide. It must know which customers owe money, how much each customer owes, when the customer last made payment, when the next payment is due, and so on. The accounts receivable subsidiary ledger contains these essential details.

FIGURE 2-8 FLOW OF INFORMATION FROM THE ECONOMIC EVENT TO THE GENERAL LEDGER

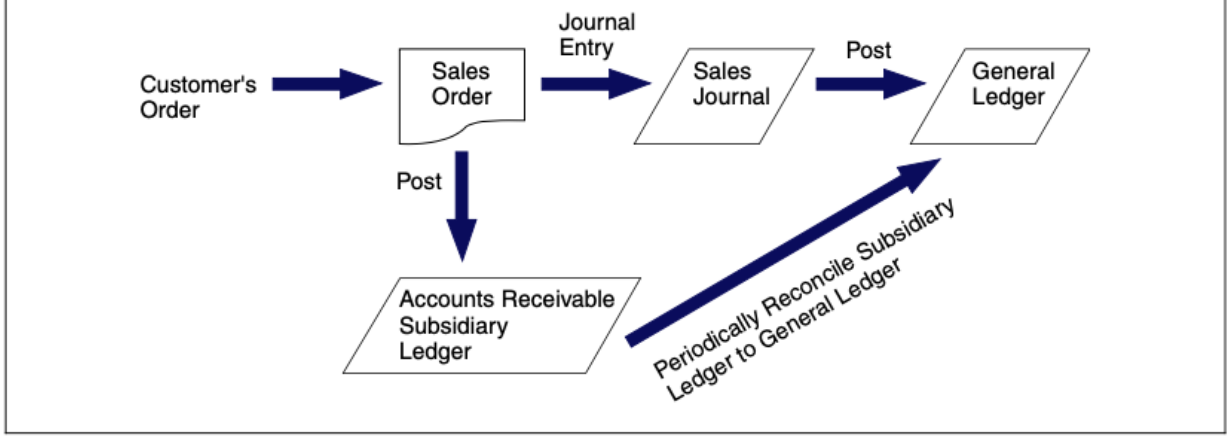


FIGURE 2-9 GENERAL LEDGER

Cash — ACCOUNT NO. 101

DATE	ITEM	POST. REF.	DEBIT	CREDIT	BALANCE DEBIT	BALANCE CREDIT
Sept. 10		S1	3300		3300	
15		S1	6825		10125	
Oct. 3		S1	4000		14125	
10		CD1		2800	11325	

Accounts Receivable — ACCOUNT NO. 102

DATE	ITEM	POST. REF.	DEBIT	CREDIT	BALANCE DEBIT	BALANCE CREDIT
Sept. 1		S1	1400		1400	
8		S1	2605		4005	
15		CR1		1650	2355	

Accounts Payable — ACCOUNT NO. 201

DATE	ITEM	POST. REF.	DEBIT	CREDIT	BALANCE DEBIT	BALANCE CREDIT
Sept. 1		P1		20500		20500
10		CD1	2800			17700

FIGURE 2-9 **GENERAL LEDGER *(continued)***

Purchases ACCOUNT NO. *502*

DATE		ITEM	POST. REF.	DEBIT	CREDIT	BALANCE	
						DEBIT	CREDIT
Sept.	*1*		P1	*2 0 5 0 0*		*2 0 5 0 0*	

SUBSIDIARY LEDGERS. Subsidiary ledgers are kept in various accounting departments of the firm, including inventory, accounts payable, payroll, and accounts receivable. This separation provides better control and support of operations. Figure 2-10 illustrates that the total of account balances in a subsidiary ledger should equal the balance in the corresponding general ledger control account. Thus, in addition to providing financial statement information, the general ledger is a mechanism for verifying the overall accuracy of accounting data that separate accounting departments have processed. Any event incorrectly recorded in a journal or subsidiary ledger will cause an out-of-balance condition that should be detected during the general ledger update. By periodically reconciling summary balances from subsidiary accounts, journals, and control accounts, the completeness and accuracy of transaction processing can be formally assessed.

THE AUDIT TRAIL

The accounting records described previously provide an audit trail for tracing transactions from source documents to the financial statements. Of

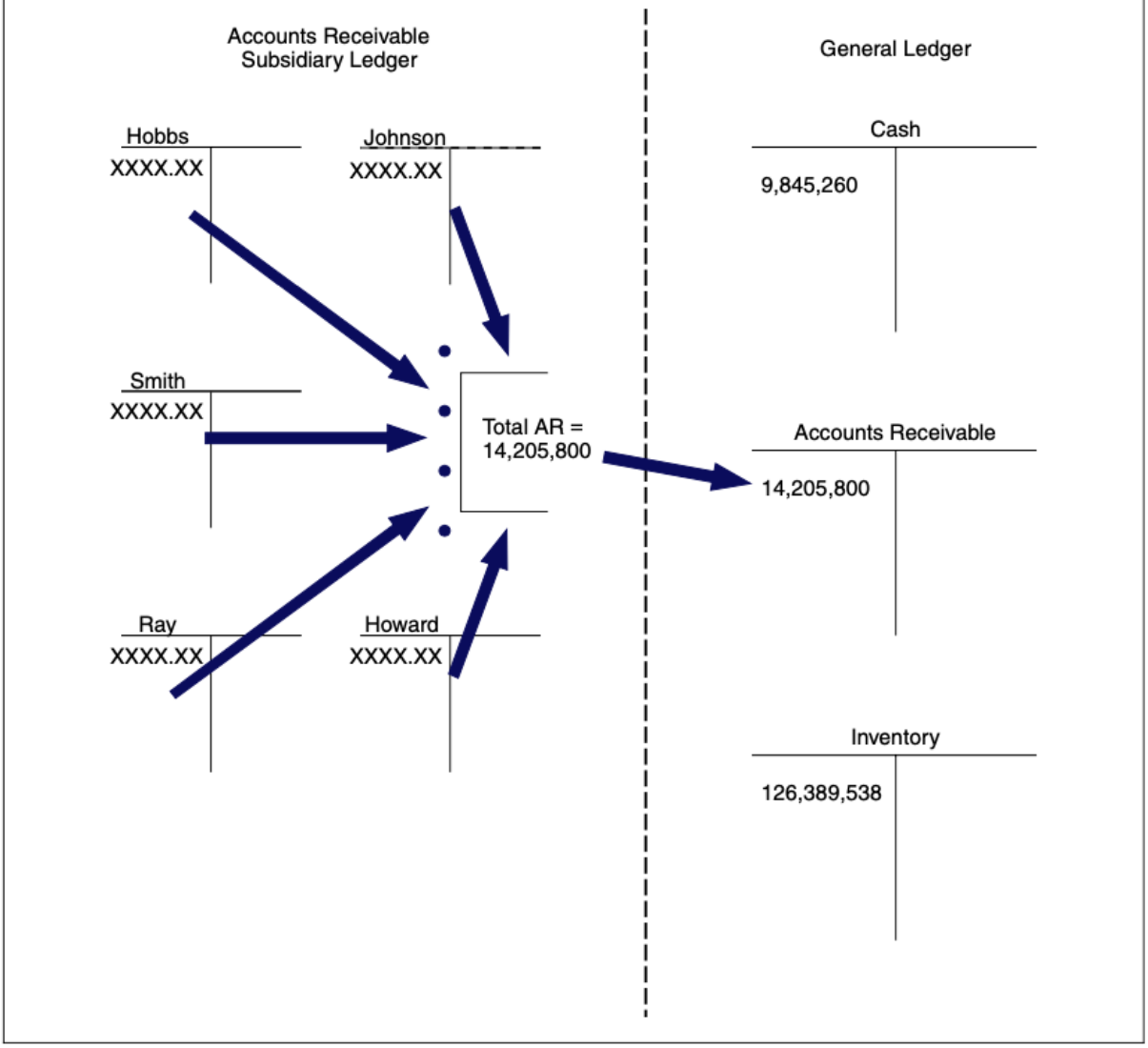
the many purposes of the audit trail, most important to accountants is the year-end audit. Although the study of financial auditing falls outside the scope of this text, the following thumbnail sketch of the audit process will demonstrate the importance of the audit trail.

The external auditor periodically evaluates the financial statements of publicly held business organizations on behalf of its stockholders and other interested parties. The auditor's responsibility involves, in part, the review of selected accounts and transactions to determine their validity, accuracy, and completeness. Let's assume an auditor wishes to verify the accuracy of a client's AR as published in its annual financial statements. The auditor can trace the AR figure on the balance sheet to the general ledger AR control account. This balance can then be reconciled with the total for the accounts receivable subsidiary ledger. Rather than examining every transaction that affected the AR account, the auditor will use a sampling technique to examine a representative subset of transactions. Following this approach, the auditor can select a number of accounts from the AR subsidiary ledger and trace these back to the sales journal. From the sales journal, the auditor can identify the specific source documents that initiated the transactions and pull them from the files to verify their validity and accuracy.

The audit of AR often includes a procedure called confirmation. This involves contacting selected customers to determine if the transactions recorded in the accounts actually took place and that customers agree with the recorded balance. Information contained in source documents and subsidiary accounts enables the auditor to identify and locate customers chosen for confirmation. The results from reconciling the AR subsidiary ledger with the control account and from confirming customers' accounts help the auditor form an opinion about the accuracy of accounts receivable

as reported on the balance sheet. The auditor performs similar tests on all of the client firm's major accounts and transactions to arrive at an overall opinion about the fair presentation of the financial statement. The audit trail plays an important role in this process.

FIGURE 2-10 RELATIONSHIP BETWEEN THE SUBSIDIARY LEDGER AND THE GENERAL LEDGER



COMPUTER-BASED SYSTEMS

Types of Files

Audit trails in computer-based systems are less observable than in traditional manual systems, but they still exist. Accounting records in computer-based systems are represented by four different types of magnetic files: master files, transaction files, reference files, and archive files. Figure 2-11 illustrates the relationship of these files in forming an audit trail.

MASTER FILE. A master file generally contains account data. The general ledger and subsidiary ledgers are examples of master files. Data values in master files are updated from transactions.

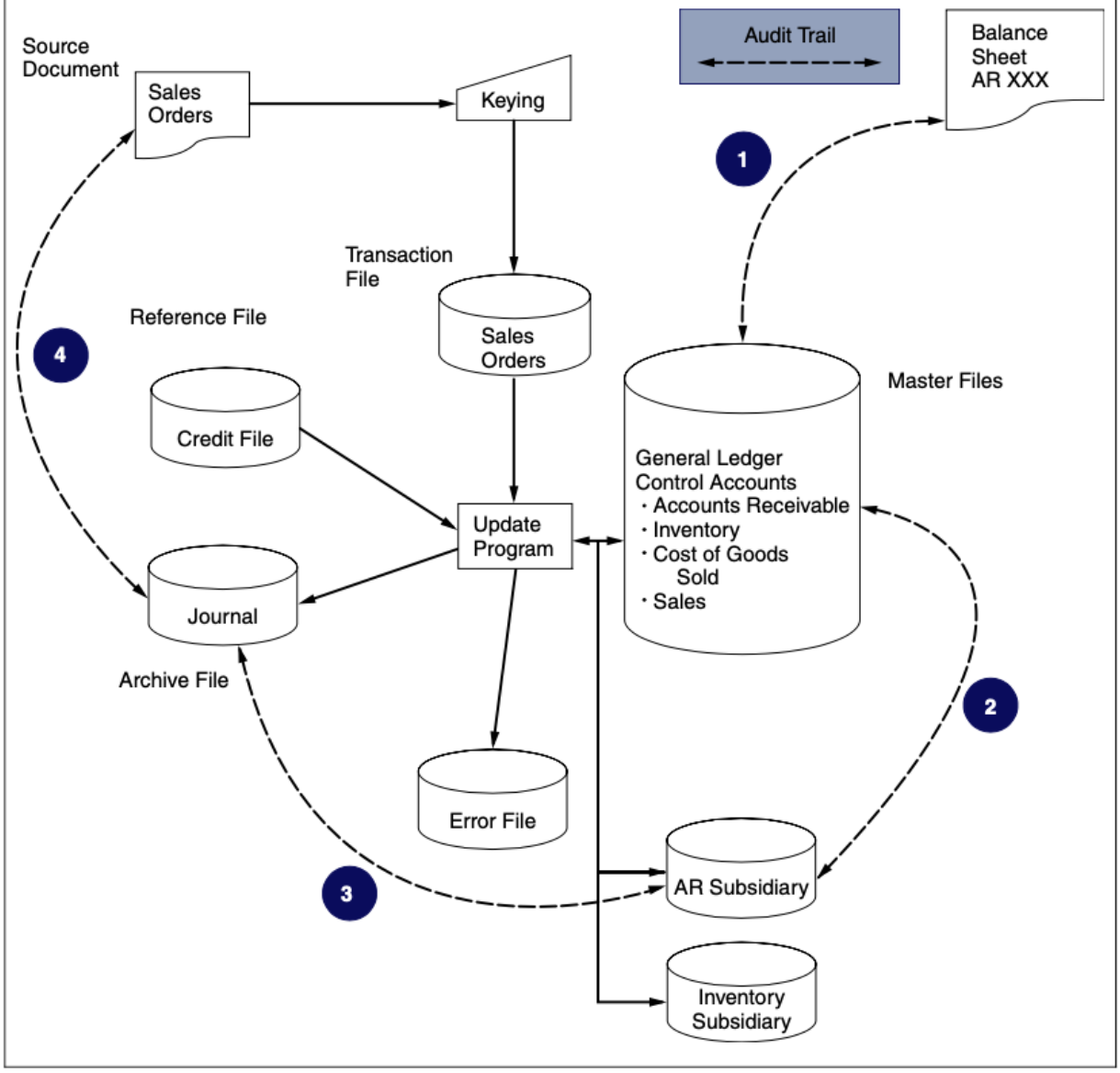
TRANSACTION FILE. A transaction file is a temporary file of transaction records used to change or update data in a master file. Sales orders, inventory receipts, and cash receipts are examples of transaction files.

REFERENCE FILE. A reference file stores data that are used as standards for processing transactions. For example, the payroll program may refer to a tax table to calculate the proper amount of withholding taxes for payroll transactions. Other reference files include price lists used for preparing customer invoices, lists of authorized suppliers, employee rosters, and customer credit files for approving credit sales. The reference file in Figure 2-11 is a credit file.

ARCHIVE FILE. An archive file contains records of past transactions that are retained for future reference. These transactions form an important part of the audit trail. Archive files include journals, prior period payroll information,

lists of former employees, records of accounts written off, and prior-period ledgers.

FIGURE 2-11 ACCOUNTING RECORDS IN A COMPUTER-BASED SYSTEM



The Digital Audit Trail

Let's walk through the system represented in Figure 2-11 to illustrate how computer files provide an audit trail. We begin with the capture of the economic event. In this example, sales are recorded manually on source documents, just as in the manual system. The next step in this process is to convert the source documents to digital form. This is done in the data-input stage, when the transactions are edited and a transaction file of sales orders is produced. Some computer systems do not use physical source documents. Instead, transactions are captured directly on digital media.

The next step is to update the various master file subsidiary and control accounts that the transaction affects. During the update procedure, additional editing of transactions takes place. Some transactions may prove to be in error or invalid for such reasons as incorrect account numbers, insufficient quantities on hand, or customer credit problems. In this example, the system determines the available credit for each customer from the credit file before processing the sale. Any records that are rejected for credit problems are transferred to the error file. The remaining good records are used to update the master files. Only these transactions are added to the archive file that serves as the sales journal. By copying the valid transactions to the journal, the original transaction file is not needed for audit trail purposes. This file can now be erased (scratched) in preparation for the next batch of sales orders.

Like the paper trail, this digital audit trail allows transaction tracing. Again, an auditor attempting to evaluate the accuracy of the AR figure published in the balance sheet could do so via the following steps, which are identified in Figure 2-11.

1. Compare the accounts receivable balance in the balance sheet with the master file AR control account balance.

2. Reconcile the AR control figure with the AR subsidiary account total.

3. Select a sample of update entries made to accounts in the AR subsidiary ledger and trace these to transactions in the sales journal (archive file).

4. From these journal entries, identify specific source documents that can be pulled from their files and verified. If necessary, the auditor can confirm the accuracy and propriety of these source documents by contacting the customers in question.

Documentation Techniques

The old saying that a picture is worth a thousand words is very applicable when it comes to documenting systems. A written description of a system can be wordy and difficult to follow. Experience has shown that a visual image can convey vital system information more effectively and efficiently than words. Accountants use system documentation routinely, as both systems designers and auditors, the ability to document systems in graphic form is thus an important skill for accountants to master. Five basic documentation techniques are introduced in this section: data flow diagrams, entity relationship diagrams, system flowcharts, program flowcharts, and record layout diagrams.

DATA FLOW DIAGRAMS AND ENTITY RELATIONSHIP DIAGRAMS

Two commonly used systems design and documentation techniques are the entity relationship diagram and the data flow diagram. This section

introduces the principal features of these techniques, illustrates their use, and shows how they are related.

Data Flow Diagrams

The data flow diagram (DFD) uses symbols to represent the entities, processes, data flows, and data stores that pertain to a system. Figure 2-12 presents the symbol set most commonly used. DFDs are used to represent systems at different levels of detail from very general to highly detailed. At this point, a single-level DFD is sufficient to demonstrate its use as a documentation tool. We see an example of this in Figure 2-13.

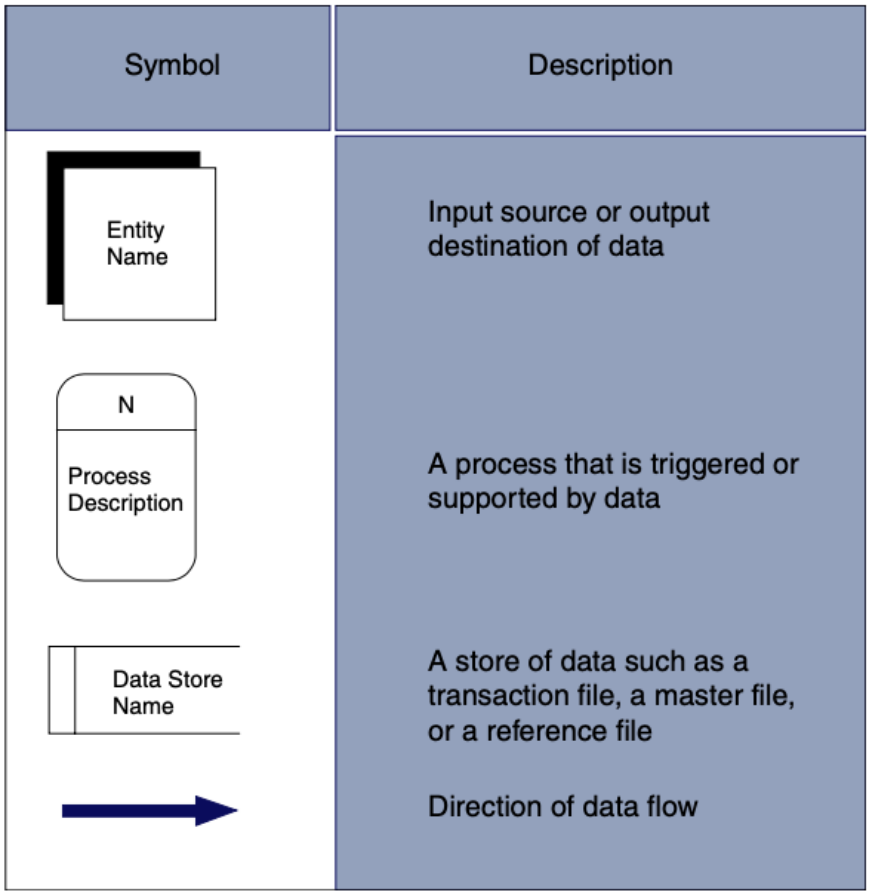
Entities in a DFD are external objects at the boundary of the system being modeled. They represent sources of and destinations for data. Entities may be other interacting systems or functions, or they may be external to the organization. Entities should always be labeled as nouns on a DFD, such as customer or supplier. Data stores represent the accounting records used in each process, and labeled arrows represent the data flows between processes, data stores, and entities.

Processes in the DFD should be labeled with a descriptive verb such as Ship Goods, Update Records, or Receive Customer Order. Process objects should not be represented as nouns like Warehouse, AR Dept., or Sales Dept. The labeled arrows connecting the process objects represent flows of data such as Sales Order, Invoice, or Shipping Notice. Each data flow label should be unique—the same label should not be attached to two different flow lines in the same DFD. When data flow into a process and out again (to another process), they have, in some way, been changed. This is true even if the data have not been physically altered. For example, consider the Approve Sales process in Figure 2-13, where Sales Order is examined

for completeness before being processed further. It flows into the process as Sales Order and out of it as Approved Sales Order.

Systems analysts use DFDs extensively to represent the logical elements of the system. This technique does not, however, depict the physical system. In other words, DFDs show what logical tasks are being done, but not how they are done or who (or what) is performing them. For example, the DFD does not show whether the sales approval process is separated physically from the billing process in compliance with internal control objectives.

FIGURE 2-12 DATA FLOW DIAGRAM SYMBOL SET



Entity Relationship Diagrams

An entity relationship (ER) diagram is a documentation technique used to represent the relationship between entities. Entities are physical resources (automobiles, cash, or inventory), events (ordering inventory, receiving cash, shipping goods), and agents (salesperson, customer, or vendor) about which the organization wishes to capture data. One common use for ER diagrams is to model an organization's database.

Figure 2-14 shows the symbol set used in an ER diagram. The square symbol represents entities in the system. The labeled connecting line represents the nature of the relationship between two entities. The degree of the relationship, called cardinality, is the numeric mapping between entity instances. A relationship can be one-to-one (1:1), one-to-many (1:M), or many-to-many (M:M).2 If we think of entities in the ER diagram as files of records, cardinality is the maximum number of records in one file that are related to a single record in the other file and vice versa.

Cardinality reflects normal business rules as well as organizational policy. For instance, the 1:1 cardinality in the first example in Figure 2-14 suggests that each salesperson in the organization is assigned one automobile. If instead the organization's policy were to assign a single automobile to one or more salespersons who share it, this policy would be reflected by a 1:M relationship. Similarly, the M:M relationship between vendor and inventory in Figure 2-14 implies that the organization buys the same type of products from one or more vendors. A company policy to buy particular items from a single vendor would be reflected by a 1:M cardinality.

System designers identify entities and prepare a model of them, similar to the one presented in Figure 2-15. This data model is the blueprint for what ultimately will become the physical database. The data model presented in

our example is not, however, sufficiently refined to be the plan for a workable database. Constructing a realistic data model is an advanced topic that involves understanding and applying techniques and rules that are beyond the scope of this chapter.

FIGURE 2-13 DATA FLOW DIAGRAM OF SALES ORDER PROCESSING SYSTEM

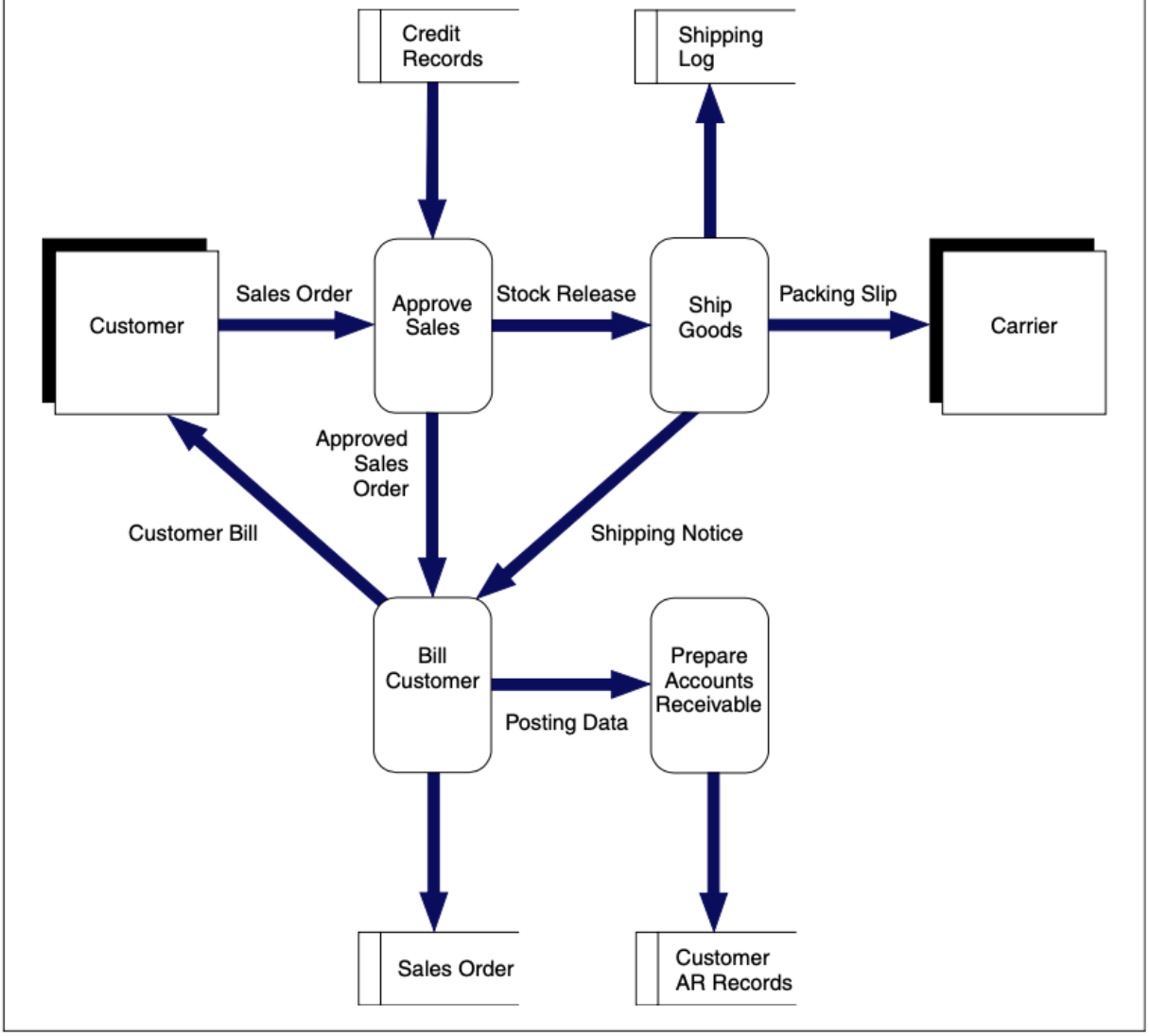


FIGURE 2-14 ENTITY RELATIONSHIP DIAGRAM SYMBOLS

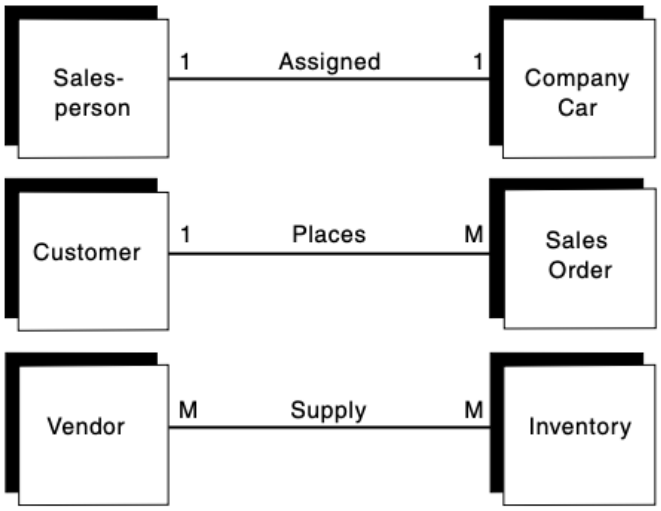
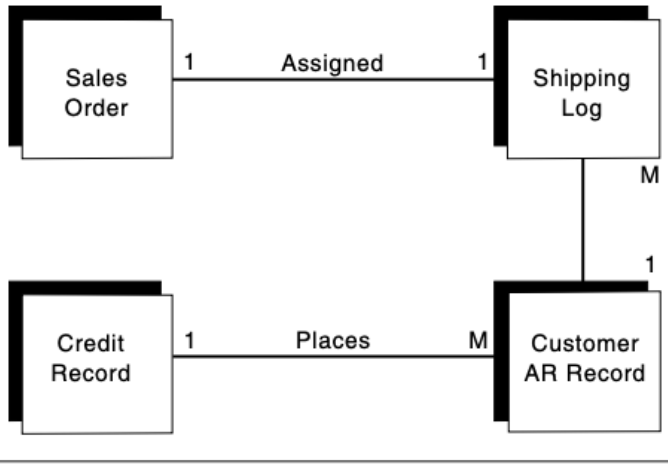


FIGURE 2-15 DATA MODEL



Relationship between ER Diagrams and Data Flow Diagrams

DFDs and ER diagrams depict different aspects of the same system, but they are related and can be reconciled. A DFD is a model of system processes, and the ER diagram models the data used in or affected by the system. The two diagrams are related through data; each data store in the

DFD represents a corresponding data entity in the ER diagram. Figure 2-15 presents the ER diagram for the DFD in Figure 2-13.

SYSTEM FLOWCHARTS

A system flowchart is the graphical representation of the physical relationships among key elements of a system. These elements may include organizational departments, manual activities, computer programs, hard-copy accounting records (documents, journals, ledgers, and files), and digital records (reference files, transaction files, archive files, and master files).3 System flowcharts also describe the type of computer media being employed in the system, such as magnetic tape, magnetic disks, and terminals.

The flowcharting examples in the following sections illustrate techniques for representing both manual and computer-based accounting processes. We begin by documenting manual procedures. We will add computer elements to the system later.

Flowcharting Manual Activities

To demonstrate the flowcharting of manual activities, let's assume that an auditor needs to flowchart a sales order system to evaluate its internal controls and procedures. The auditor will begin by interviewing individuals involved in the sales order process to determine what they do. This information will be captured in a set of written facts similar to those below. Keep in mind that the purpose here is to demonstrate flowcharting. Thus, for clarity, the system facts are intentionally simplistic.

1. A clerk in the sales department receives a hard-copy customer order by mail and manually prepares four hard copies of a sales order.

2. The clerk sends Copy 1 of the sales order to the credit department for approval. The other three copies and the original customer order are filed temporarily, pending credit approval.

3. The credit department clerk validates the customer's order against hard-copy credit records kept in the credit department. The clerk signs Copy 1 to signify approval and returns it to the sales clerk.

4. When the salesclerk receives credit approval, he or she files Copy 1 and the customer order in the department. The clerk sends Copy 2 to the warehouse and Copies 3 and 4 to the shipping department.

5. The warehouse clerk picks the products from the shelves, records the transfer in the hard-copy stock records, and sends the products and Copy 2 to the shipping department.

6. The shipping department receives Copy 2 and the goods from the warehouse, attaches Copy 2 as a packing slip, and ships the goods to the customer. Finally, the clerk files Copies 3 and 4 in the shipping department.

Based on these facts, the auditor can create a flowchart of this partial system. It is important to note that flowcharting is as much an art form as it is a technical skill, giving the flowchart author a great deal of license. Nevertheless, the primary objective should be to provide an unambiguous description of the system. With this in mind, certain rules and conventions need to be observed:

1. The flowchart should be labeled to clearly identify the system that it represents.

2. The correct symbols should be used to represent the various entities in the system.

3. All symbols on the flowchart should be labeled.

4. Lines should have arrowheads to clearly show the process flow and sequence of events.

5. If complex processes need additional explanation for clarity, a text description should be included on the flowchart or in an attached document referenced by the flowchart.

LAY OUT THE PHYSICAL AREAS OF ACTIVITY. Remember that a flowchart reflects the physical system, which is represented as vertical columns of events and actions separated by lines of demarcation. Generally, each of these areas of activity is a separate column with a heading. From the written system facts, we see that there are four distinct areas of activity: sales department, credit department, warehouse, and shipping department. The first step in preparing the flowchart is to lay out these areas of activity and label each of them. This step is illustrated in Figure 2-16.

TRANSCRIBE THE WRITTEN FACTS INTO VISUAL FORMAT. At this point we are ready to start visually representing the system facts. The symbols used for this purpose will be selected from the set presented in Figure 2-17. We begin with the first stated fact:

1. A clerk in the sales department receives a hard-copy customer order by mail and manually prepares four hard copies of a sales order.

Figure 2-18 illustrates how this fact could be represented. The customer is the source of the order but is not part of the system. The oval object is typically used to convey a data source or destination that is separate from the system being flowcharted. The document symbol entering the sales department signifies the hard-copy customer order and is labeled accordingly. The bucket-shaped symbol represents a manual process. In this

case, the clerk in the sales department prepares four copies of the sales order. Notice that the clerk's task, not the clerk, is depicted. The arrows between the objects show the direction of flow and
the sequence of events.

By transcribing each fact in this way, we systematically construct a flowchart. See how the second and third facts restated below add to the flowchart in Figure 2-19.

2. The clerk sends Copy 1 of the sales order to the credit department for approval. The other three copies and the original customer order are filed temporarily, pending credit approval.

3. The credit department clerk validates the customer's order against hard-copy credit records kept in the credit department. The clerk signs Copy 1 to signify approval and returns it to the salesclerk.

Two new symbols are introduced in this figure. First, the upside-down triangle symbol represents the temporary file mentioned in Fact 2. This is a physical file of paper documents such as a drawer in a filing cabinet or desk. Such files are typically arranged according to a specified order. To signify the filing system used, the file symbol will usually contain an ‘‘N’’ for numeric (invoice number), ‘‘C’’ for chronological (date), or ‘‘A’’ for alphabetic order (customer name). Secondly, the parallelogram shape represents the credit records mentioned in Fact 3. This symbol is used to depict many types of hard-copy accounting records, such as journals, subsidiary ledgers, general ledgers, and shipping logs.

FIGURE 2-16 **Flowchart Showing Areas of Activity**

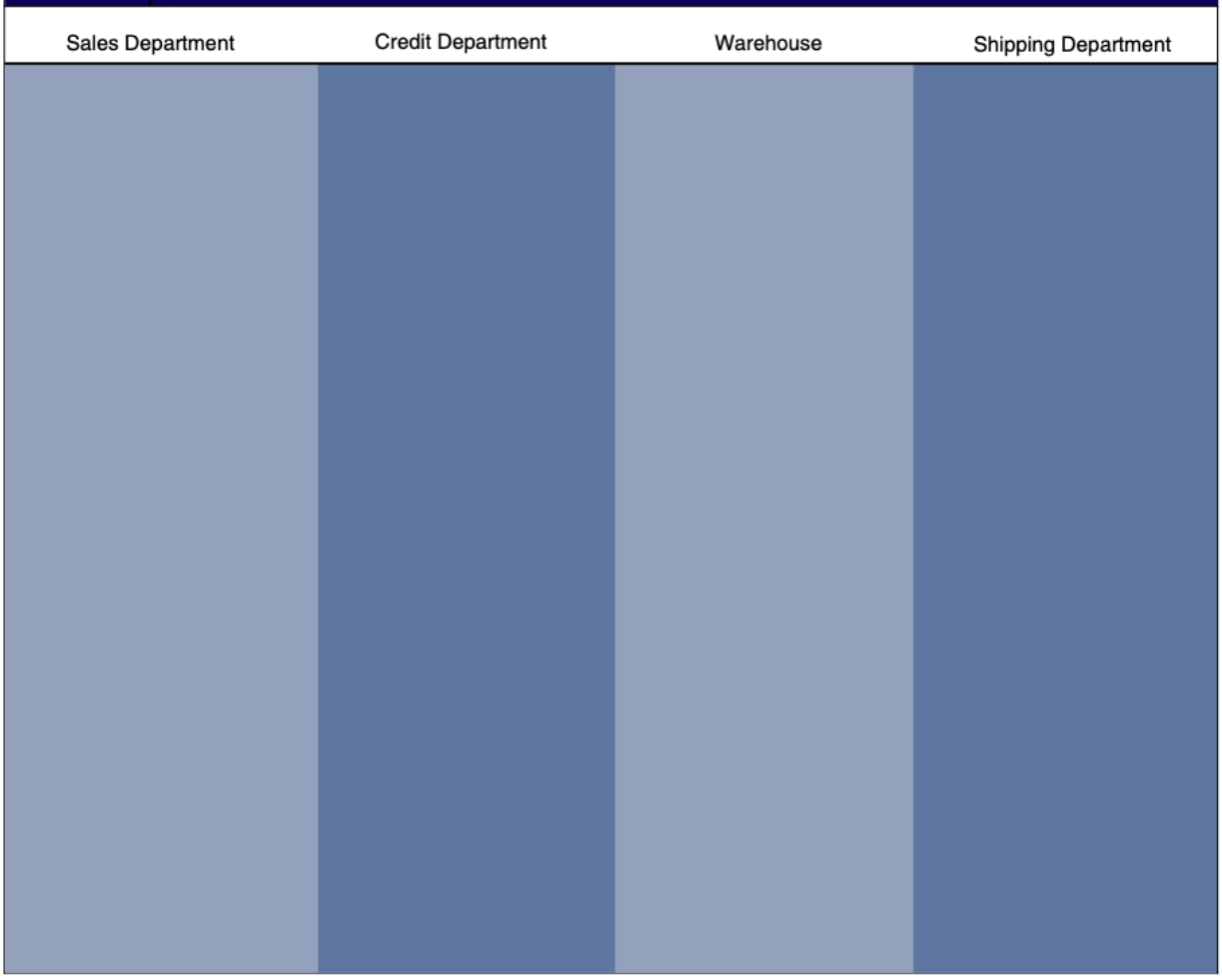
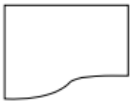


FIGURE 2-17

SYMBOL SET FOR REPRESENTING MANUAL PROCEDURES

Terminal showing source or destination of documents and reports

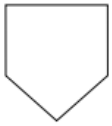
Calculated batch total



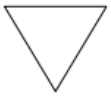
Source document or report

On-page connector

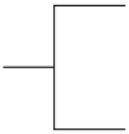
Manual operation



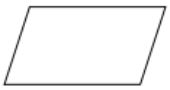
Off-page connector



File for storing source documents and reports



Description of process or comments

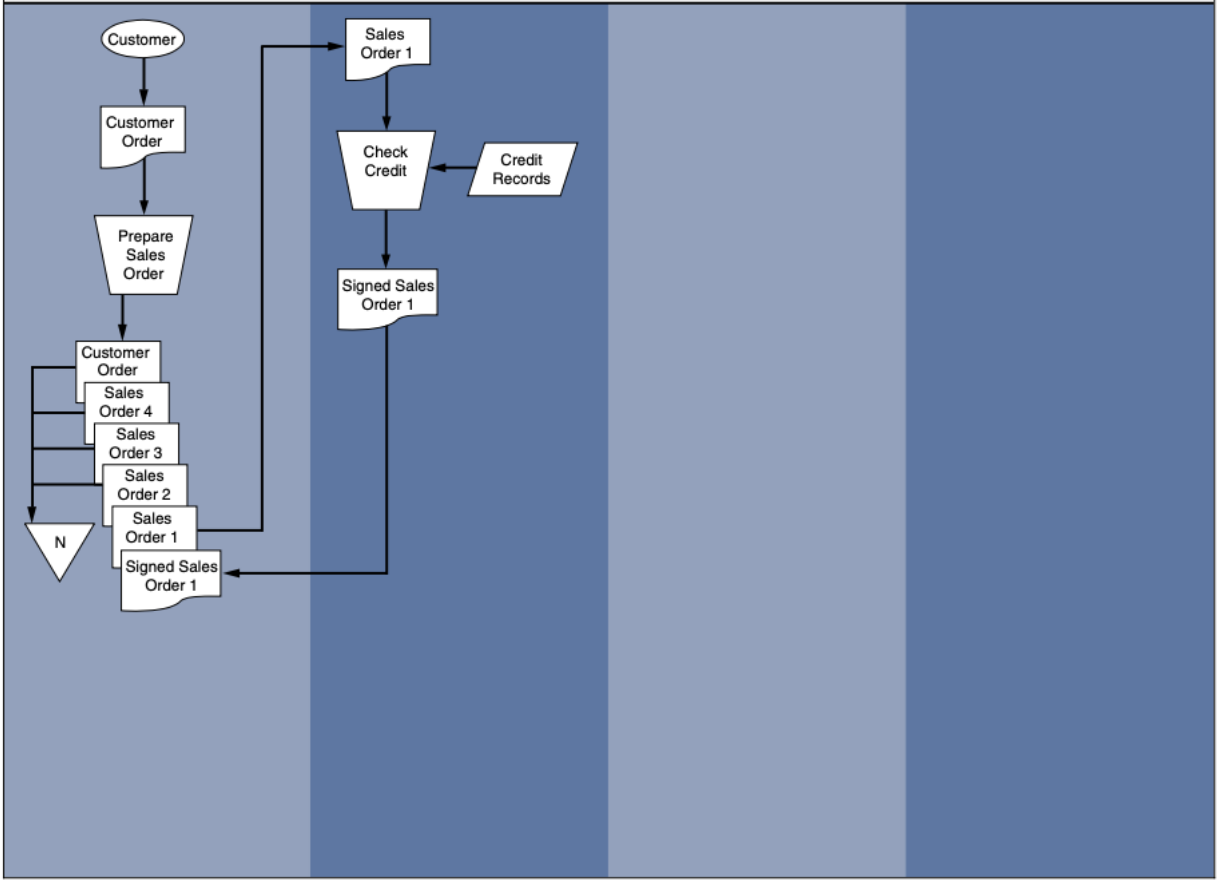


Accounting records (journals, registers, logs, ledgers)

Document flowline

FIGURE 2-18 **FLOWCHART SHOWING STATED FACT I TRANSLATED INTO VISUAL SYMBOLS**

FIGURE 2-19 FLOWCHART SHOWING STATED FACTS 1, 2, AND 3 TRANSLATED INTO VISUAL SYMBOLS



Having laid these foundations, let's now complete the flowchart by depicting the remaining facts.

4. When the salesclerk receives credit approval, he or she files Copy 1 and the customer order in the department. The clerk sends Copy 2 to the warehouse and Copies 3 and 4 to the shipping department.

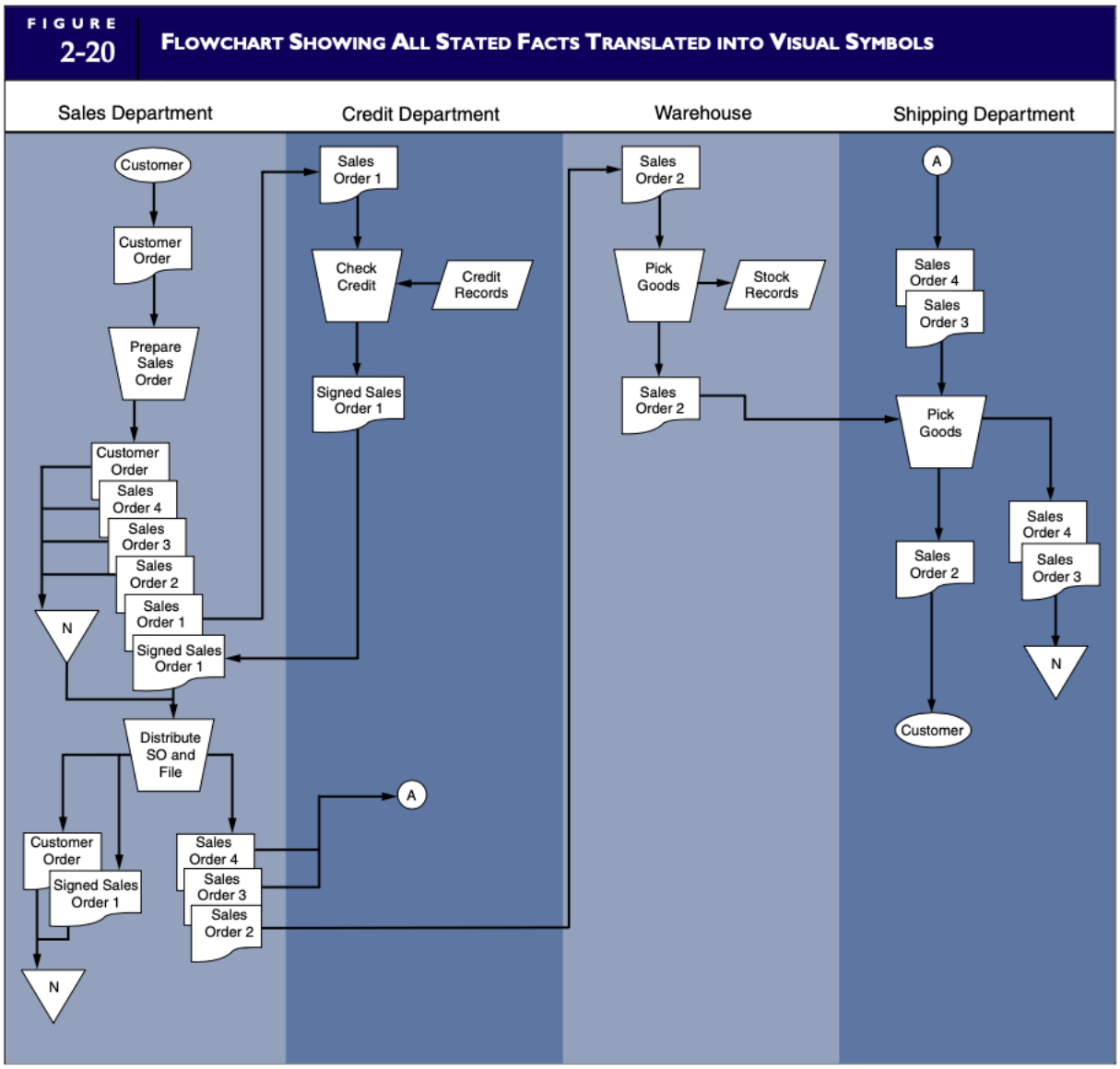
5. The warehouse clerk picks the products from the shelves, records the transfer in the hard-copy stock records, and sends the products and Copy 2 to the shipping department.

6. The shipping department receives Copy 2 and the goods from the warehouse, attaches Copy 2 as a packing slip, and ships the goods to the customer. Finally, the clerk files Copies 3 and 4 in the shipping department.

The completed flowchart is presented in Figure 2-20. Notice the circular symbol labeled ‘‘A.’’ This is an on-page connector used to replace flow lines that otherwise would cause excessive clutter on the page. In this instance, the connector replaces the lines that signify the movement of Copies 3 and 4 from the sales department to the shipping department. Lines should be used whenever possible to promote clarity. Restricted use of connectors, however, can improve the readability of the flowchart.

Notice also that the physical products or goods mentioned in Facts 4 and 5 are not shown on the flowchart. The document (Copy 2) that accompanies and controls the goods, however, is shown. Typically, a system flowchart shows only the flow of documents, not physical assets.

Finally, for visual clarity, system flowcharts show the processing of a single transaction only. You should keep in mind, however, that transactions usually pass through manual procedures in batches (groups). Before exploring documentation techniques further, we need to examine some important issues related to batch processing.



Batch Processing

Batch processing permits the efficient management of a large volume of transactions. A batch is a group of similar transactions (such as sales orders) that are accumulated over time and then processed together. Batch processing offers two general advantages. First, organizations improve operational efficiency by grouping together large numbers of transactions

into batches and processing them as a unit of work rather than processing each event separately.

Second, batch processing provides control over the transaction process. The accuracy of the process is established by periodically reconciling the batch against the control figure. For example, assume that the total value of a batch of sales orders is $100,000. This number is recorded when the batch is first assembled and then recalculated at various points during its processing. If an error occurs during processing (for example, a sales order is lost), then the recalculated batch total will not equal the original batch total and the problem will be detected.

Both of these advantages have implications for designing batch systems. The first is that economies are derived by making transaction batches large as possible. The average transaction cost is thus reduced when the processing fixed cost associated with the batch is allocated across a large number of transactions.

The second implication is that finding an error in a very large batch may prove difficult. When a batch is small, error identification is much easier. In designing a batch system, the accountant should seek a balance between the economic advantage of large batches and the troubleshooting advantage of small batches. There is no magic number for the size of a batch. This decision is based on a number of operational, business, and economic factors. Among these are the volume of transactions, the competitiveness of the industry, the normal frequency of errors, the financial implications of an undetected error, and the costs of processing. Depending on these factors, a system might be designed to process many small batches throughout the day or an entire day’s activity as a single batch.

Flowcharting Computer Processes

We now examine flowcharting techniques to represent a system that employs both manual and computer processes. The symbol set used to construct this system flowchart will come from both Figure 2-17 and Figure 2-21. Again, our example is based on a sales order system with the following facts:

1. A clerk in the sales department receives a customer order by mail and enters the information into a computer terminal that is networked to a centralized computer program in the computer operations department. The original customer order is filed in the sales department. Facts 2, 3, and 4 relate to activities that occur in the computer operations department.

2. A computer program edits the transactions, checks the customers' credit by referencing a credit history file, and produces a transaction file of sales orders.

3. The sales order transaction file is then processed by an update program that posts the transactions to corresponding records in AR and inventory files.

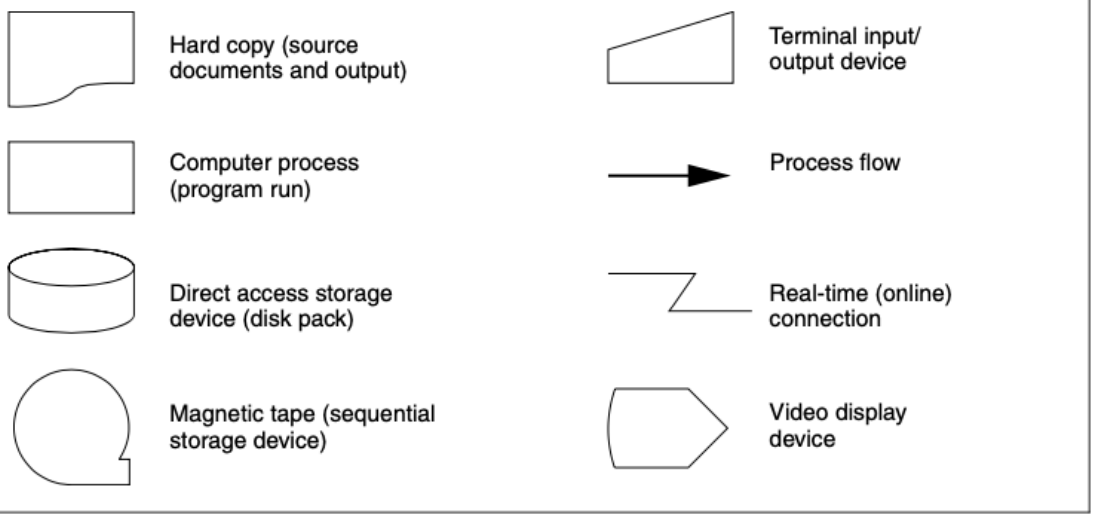
4. Finally, the update program produces three hard copies of the sales order. Copy 1 is sent to the warehouse, and Copies 2 and 3 are sent to the shipping department.

5. On receipt of Copy 1, the warehouse clerk picks the products from the shelves. Using Copy 1 and the warehouse personal computer (PC), the clerk records the inventory transfer in the digital stock records that are kept on the PC. Next, the clerk sends the physical inventory and Copy 1 to the shipping department.

6. The shipping department receives Copy 1 and the goods from the warehouse. The clerk reconciles the goods with Copies 1, 2, and 3 and

attaches Copy 1 as a packing slip. Next, the clerk ships the goods (with Copy 1 attached) to the customer. Finally, the clerk records the shipment in the hardcopy shipping log and files Copies 2 and 3 in the shipping department.

FIGURE 2-21 **SYMBOL SET FOR REPRESENTING COMPUTER PROCESSES**



LAY OUT THE PHYSICAL AREAS OF ACTIVITY. The flowcharting process begins by creating a template that depicts the areas of activity similar to the one shown in Figure 2-16. The only differences in this case are that this system has a computer operations department but does not have a credit department.

TRANSCRIBE THE WRITTEN FACTS INTO VISUAL FORMAT. As with the manual system example, the next step is to systematically transcribe the written facts into visual objects. Figure 2-22 illustrates how Facts 1, 2, and 3 translate visually.

The customer, customer order, and file symbols in this flowchart are the same as in the previous example. The salesclerk's activity, however, is

now automated, and the manual process symbol has been replaced with a computer terminal symbol. Also, because this is a data-input operation, the arrowhead on the flowchart line points in the direction of the edit and credit check program. If the terminal was also used to receive output (the facts do not specify such an operation), arrowheads would be on both ends of the line.

Recall that the emphasis in flowcharting is on the physical system. For example, the terminal used by the salesclerk to enter customer orders is physically located in the sales department, but the programs that process the transactions and the files that it uses and updates are stored in a separate computer operations department.

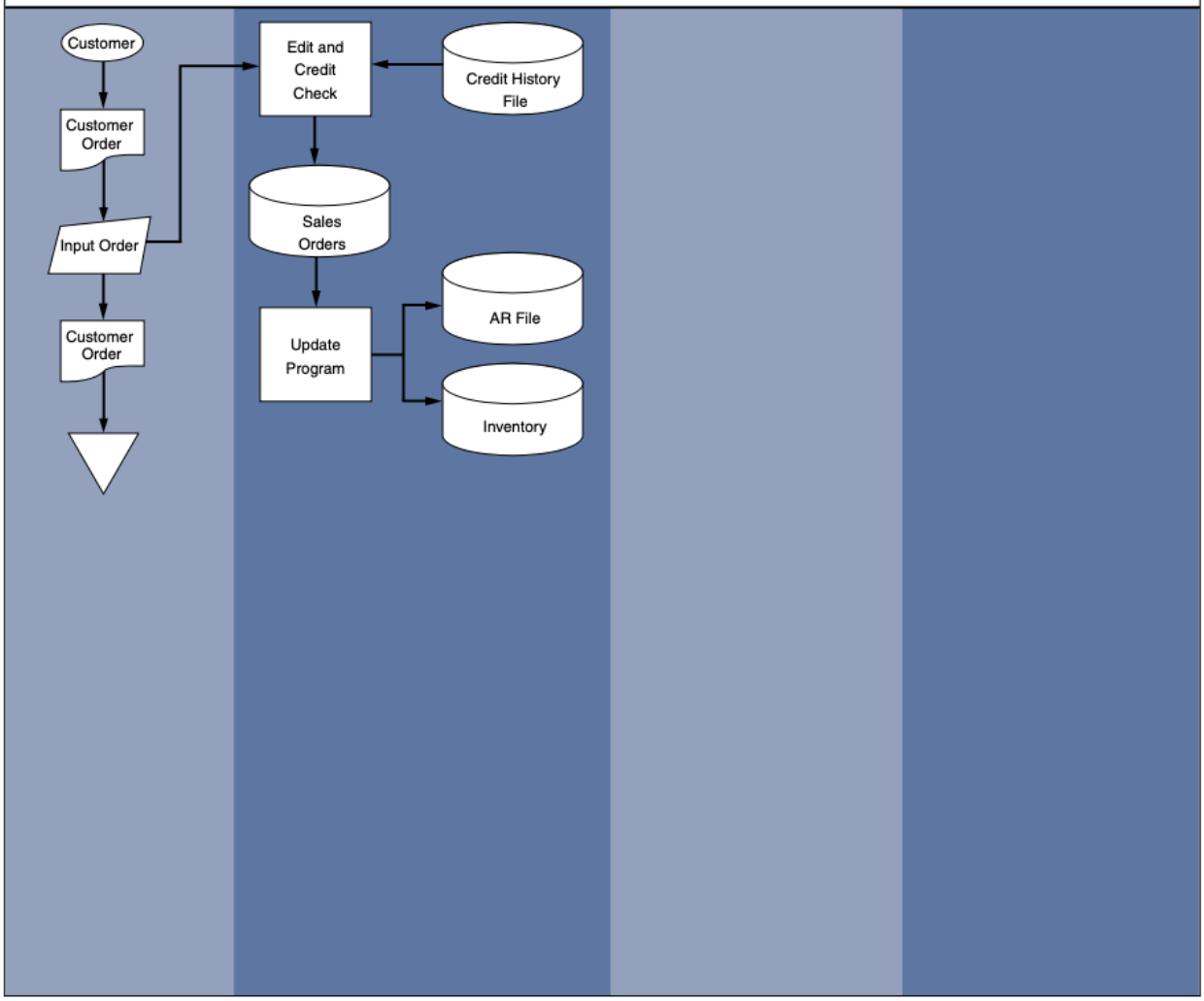
Notice how the flow line points from the credit history file to the edit program. This indicates that the file is read (referenced) but not changed (updated) by the program. In contrast, the interactions between the update program and the AR and inventory files are in the opposite direction. The relevant records in these files have been changed to reflect the transactions. The logic of a file update is explained later in the chapter.

Let’s now translate the remaining facts into visual symbols. Fact 4 states that the update program produces three hard-copy documents in the computer operations department, which are then distributed to the warehouse and shipping departments. The translation of this fact is illustrated in Figure 2-23.

Fact 5 states that the warehouse clerk updates the stock records on the department PC and then sends the physical inventory and Copy 1 to the shipping department. Notice on Figure 2-23 how this computer activity is represented. The warehouse PC is a stand-alone computer system that is not networked into the computer operations department like the terminal in

the sales department. The PC, the stock record update program, and the stock records themselves are all physically located in the warehouse. As with manual procedures, when documenting computer operations the flowchart author must accurately represent the physical arrangement of the system components. As we will see in later chapters, the physical arrangement of system components (both manual and computer) often plays an important role in the auditor's assessment of internal control.

FIGURE 2-22 FLOWCHART SHOWING THE TRANSLATION OF FACTS 1, 2, AND 3 INTO VISUAL SYMBOLS



Finally, Fact 6 describes how the shipping department clerk reconciles the goods with the supporting documents, sends the goods and the packing slip to the customer, updates the shipping log, and files two copies of the sales order. This is entirely a manual operation, as evidenced by the symbols in Figure 2-23. Note that the shipping log uses the same symbol that is used for representing journals and ledgers.

PROGRAM FLOWCHARTS

The system flowchart in Figure 2-23 shows the relationship between computer programs, the files they use, and the outputs they produce. This high level of documentation, however, does not provide the operational details that are sometimes needed. For example, an auditor wishing to assess the correctness of the edit program's logic cannot do so from the system flowchart. This requires a program flowchart. The symbol set used for program flowcharts is presented in Figure 2-24.

Every program represented in a system flowchart should have a supporting program flowchart that describes its logic. Figure 2-25 presents the logic of the edit program shown in Figure 2-26. A separate symbol represents each step of the program's logic, and each symbol represents one or more lines of computer program code. The connector lines between the symbols establish the logical order of execution. Tracing the flowchart downward from the start symbol, we see that the program performs the following logical steps in the order listed:

1. The program retrieves a single record from the unedited transaction file and stores it in memory.

2. The first logical test is to see if the program has reached the end-of-file (EOF) condition for the transaction file. Most file structures use a special

record or marker to indicate an EOF condition. When EOF is reached, the edit program will terminate and the next program in the system (in this case, the update program) will be executed. As long as there is a record in the unedited transaction file, the result of the EOF test will be ‘‘no’’ and process control is passed to the next logical step in the edit program.

3. Processing involves a series of tests to identify certain clerical and logical errors. Each test, represented by a decision symbol, evaluates the presence or absence of a condition. For example, an edit test could be to detect the presence of alphabetic data in a field that should contain only numeric data.

4. Error-free records are sent to the edited transaction file.

5. Records containing errors are sent to the error file.

6. The program loops back to Step 1, and the process is repeated until the EOF condition is reached.

Accountants sometimes use program flowcharts to verify the correctness of program logic. They compare flowcharts to the actual program code to determine whether the program is actually doing what the documentation describes. Program flowcharts provide essential details for conducting information technology audits.

FIGURE 2-23 **FLOWCHART SHOWING ALL FACTS TRANSLATED INTO VISUAL SYMBOLS**

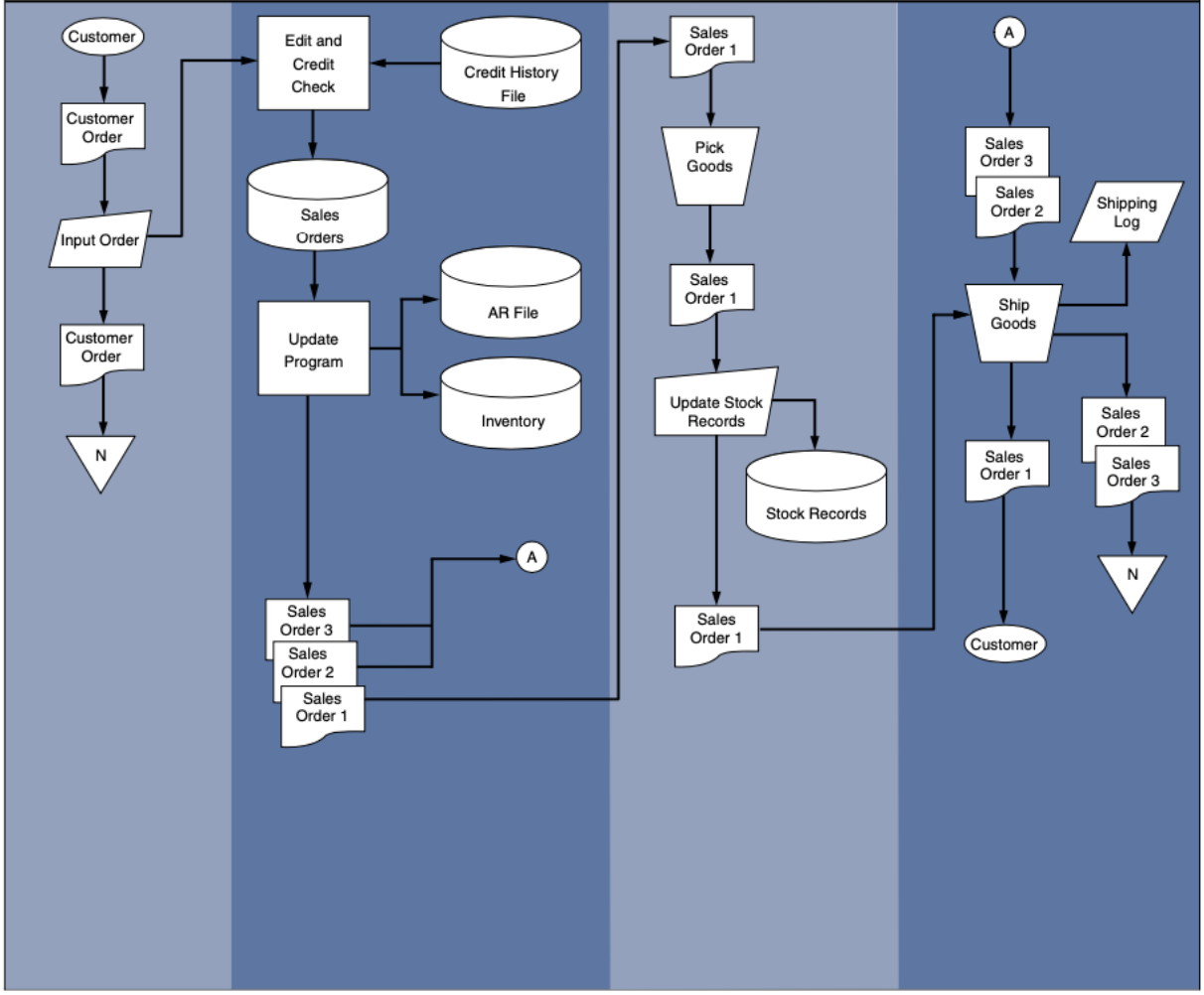


FIGURE 2-24 **PROGRAM FLOWCHART SYMBOLS**

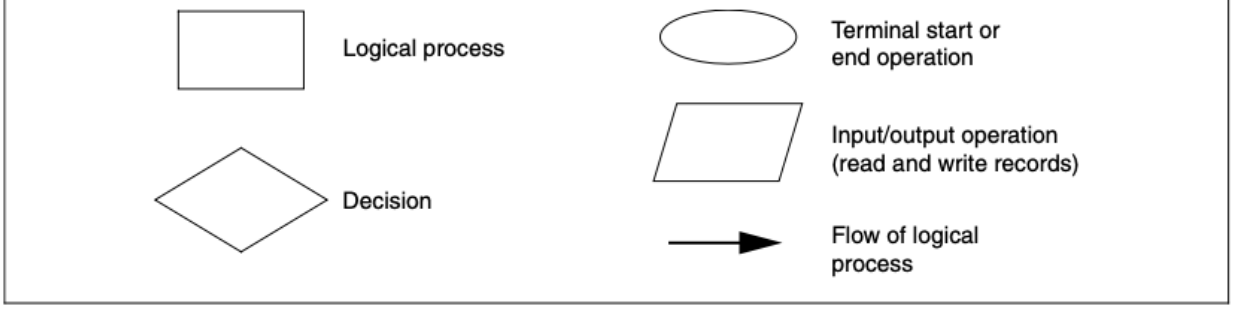


FIGURE 2-25 PROGRAM FLOWCHART FOR EDIT PROGRAM

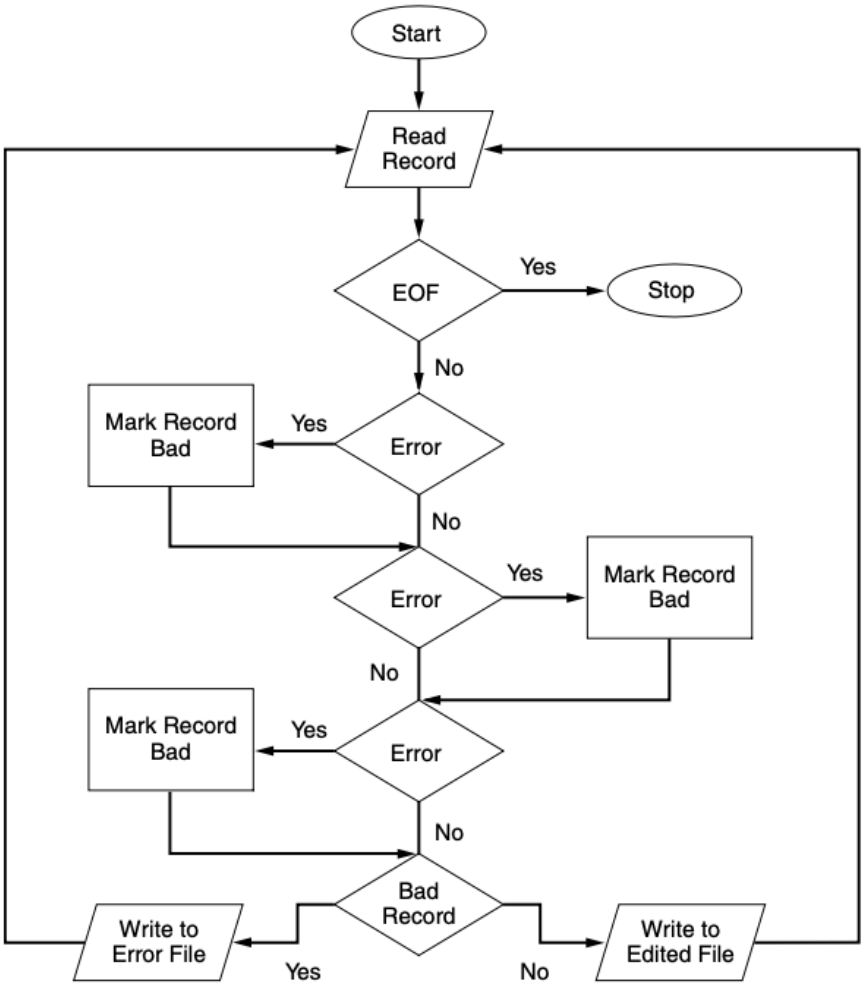
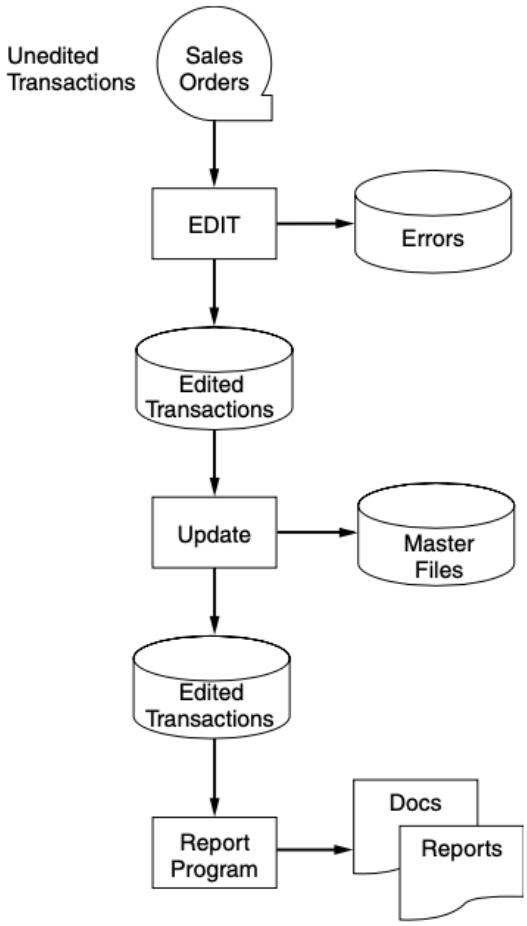


FIGURE 2-26 SYSTEM FLOWCHART



RECORD LAYOUT DIAGRAMS

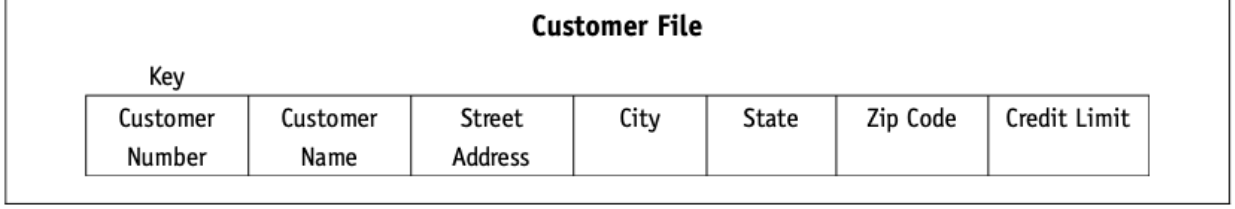
Record layout diagrams are used to reveal the internal structure of the records that constitute a file or database table. The layout diagram usually shows the name, data type, and length of each attribute (or field) in the record. Detailed data structure information is needed for such tasks as identifying certain types of system failures, analyzing error reports, and designing tests of computer logic for debugging and auditing purposes. A simpler form of record layout, shown in Figure 2-27, suits our purposes best.

This type of layout shows the content of a record. Each data attribute and key field is shown in terms of its name and relative location.

Computer-Based Accounting Systems

The final section in this chapter examines alternative computer-based transaction processing models. Computer-based accounting systems fall into two broad classes: batch systems and real-time systems. A number of alternative configurations exist within each of these classes. Systems designers base their configuration choices on a variety of considerations. Table 2-1 summarizes some of the distinguishing characteristics of batch and real-time processing that feature prominently in these decisions.

FIGURE 2-27 RECORD LAYOUT DIAGRAM FOR CUSTOMER FILE



DIFFERENCES BETWEEN BATCH AND REAL-TIME SYSTEMS

Information Time Frame

Batch systems assemble transactions into groups for processing. Under this approach, there is always a time lag between the point at which an economic event occurs and the point at which it is reflected in the firm's accounts. The amount of lag depends on the frequency of batch processing. Time lags can range from minutes to weeks. Payroll processing is an example of a typical batch system. The economic events—the application of employee labor—occur continuously throughout the pay period. At the end

of the period, the paychecks for all employees are prepared together as a batch.

Real-time systems process transactions individually at the moment the event occurs. Because records are not grouped into batches, there are no time lags between occurrence and recording. An example of real-time processing is an airline reservations system, which processes requests for services from one traveler at a time while he or she waits.

Resources

Generally, batch systems demand fewer organizational resources (such as programming costs, computer time, and user training) than real-time systems. For example, batch systems can use sequential files stored on magnetic tape. Real-time systems use direct access files that require more expensive storage devices, such as magnetic disks. In practice, however, these cost differentials are disappearing. As a result, business organizations typically use magnetic disks for both batch and real-time processing.

The most significant resource differentials are in the areas of systems development (programming) and computer operations. As batch systems are generally simpler than their real-time counterparts, they tend to have shorter development periods and are easier for programmers to maintain. On the other hand, as much as 50 percent of the total programming costs for real-time systems are incurred in designing the user interfaces. Real-time systems must be friendly, forgiving, and easy to work with. Pop-up menus, online tutorials, and special help features require additional programming and add greatly to the cost of the system.

Finally, real-time systems require dedicated processing capacity. Real-time systems must deal with transactions as they occur. Some types of systems must be available 24 hours a day whether they are being used or not. The computer capacity dedicated to such systems cannot be used for other purposes. Thus, implementing a real-time system may require either the purchase of a dedicated computer or an investment in additional computer capacity. In contrast, batch systems use computer capacity only when the program is being run. When the batch job completes processing, the freed capacity can be reallocated to other applications.

TABLE 2-1 CHARACTERISTIC DIFFERENCES BETWEEN BATCH AND REAL-TIME PROCESSING

	Data Processing Methods	
Distinguishing Feature	**Batch**	**Real-Time**
Information time frame	Lag exists between time when the economic event occurs and when it is recorded.	Processing takes place when the economic event occurs.
Resources	Generally, fewer resources (e.g., hardware, programming, training) are required.	More resources are required than for batch processing.
Operational efficiency	Certain records are processed after the event to avoid operational delays.	All records pertaining to the event are processed immediately.

Operational Efficiency

Real-time processing in systems that handle large volumes of transactions each day can create operational inefficiencies. A single transaction may affect several different accounts. Some of these accounts, however, may not need to be updated in real time. In fact, the task of doing so takes time that, when multiplied by hundreds or thousands of transactions, can cause significant processing delays. Batch processing of noncritical accounts, however, improves operational efficiency by eliminating unnecessary activities at critical points in the process. This is illustrated with an example later in the chapter.

Efficiency Versus Effectiveness

In selecting a data processing mode, the designer must consider the trade-off between efficiency and effectiveness. For example, users of an airline reservations system cannot wait until 100 passengers (an efficient batch size) assemble in the travel agent's office before their transactions are processed. When immediate access to current information is critical to the user's needs, real-time processing is the logical choice. When time lags in information have no detrimental effects on the user's performance and operational efficiencies can be achieved by processing data in batches, batch processing is probably the superior choice.

ALTERNATIVE DATA PROCESSING APPROACHES

Legacy Systems Versus Modern Systems

Not all modern organizations use entirely modern information systems. Some firms employ legacy systems for certain aspects of their data processing. When legacy systems are used to process financially significant transactions, auditors need to know how to evaluate and test them. We saw in Chapter 1 that legacy systems tend to have the following distinguishing features: they are mainframe-based applications; they tend to be batch oriented; early legacy systems use flat files for data storage, but hierarchical and network databases are often associated with later-era legacy systems. These highly structured and inflexible storage systems promote a single-user environment that discourages information integration within business organizations.

Modern systems tend to be client-server (network)–based and process transactions in real time. Although this is the trend in most organizations, please note that many modern systems are mainframe-based and use batch

processing. Unlike their predecessors, modern systems store transactions and master files in relational database tables. A major advantage of database storage is the degree of process integration and data sharing that can be achieved.

Although legacy system configurations no longer constitute the defining features of accounting information systems (AIS), they are still of marginal importance to accountants.

The remainder of the chapter focuses on modern system technologies used for processing accounting transactions. Some systems employ a combination of batch and real-time processing, while others are purely real-time systems.

Updating Master Files from Transactions

Whether batch or real-time processing is being used, updating a master file record involves changing the value of one or more of its variable fields to reflect the effects of a transaction. Figure 2-28 presents record structures for a sales order transaction file and two associated master files, AR and inventory. The primary key (PK)—the unique identifier—for the inventory file is INVENTORY NUMBER. The primary key for AR is ACCOUNT NUMBER. Notice that the record structure for the sales order file contains a primary key (SALES ORDER NUMBER) and two secondary key (SK) fields, ACCOUNT NUMBER and INVENTORY NUMBER. These secondary keys are used for locating the corresponding records in the master files. To simplify the example, we assume that each sale is for a single item of inventory. The update procedure in this example involves the following steps:

1. A sales order record is read by the system.

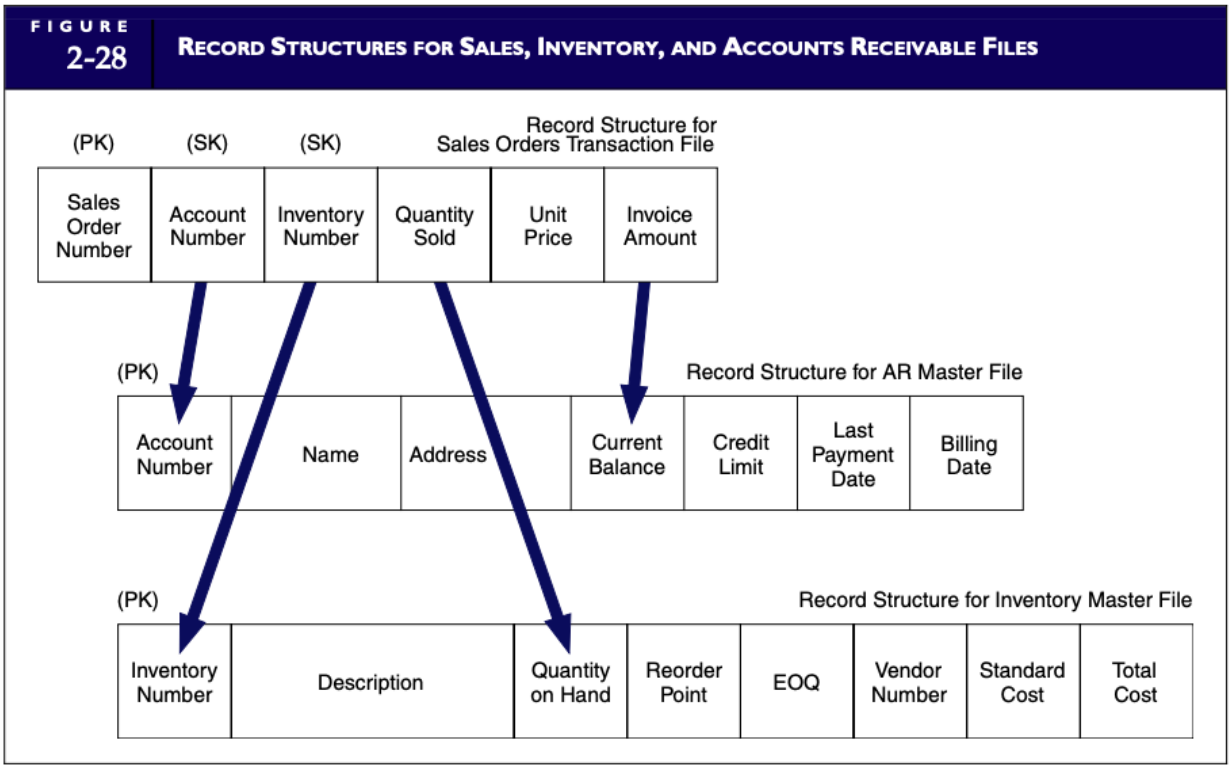
2. ACCOUNT NUMBER is used to search the AR master file and retrieve the corresponding AR record.

3. The AR update procedure calculates the new customer balance by adding the value stored in the INVOICE AMOUNT field of the sales order record to the CURRENT BALANCE field value in the AR master record.

4. Next, INVENTORY NUMBER is used to search for the corresponding record in the inventory master file.

5. The inventory update program reduces inventory levels by deducting the QUANTITY SOLD value in a transaction record from the QUANTITY ON HAND field value in the inventory record.

6. A new sales order record is read, and the process is repeated.



Database Backup Procedures

Each record in a database file is assigned a unique disk location or address that is determined by its primary key value. Because only a single valid location exists for each record, updating the record must occur in place. Figure 2-29 shows this technique.

In this example, an AR record with a $100 current balance is being updated by a $50 sale transaction. The master file record is permanently stored at a disk address designated Location A. The update program reads both the transaction record and the master file record into memory. The receivable is updated to reflect the new current balance of $150 and then returned to Location A. The original current balance, value of $100, is destroyed when replaced by the new value of $150. This technique is called destructive update.

The destructive update approach leaves no backup copy of the original master file. Only the current value is available to the user. To preserve adequate accounting records in case the current master becomes damaged or corrupted, separate backup procedures, such as those shown in Figure 2-30, must be implemented.

Prior to each batch update or periodically (for example, every 15 minutes), the master file being updated is copied to create a backup version of the original file. Should the current master be destroyed after the update process, reconstruction is possible in two stages. First, a special recovery program uses the backup file to create a pre-update version of the master file. Second, the file update process is repeated using the previous batch of transactions to restore the master to its current condition. Because of the potential risk to accounting records, accountants are naturally concerned about the adequacy of all backup procedures.

BATCH PROCESSING USING REAL-TIME DATA COLLECTION

A popular data processing approach, particularly for large operations, is to electronically capture transaction data at the source as they occur. By distributing data input capability to users, certain transaction errors can be prevented or detected and corrected at their source. The result is a transaction file that is free from most of the errors that plague older legacy systems. The transaction file is later processed in batch mode to achieve operational efficiency. Figure 2-31 illustrates this approach with a simplified sales order system such as that used in a department store. Key steps in the process are:

- The sales department clerk captures customer sales data pertaining to the item(s) being purchased and the customer's account.
- The system then checks the customer's credit limit from data in the customer record (account receivable subsidiary file) and updates his or her account balance to reflect the amount of the sale.
- Next the system updates the quantity-on-hand field in the inventory record (inventory subsidiary file) to reflect the reduction in inventory. This provides up-to-date information to other clerks as to inventory availability.
- A record of the sale is then added to the sales order file (transaction file), which is processed in batch mode at the end of the business day. This batch process records each transaction in the sales journal and updates the affected general ledger accounts.

You may be wondering at this point why the sales journal and general ledger accounts are being processed in batch mode. Why not update them in real time along with the subsidiary accounts? The answer is to achieve operational efficiency. We now examine what that means.

Let’s assume that the organization using the sales order system configuration illustrated in Figure 2-31 is large and capable of serving hundreds of customers concurrently. Also assume that 500 sales terminals are distributed throughout its many large departments.

Each customer sale affects the following six accounting records:

- Customer account receivable (Subsidiary—unique)
- Inventory item (Subsidiary—almost unique)
- Inventory control (GL—common)
- Account receivable control (GL—common)
- Sales (GL—common)
- Cost of good sold (GL—common)

To maintain the integrity of accounting data, once a record has been accessed for processing, it is locked by the system and made unavailable to other users until its processing is complete. Using the affected records noted here as an example, consider the implications that this data-locking rule has on the users of the system.

When processing a customer account receivable subsidiary record, the rule has no implications for other users of the system. Each user accesses only his or her unique record. For example, accessing John Smith’s account does not prevent Mary Jones from accessing her account. Updating the inventory subsidiary record is almost unique. Because it is possible that both Mary Jones and John Smith are independently purchasing the same item at the same time, Mary Jones may be kept waiting a few seconds until John Smith’s transaction releases the lock on the inventory account. This will be a relatively rare event, and any such conflicts will be of little inconvenience to customers. As a general rule, therefore, master file records that are unique

to a transaction such as customer accounts and individual inventory records can be updated in real time without causing operational delays.

Updating the records in the general ledger is a different matter. All general ledger accounts previously listed need to be updated by every sales transaction. If the processing of John Smith's transaction begins before that of Mary Jones, then she must wait until all six records have been updated before her transaction can proceed. However, the 20- or 30-second delay brought about by this conflict will probably not inconvenience Mary Jones. This problem becomes manifest as transaction volumes increase. A 20-second delay in each of 500 customer transactions would create operational inefficiency on a chaotic level. Each of the 500 customers must wait until the person ahead of him or her in the queue has completed processing their transaction. The last person in the queue will experience a delay of 500 x 20 seconds = 2.75 hours.

FIGURE 2-29 DESTRUCTIVE UPDATE APPROACH

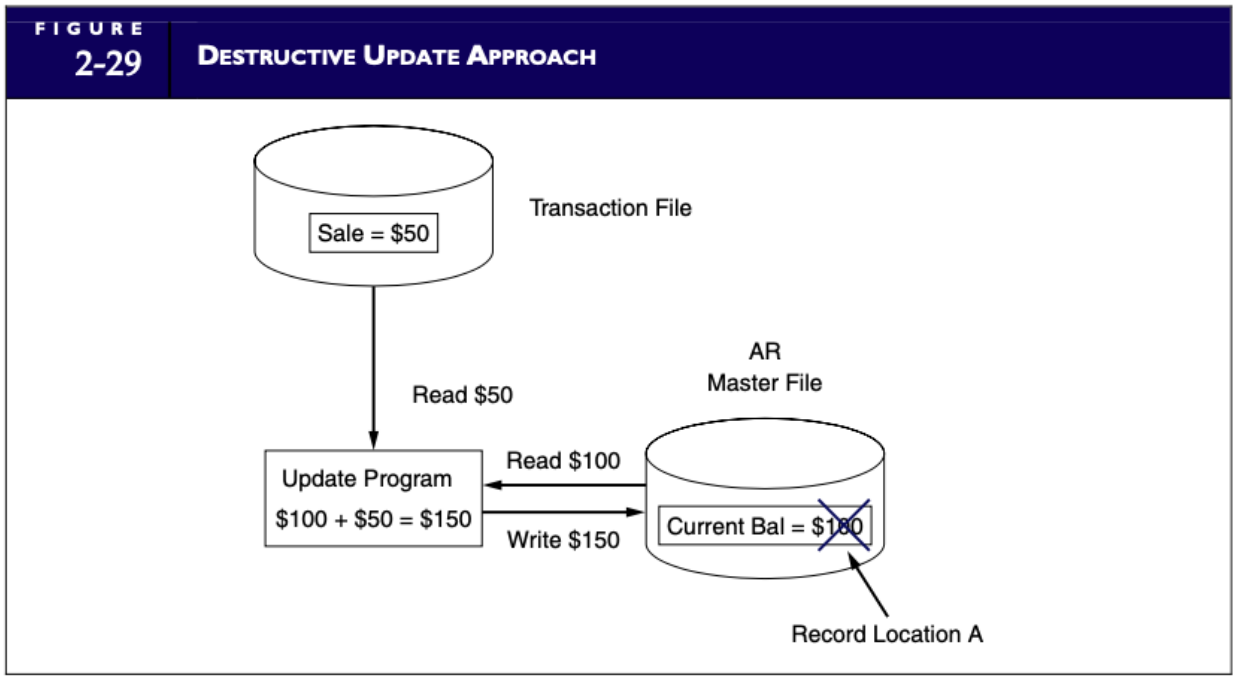
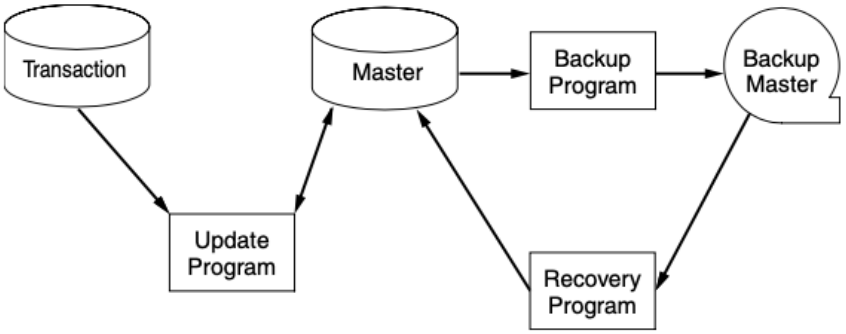
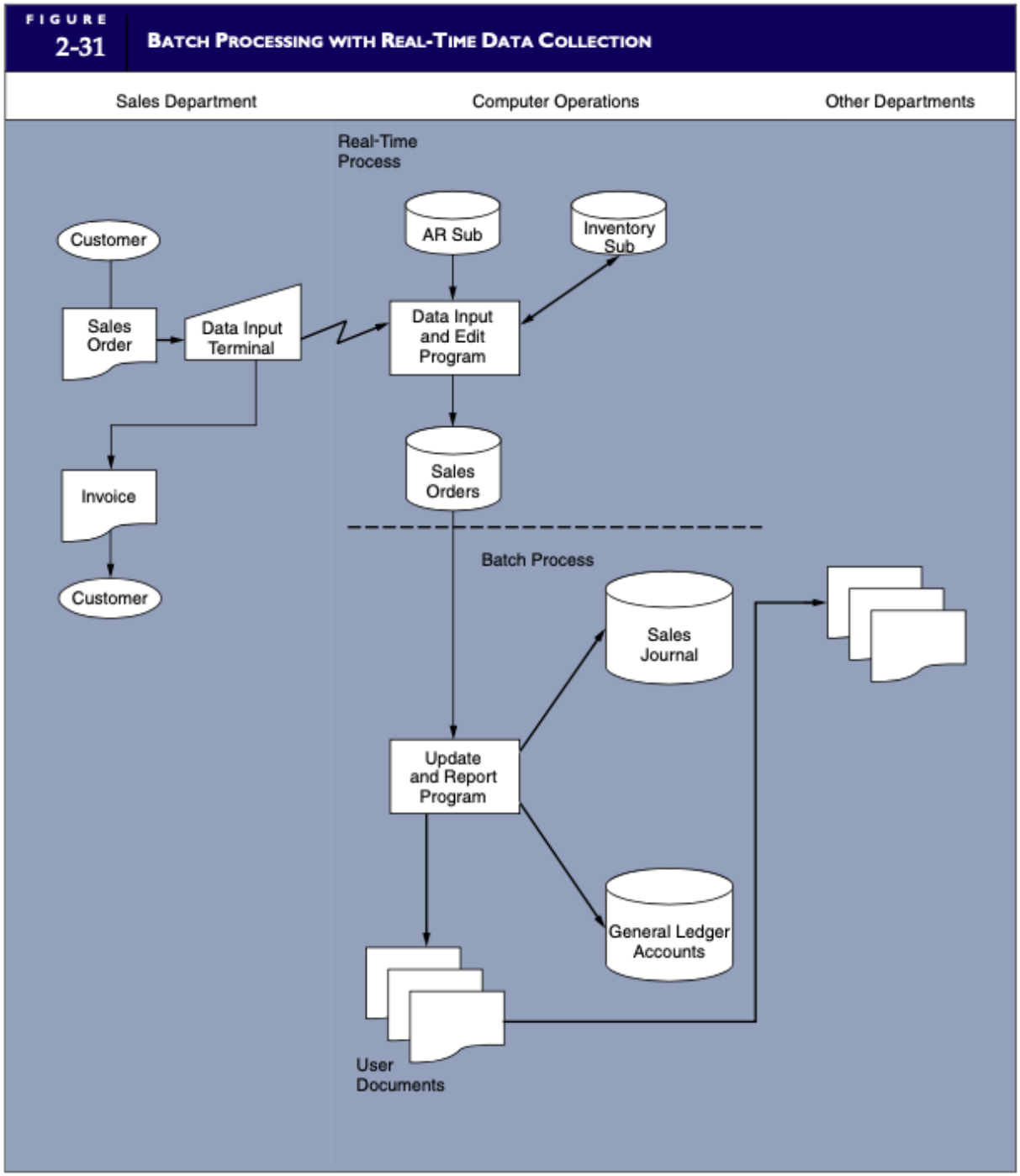


FIGURE 2-30 BACKUP AND RECOVERY PROCEDURES FOR DATABASE FILES



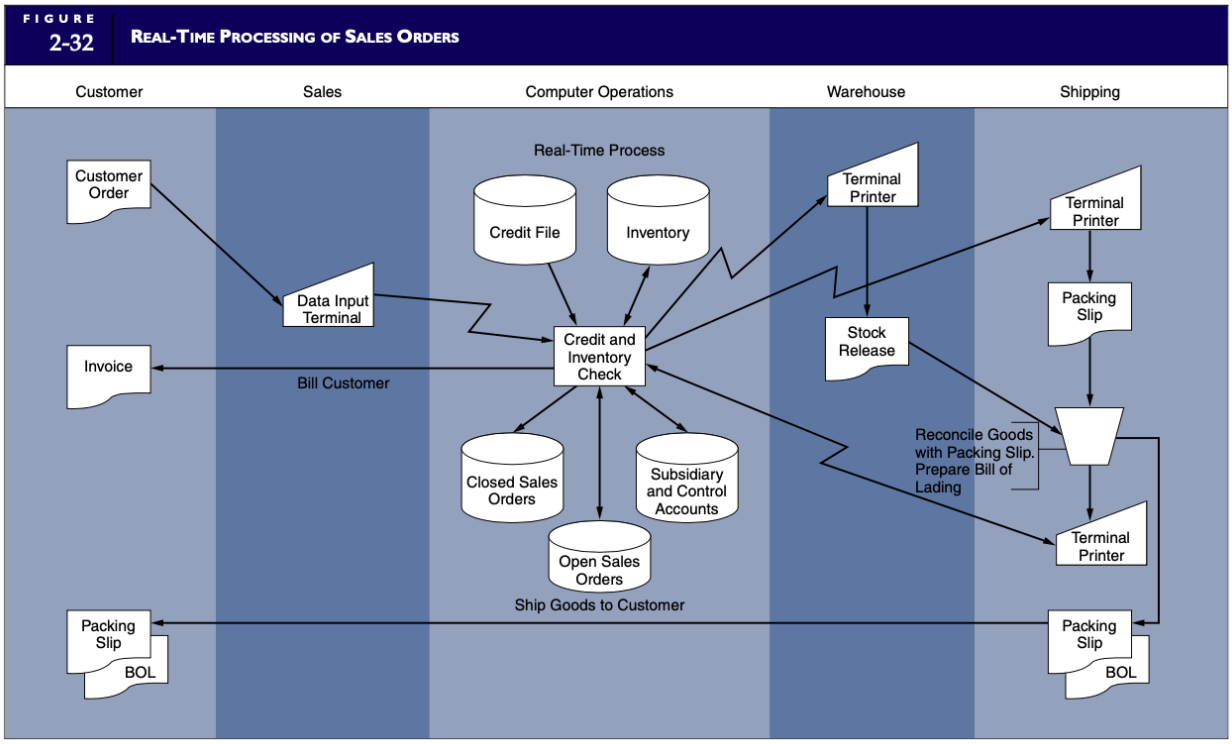


REAL-TIME PROCESSING

Real-time systems process the entire transaction as it occurs. For example, a sales order processed by the system in Figure 2-32 can be captured, filled, and shipped the same day. Such a system has many

potential benefits, including improved productivity, reduced inventory, increased inventory turnover, decreased lags in customer billing, and enhanced customer satisfaction. Because transaction information is transmitted electronically, physical source documents can be eliminated or greatly reduced.

Real-time processing is well suited to systems that process lower transaction volumes and those that do not share common records. These systems make extensive use of local area network and wide area network technology. Terminals at distributed sites throughout the organization are used for receiving, processing, and sending information about current transactions. These must be linked in a network arrangement so users can communicate.



Data Coding Schemes

Within the context of transaction processing, data coding involves creating simple numeric or alphabetic codes to represent complex economic phenomena that facilitate efficient data processing. In Figure 2-28, for example, we saw how the secondary keys of transaction file records are linked to the primary keys of master file records. The secondary and primary keys in the example are instances of data coding. In this section we explore several data coding schemes and examples of their application in AIS. To emphasize the importance of data codes, we first consider a hypothetical system that does not use them.

A SYSTEM WITHOUT CODES

Firms process large volumes of transactions that are similar in their basic attributes. For instance, a firm's AR file may contain accounts for several different customers with the same name and similar addresses. To process transactions accurately against the correct accounts, the firm must be able to distinguish one John Smith from another. This task becomes particularly difficult as the number of similar attributes and items in the class increase.

Consider the most elemental item that a machine shop wholesaler firm might carry in its inventory—a machine nut. Assume that the total inventory of nuts has only three distinguishing attributes: size, material, and thread type. As a result, this entire class of inventory must be distinguished on the basis of these three features, as follows:

1. The size attribute ranges from 1=4 inch to 13=4 inches in diameter in increments of 1=64 of an inch, giving 96 nut sizes.

2. For each size subclass, four materials are available: brass, copper, mild steel, and case-hardened steel.

3. Each of these size and material subclasses come in three different threads: fine, standard, and coarse.

Under these assumptions, this class of inventory could contain 1,152 separate items (96 _ 4 _ 3). The identification of a single item in this class thus requires a description featuring these distinguishing attributes. To illustrate, consider the following journal entry to record the receipt of $1,000 worth of half-inch, casehardened steel nuts with standard threads supplied by Industrial Parts Manufacturer of Cleveland, Ohio.

	DR	CR
Inventory—nut, ½ inch, case-hardened steel, standard thread	1,000	
AP—Industrial Parts Manufacturer, Cleveland, Ohio		1,000

This uncoded entry takes a great deal of recording space, is time-consuming to record, and is obviously prone to many types of errors. The negative effects of this approach may be seen in many parts of the organization:

1. Sales staff. Properly identifying the items sold requires the transcription of large amounts of detail onto source documents. Apart from the time and effort involved, this tends to promote clerical errors and incorrect shipments.

2. Warehouse personnel. Locating and picking goods for shipment are impeded and shipping errors will likely result.

3. Accounting personnel. Postings to ledger accounts will require searching through the subsidiary files using lengthy descriptions as the key. This will be painfully slow, and postings to the wrong accounts will be common.

A SYSTEM WITH CODES

These problems are solved, or at least greatly reduced, by using codes to represent each item in the inventory and supplier accounts. Let's assume the inventory item in our previous example had been assigned the numeric code 896, and the supplier in the AP account is given the code number 321. The coded version of the previous journal entry can now be greatly simplified:

ACCOUNT	DR	CR
896	1,000	
321		1,000

This is not to suggest that detailed information about the inventory and the supplier is of no interest to the organization. Obviously it is! These facts will be kept in reference files and used for such purposes as the preparation of parts lists, catalogs, bills of material, and mailing information. The inclusion of such details, however, would clutter the task of transaction processing and could prove dysfunctional, as this simple example illustrates. Other uses of data coding in AIS are to:

1. Concisely represent large amounts of complex information that would otherwise be unmanageable.

2. Provide a means of accountability over the completeness of the transactions processed.

3. Identify unique transactions and accounts within a file.

4. Support the audit function by providing an effective audit trail.

The following discussion examines some of the more commonly used coding techniques and explores their respective advantages and disadvantages.

NUMERIC AND ALPHABETIC CODING SCHEMES

Sequential Codes

As the name implies, sequential codes represent items in some sequential order (ascending or descending). A common application of numeric sequential codes is the prenumbering of source documents. At printing, each hard-copy document is given a unique sequential code number. This number becomes the transaction number that allows the system to track each transaction processed and to identify any lost or out-of-sequence documents. Digital documents are similarly assigned a sequential number by the computer when they are created.

ADVANTAGES. Sequential coding supports the reconciliation of a batch of transactions, such as sales orders, at the end of processing. If the transaction processing system detects any gaps in the sequence of transaction numbers, it alerts management to the possibility of a missing or misplaced transaction. By tracing the transaction number back through the stages in the process, management can eventually determine the cause and effect of the error. Without sequentially numbered documents, problems of this sort are difficult to detect and resolve.

DISADVANTAGES. Sequential codes carry no information content beyond their order in the sequence. For instance, a sequential code assigned to a raw material inventory item tells us nothing about the attributes of the item (type, size, material, warehouse location, and so on). Also, sequential coding schemes are difficult to change. Inserting a new item at some midpoint requires renumbering the subsequent items in the class accordingly. In applications where record types must be grouped together logically and

where additions and deletions occur regularly, this coding scheme is inappropriate.

Block Codes

A numeric block code is a variation on sequential coding that partly remedies the disadvantages just described. This approach can be used to represent whole classes of items by restricting each class to a specific range within the coding scheme. A common application of block coding is the construction of a chart of accounts.

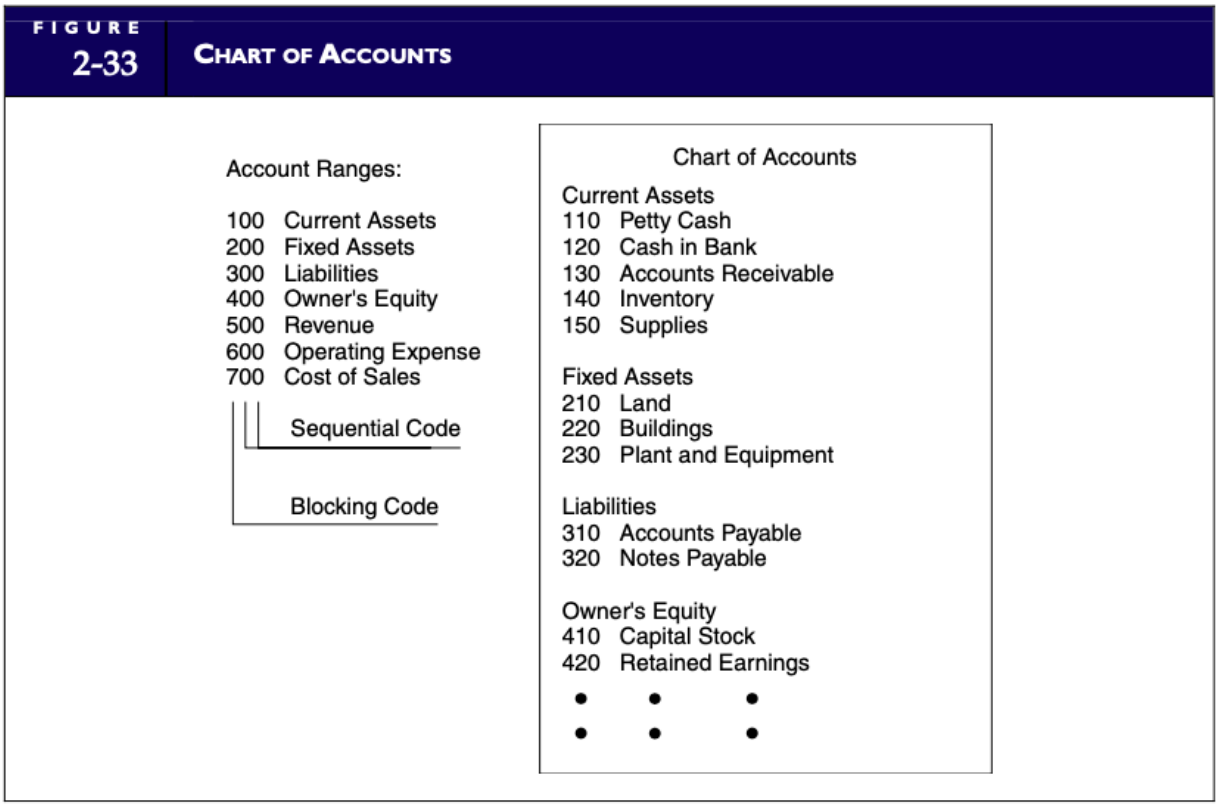
A well-designed and comprehensive chart of accounts is the basis for the general ledger and is thus critical to a firm's financial and management reporting systems. The more extensive the chart of accounts, the more precisely a firm can classify its transactions and the greater the range of information it can provide to internal and external users. Figure 2-33 presents an example of accounts using block codes.

Notice that each account type is represented by a unique range of codes or blocks. Thus, balance sheet and income statement account classifications and subclassifications can be depicted. In this example, each of the accounts consists of a three-digit code. The first digit is the blocking digit and represents the account classification; for example, current assets, liabilities, or operating expense. The other digits in the code are sequentially assigned.

ADVANTAGES. Block coding allows for the insertion of new codes within a block without having to reorganize the entire coding structure. For example, if advertising expense is account number 626, the first digit indicates that this account is an operating expense. As new types of expense items are

incurred and have to be specifically accounted for, they may be added sequentially within the 600-account classification. This three-digit code accommodates 100 individual items (X00 through X99) within each block. Obviously, the more digits in the code range, the more items that can be represented.

FIGURE 2-33 CHART OF ACCOUNTS



DISADVANTAGES. As with the sequential codes, the information content of the block code is not readily apparent. For instance, account number 626 means nothing until matched against the chart of accounts, which identifies it as advertising expense.

Group Codes

Numeric group codes are used to represent complex items or events involving two or more pieces of related data. The code consists of zones or fields that possess specific meaning. For example, a department store chain might code sales order transactions from its branch stores as follows:

Store Number	*Dept. Number*	*Item Number*	*Salesperson*
04	*09*	*476214*	*99*

ADVANTAGES. Group codes have a number of advantages over sequential and block codes.

1. They facilitate the representation of large amounts of diverse data.

2. They allow complex data structures to be represented in a hierarchical form that is logical and more easily remembered by humans.

3. They permit detailed analysis and reporting both within an item class and across different classes of items.

Using the previous example to illustrate, Store Number 04 could represent the Hamilton Mall store in Allentown; Dept. Number 09 represents the sporting goods department; Item Number 476214 is a hockey stick; and Salesperson 99 is Jon Innes. With this level of information, a corporate manager could measure profitability by store, compare the performance of similar departments across all stores, track the movement of specific inventory items, and evaluate sales performance by employees within and between stores.

DISADVANTAGES. Ironically, the primary disadvantage of group coding results from its success as a classification tool. Because group codes can effectively present diverse information, they tend to be overused. Unrelated

data may be linked simply because it can be done. This can lead to unnecessarily complex group codes that cannot be easily interpreted. Finally, overuse can increase storage costs, promote clerical errors, and increase processing time and effort.

Alphabetic Codes

Alphabetic codes are used for many of the same purposes as numeric codes. Alphabetic characters may be assigned sequentially (in alphabetic order) or may be used in block and group coding techniques.

ADVANTAGES. The capacity to represent large numbers of items is increased dramatically through the use of pure alphabetic codes or alphabetic characters embedded within numeric codes (alphanumeric codes). The earlier example of a chart of accounts using a three-digit code with a single blocking digit limits data representation to only 10 blocks of accounts—0 through 9. Using alphabetic characters for blocking, however, increases the number of possible blocks to 26—A through Z. Furthermore, whereas the two-digit sequential portion of that code has the capacity of only 100 items (102), a two-position alphabetic code can represent 676 items (262). Thus, by using alphabetic codes in the same three-digit coding space, we see a geometric increase in the potential for data representation

(10 blocks x 100 items each) = 1,000 items

to

(26 blocks x 676 items each) = 17,576 items

DISADVANTAGES. The primary drawbacks with alphabetic coding are (1) as with numeric codes, there is difficulty rationalizing the meaning of codes

that have been sequentially assigned, and (2) users tend to have difficulty sorting records that are coded alphabetically.

Mnemonic Codes

Mnemonic codes are alphabetic characters in the form of acronyms and other combinations that convey meaning. For example, a student enrolling in college courses may enter the following course codes on the registration form:

Course Type	Course Number
Acctg	101
Psyc	110
Mgt	270
Mktg	300

This combination of mnemonic and numeric codes conveys a good deal of information about these courses; with a little analysis, we can deduce that Acctg is accounting, Psyc is psychology, Mgt is management, and Mktg is marketing. The sequential number portion of the code indicates the level of each course. Another example of the use of mnemonic codes is assigning state codes in mailing addresses:

Code	Meaning
NY	New York
CA	California
OK	Oklahoma

ADVANTAGES. The mnemonic coding scheme does not require the user to memorize meaning; the code itself conveys a high degree of information about the item that is being represented.

DISADVANTAGES. Although mnemonic codes are useful for representing classes of items, they have limited ability to represent items within a class. For example, the entire class of accounts receivable could be represented by the mnemonic code AR, but we would quickly exhaust meaningful combinations of alphabetic characters if we attempted to represent the individual accounts that make up this class. These accounts would be represented better by sequential, block, or group coding techniques.

Summary

This chapter divided the treatment of transaction processing systems into five major sections. The first section provided an overview of transaction processing, showing its vital role as an information provider for financial reporting, internal management reporting, and the support of day-to-day operations. To deal efficiently with large volumes of financial transactions, business organizations group together transactions of similar types into transaction cycles. Three transaction cycles account for most of a firm's economic activity: the revenue cycle, the expenditure cycle, and the conversion cycle. The second section described the relationship among accounting records in both manual and computer-based systems. We saw how both hard-copy and digital documents form an audit trail. The third section of the chapter presented an overview of documentation techniques used to describe the key features of systems. Accountants must be proficient in using documentation tools to perform their professional duties. Five types of documentation are commonly used for this purpose: data flow diagrams, entity relationship diagrams, system flowcharts, program flowcharts, and record layout diagrams. The fourth section presented two computer-based transaction processing systems: (1) batch processing using real-time data

collection and (2) realtime processing. The section also examined the operational efficiency issues associated with each configuration. Finally, we examined data coding schemes and their role in transaction processing and AIS as a means of coordinating and managing a firm's transactions. In examining the major types of numeric and alphabetic coding schemes, we saw how each has certain advantages and disadvantages.

Review Questions

1. What three transaction cycles exist in all businesses?
2. Name the major subsystems of the expenditure cycle.
3. Identify and distinguish between the physical and financial components of the expenditure cycle.
4. Name the major subsystems of the conversion cycle.
5. Name the major subsystems of the revenue cycle.
6. Name the three types of documents.
7. Name the two types of journals.
8. Distinguish between a general journal and journal vouchers.
9. Name the two types of ledgers.
10. What is an audit trail?
11. What is the confirmation process?
12. Computer-based systems employ four types of files. Name them.
13. Give an example of a record that might comprise each of the four file types found in a computer-based system.
14. What is the purpose of a digital audit trail?
15. Give an example of how cardinality relates to business policy.
16. Distinguish between entity relationship diagrams, data flow diagrams, and system flowcharts.

17. What is meant by cardinality in entity relationship diagrams?

18. For what purpose are entity relationship diagrams used?

19. What is an entity?

20. Distinguish between batch and real-time processing.

21. Distinguish between the sequential file and database approaches to data backup.

22. Is a data flow diagram an effective documentation technique for identifying who or what performs a particular task? Explain.

23. Is a flowchart an effective documentation technique for identifying who or what performs a particular task? Explain.

24. How may batch processing be used to improve operational efficiency?

25. Why might an auditor use a program flowchart?

26. How are system flowcharts and program flowcharts related?

27. What are the distinguishing features of a legacy system?

28. What are the two data processing approaches used in modern systems?

29. How is backup of database files accomplished?

30. What information is provided by a record layout diagram?

31. In one sentence, what does update a master file record involve?

32. Comment on the following statement: ‘‘Legacy systems always use flat-file structures.’’

33. Explain the technique known as destructive update.

34. What factor influences the decision to employ real-time data collection with batch updating rather that purely real-time processing? Explain.

35. What are the advantages of real-time data processing?

36. What are the advantages of real-time data collection?

37. What are some of the more common uses of data codes in accounting information systems?

38. Compare and contrast the relative advantages and disadvantages of sequential, block, group, alphabetic, and mnemonic codes.

Discussion Questions

1. Discuss the flow of cash through the transaction cycles. Include in your discussion the relevant subsystems and any time lags that may occur.
2. Explain whether the cost accounting system primarily supports internal or external reporting.
3. Discuss the role of the conversion cycle for service and retailing entities.
4. Can a turnaround document contain information that is subsequently used as a source document? Why or why not?
5. Would the writing down of obsolete inventory be recorded in a special journal or the general journal? Why?
6. Are both registers and special journals necessary?
7. Discuss the relationship between the balance in the accounts payable general ledger control account and what is found in the accounts payable subsidiary ledger.
8. What role does the audit trail play in the task of confirmation?
9. Explain how the magnetic audit trail functions.
10. Are large batch sizes preferable to small batch sizes? Explain.
11. Discuss why an understanding of legacy system technologies is of some importance to auditors.
12. If an organization processes large numbers of transactions that use common data records, what type of system would work best (all else being equal)?
13. If an organization processes transactions that have independent (unique) data needs, what type of system would work best (all else being equal)?

14. Explain how a hashing structure works and why it's quicker than using an index. Give an example. If it's so much faster, why isn't it used exclusively?

15. Describe a specific accounting application that could make use of a virtual storage access method file.

16. Explain the following three types of pointers: physical address pointer, relative address pointer, and logical key pointer.

17. Should an auditor wishing to assess the adequacy of separation of functions examine a data flow diagram or a system flowchart? Why?

18. Discuss some of the problems associated with general ledger systems that do not have data coding schemes.

19. For each of the following items, indicate whether a sequential, block, group, alphabetic, or mnemonic code would be most appropriate (you may list multiple methods; give an example and explain why each method is appropriate):

a. state codes

b. check number

c. chart of accounts

d. inventory item number

e. -bin number (inventory warehouse location)

f. sales order number

g. vendor code

h. invoice number

i. customer number

Multiple-Choice Questions

1. Which statement is NOT true?

a. Business activities begin with the acquisition of materials, property, and labor in exchange for cash.

b. The conversion cycle includes the task of determining raw materials requirements.

c. Manufacturing firms have a conversion cycle but retail firms do not.

d. A payroll check is an example of a product document of the payroll system.

e. A journal voucher is actually a special source document.

2. A documentation tool that depicts the physical flow of information relating to a particular transaction through an organization is a

a. system flowchart.

b. program flowchart.

c. decision table.

d. work distribution analysis.

e. systems survey.

3. Sequential file processing will not permit

a. data to be edited on a separate computer run.

b. the use of a database structure.

c. data to be edited in an offline mode.

d. batch processing to be initiated from a terminal.

e. data to be edited on a real-time basis.

4. The production subsystem of the conversion cycle includes all of the following EXCEPT

a. determining raw materials requirements.
b. make or buy decisions on component parts.
c. release of raw materials into production.
d. scheduling the goods to be produced.

5. Which of the following files is a temporary file?
a. transaction file
b. master file
c. reference file
d. none of the above

6. A documentation tool used to represent the logical elements of a system is a(n)
a. programming flowchart.
b. entity relationship diagram.
c. system flowchart.
d. data flow diagram.

7. Which of the following is NOT an advantage of real-time processing files over batch processing?
a. shorter transaction processing time
b. reduction of inventory stocks
c. improved customer service
d. all are advantages

8. Which statement is NOT correct?
a. Legacy systems may process financially significant transactions.

b. Some legacy systems use database technology.
c. Mainframes are exclusive to legacy systems, while modern systems use only the client server model.
d. All the above are true.

9. Which statement is NOT correct?
a. Indexed random files are dispersed throughout the storage device without regard for physical proximity with related records.
b. Indexed random files use disk storage space efficiently.
c. Indexed random files are efficient when processing a large portion of a file at one time.
d. Indexed random files are easy to maintain in terms of adding records.

10. Which statement is NOT correct? The indexed sequential access method
a. is used for very large files that need both direct access and batch processing.
b. may use an overflow area for records.
c. provides an exact physical address for each record.
d. is appropriate for files that require few insertions or deletions.

11. Which statement is true about a hashing structure?
a. The same address could be calculated for two records.
b. Storage space is used efficiently.
c. Records cannot be accessed rapidly.
d. A separate index is required.

12. In a hashing structure

a. two records can be stored at the same address.

b. pointers are used to indicate the location of all records.

c. pointers are used to indicate location of a record with the same address as another record.

d. all locations on the disk are used for record storage.

13. An advantage of a physical address pointer is that

a. it points directly to the actual disk storage location.

b. it is easily recovered if it is inadvertently lost.

c. it remains unchanged when disks are reorganized.

d. all of the above are advantages of the physical address pointer.

14. Which of the following is NOT true of a turnaround document?

a. They may reduce the number of errors made by external parties.

b. They are commonly used by utility companies (gas, power, water).

c. They are documents used by internal parties only.

d. They are both input and output documents.

15. Which of the following is NOT a true statement?

a. Transactions are recorded on source documents and are posted to journals.

b. Transactions are recorded in journals and are posted to ledgers.

c. Infrequent transactions are recorded in the general journal.

d. Frequent transactions are recorded in special journals.

16. Which of the following is true of the relationship between subsidiary ledgers and general ledger accounts?

a. The two contain different and unrelated data.

b. All general ledger accounts have subsidiaries.

c. The relationship between the two provides an audit trail from the financial statements to the source documents.

d. The total of subsidiary ledger accounts usually exceeds the total in the related general ledger account.

17. Real-time systems might be appropriate for all of the following EXCEPT

a. airline reservations.

b. payroll.

c. point-of-sale transactions.

d. air traffic control systems.

e. all of these applications typically utilize realtime processing.

18. is the system flowchart symbol for:

a. on-page connector.

b. off-page connector.

c. home base.

d. manual operation.

e. document.

19. A chart of accounts would best be coded using

a(n) _____ coding scheme.

a. alphabetic

b. mnemonic

c. block
d. sequential

20. Which of the following statements is NOT true?
a. Sorting records that are coded alphabetically tends to be more difficult for users than sorting numeric sequences.
b. Mnemonic coding requires the user to memorize codes.
c. Sequential codes carry no information content beyond their order in the sequence.
d. Mnemonic codes are limited in their ability to represent items within a class.

21. A coding scheme in the form of acronyms and other combinations that convey meaning is a(n)
a. sequential code.
b. block code.
c. alphabetic code.
d. mnemonic code.

Problems

1. TRANSACTION CYCLE IDENTIFICATION
Categorize each of the following activities into the expenditure, conversion, or revenue cycles, and identify the applicable subsystem.
a. preparing the weekly payroll for manufacturing personnel
b. releasing raw materials for use in the manufacturing cycle
c. recording the receipt of payment for goods sold
d. recording the order placed by a customer

e. ordering raw materials

f. determining the amount of raw materials to order

2. TYPES OF FILES

For each of the following records, indicate the appropriate related file structure: master file, transaction file, reference file, or archive file.

a. customer ledgers

b. purchase orders

c. list of authorized vendors

d. records related to prior pay periods

e. vendor ledgers

f. hours each employee has worked during the current pay period

g. tax tables

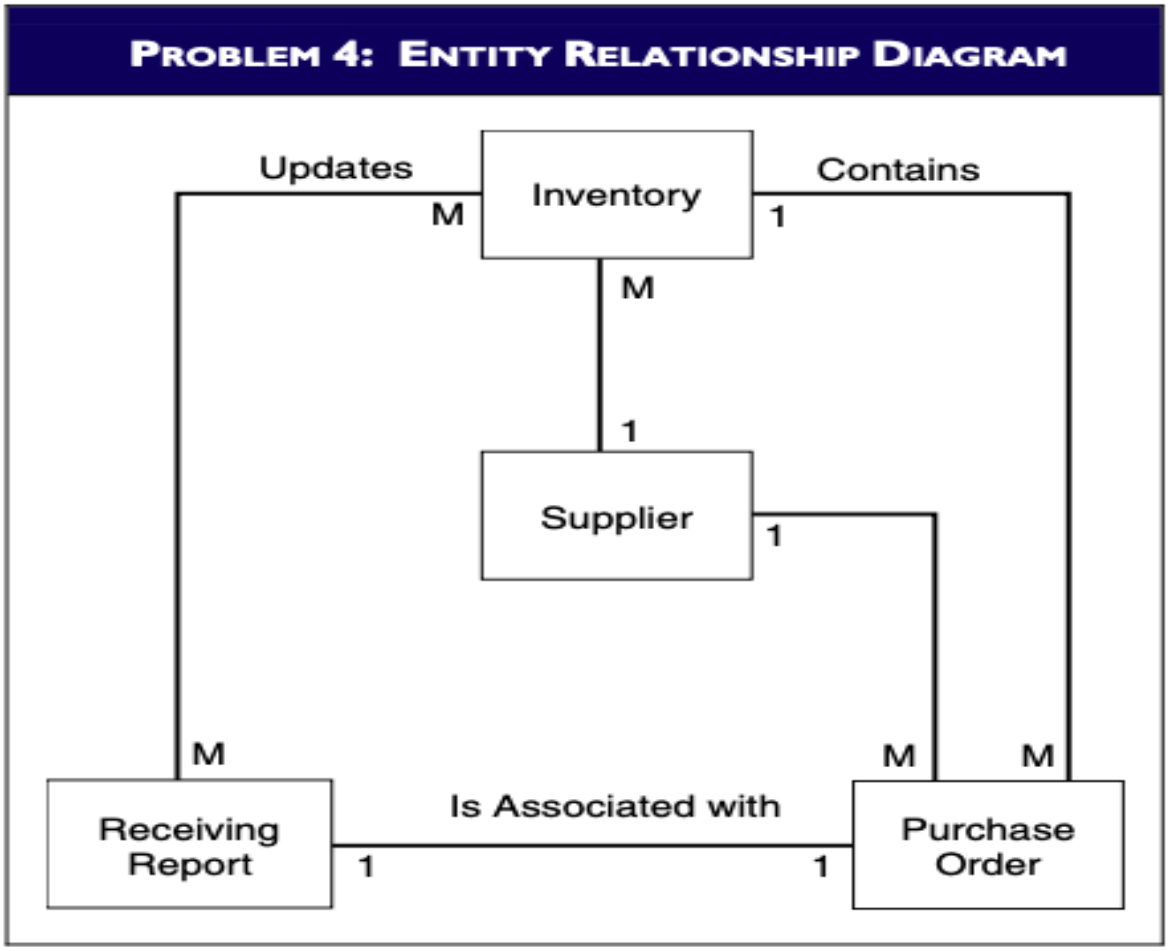
h. sales orders that have been processed and recorded

3. SYSTEM FLOWCHART

Figure 2-4 illustrates how a customer order is transformed into a source document, a product document, and a turnaround document. Develop a similar flowchart for the process of paying hourly employees. Assume time sheets are used and the payroll department must total the hours. Each hour worked by any employee must be charged to some account (a cost center). Each week, the manager of each cost center receives a report listing the employee's name and the number of hours charged to this center. The manager is required to verify that this information is correct by signing the form and noting any discrepancies, then sending this form back to the payroll department. Any discrepancies noted must be corrected by the payroll department.

4. ENTITY RELATIONSHIP DIAGRAM

Shown here is a partial entity relationship diagram of a purchase system. Describe the business rules represented by the cardinalities in the diagram.



5. ENTITY RELATIONSHIP DIAGRAM

Refer to the entity relationship diagram in Problem 4. Modify the diagram to deal with payments of merchandise purchased. Explain the business rules represented by the cardinalities in the diagram.

6. ENTITY RELATIONSHIP DIAGRAM

Prepare an entity relationship diagram, in good form, for the expenditure cycle, which consists of both purchasing and cash disbursements. Describe the business rules represented by the cardinalities in the diagrams.

7. SYSTEM FLOWCHART

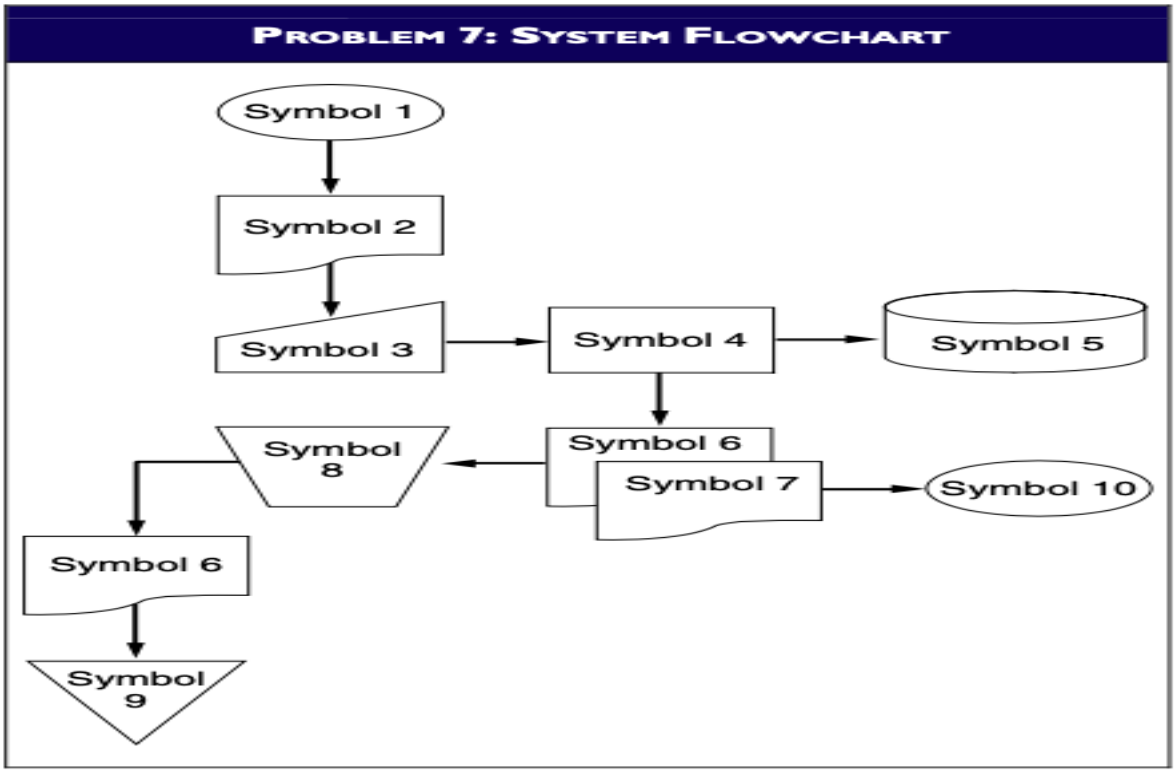
Using the diagram for Problem 7, answer the following questions:

_ What do Symbols 1 and 2 represent?

_ What does the operation involving Symbols 3 and 4 depict?

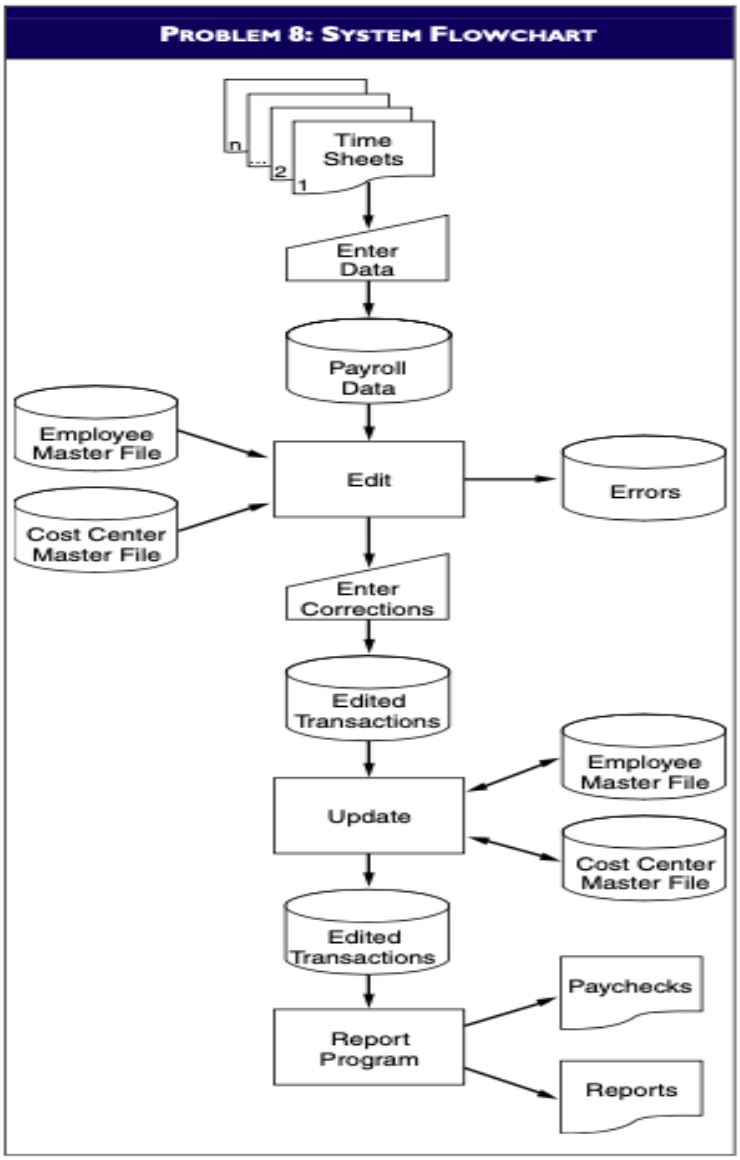
_ What does the operation involving Symbols 4 and 5 depict?

_ What does the operation involving Symbols 6, 8, and 9 depict?



8. SYSTEM FLOWCHART

Analyze the system flowchart in Problem 8 and describe in detail the processes that are occurring.



9. SYSTEM FLOWCHARTS AND PROGRAM FLOWCHART

From the diagram in Problem 8, identify three types of errors that may cause a payroll record to be placed in the error file. Use a program flowchart to illustrate the edit program.

10. DATA FLOW DIAGRAM

Data flow diagrams employ four different symbols. What are these symbols, and what does each symbol represent?

11. TRANSACTION CYCLE RELATIONSHIP

Refer to Figure 2-1, which provides a generic look at relationships between transaction cycles. Modify this figure to reflect the transaction cycles you might find at a dentist's office.

12. SYSTEM DOCUMENTATION— EXPENDITURE CYCLE (MANUAL PROCEDURES)

The following describes the expenditure cycle manual procedures for a hypothetical company. The inventory control clerk examines the inventory records for items that must be replenished and prepares a two-part purchase requisition. Copy 1 of the requisition is sent to the purchasing department and Copy 2 is filed. Upon receipt of the requisition, the purchasing clerk selects a supplier from the valid vendor file (reference file) and prepares a three-part purchase order. Copy 1 is sent to the supplier, Copy 2 is sent to the accounts payable department where it is filed temporarily, and Copy 3 is filed in the purchases department. A few days after the supplier ships the order, the goods arrive at the receiving department. They are inspected, and the receiving clerk prepares a three-part receiving report describing the number and quality of the items received. Copy 1 of the receiving report accompanies the goods to the stores, where they are secured. Copy 2 is sent to inventory control, where the clerk posts it to the inventory records and files the document. Copy 3 is sent to the accounts payable department, where it is filed with the purchase order. A day or two later, the accounts

payable clerk receives the supplier's invoice (bill) for the items shipped. The clerk pulls the purchase order and receiving report from the temporary file and compares the quantity ordered, quantity received, and the price charged. After reconciling the three documents, the clerk enters the purchase in the purchases journal and posts the amount owed to the accounts payable subsidiary account. On the payment due date, the accounts payable clerk posts to the accounts payable subsidiary account to remove the liability and prepares a voucher authorizing payment to the vendor. The voucher is then sent to the cash disbursements clerk. Upon receipt of the voucher, the cash disbursements clerk prepares a check and sends it to the supplier. The clerk records the check in the check register and files a copy of the check in the department filing cabinet.

Required

Prepare a data flow diagram and a system flowchart of the expenditure cycle procedures previously described.

13. RECORD STRUCTURES FOR RECEIPT OF ITEMS ORDERED

Refer to Figure 2-28 and the discussion about updating master files from transaction files. The discussion presents the record structures for a sales transaction. Prepare a diagram (similar to Figure 2-28) that presents the record structure for the receipt (Receiving Report) of inventory items ordered. Presume a purchase order file exists and will be updated through information collected via a receiving report. Further, presume the purchase was made on account.

14. SYSTEM DOCUMENTATION— PAYROLL

The following describes the payroll procedures for a hypothetical company. Every Thursday, the timekeeping clerk sends employee time cards to the payroll department for processing. Based on the hours worked reflected on the time cards, the employee pay rate and withholding information in the employee file, and the tax rate reference file, the payroll clerk calculates gross pay, withholdings, and net pay for each employee. The clerk then manually prepares paychecks for each employee, files hard copies of the paychecks in the payroll department, and posts the earnings to the hard-copy employee records. Finally, the clerk manually prepares a payroll summary and sends it and the paychecks to the cash disbursements department. The cash disbursements clerk reconciles the payroll summary with the paychecks and manually records the transaction in the hard-copy cash disbursements journal. The clerk then files the payroll summary and sends the paychecks to the treasurer for signing. The signed checks are then sent to the paymaster, who distributes them to the employees on Friday morning.

Required

Prepare a data flow diagram and a system flowchart of the payroll procedures previously described.

15. SYSTEM DOCUMENTATION— PAYROLL

Required

Assuming the payroll system described in Problem 14 uses database files and computer processing procedures, prepare a data flow diagram, an entity relationship diagram, and a systems flowchart.

16. SYSTEM DOCUMENTATION— REVENUE CYCLE MANUAL AND COMPUTER PROCESSES

The following describes the revenue cycle procedures for a hypothetical company. The sales department clerk receives hard-copy customer orders and manually prepares a six-part hardcopy sales order. Copies of the sales order are distributed to various departments as follows: Copies 1, 2, and 3 go to the shipping department, and Copies 4, 5, and 6 are sent to the billing department where they are temporarily filed by the billing clerk. Upon receipt of the sales order copies, the shipping clerk picks the goods from the warehouse shelves and ships them to the customer. The clerk sends Copy 1 of the sales order along with the goods to the customer. Copy 2 is sent to the billing department, and Copy 3 is filed in the shipping department. When the billing clerk receives Copy 2 from the warehouse, she pulls the other copies from the temporary file and completes the documents by adding prices, taxes, and freight charges. Then, using the department PC, the billing clerk records the sale in the digital Sales Journal, sends Copy 4 (customer bill) to the customer, and sends Copies 5 and 6 to the AR and inventory control departments, respectively. Upon receipt of the documents from the billing clerk, the accounts receivable and inventory control clerks post the transactions to the AR Subsidiary and Inventory Subsidiary ledgers, respectively, using their department PCs. Each clerk then files the respective sales order copies in the department. On the payment due date, the customer sends a check for the full amount and a copy of the bill (the remittance advice) to the company. These documents are received by the mailroom clerk who distributes them as follows:

1. The check goes to the cash receipts clerk, who manually records it in the hard-copy cash receipts journal and prepares two deposit slips. One deposit

slip and the check are sent to the bank; the other deposit slip is filed in the cash receipts department.

2. The remittance advice is sent to the AR clerk, who posts to the digital subsidiary accounts and then files the document.

Required

Prepare a data flow diagram and a system flowchart of the revenue cycle procedures previously described.

17. SYSTEM DOCUMENTATION— EXPENDITURE CYCLE (MANUAL AND COMPUTER PROCEDURES)

The following describes the expenditure cycle for a hypothetical company. The company has a centralized computer system with terminals located in various departments. The terminals are networked to a computer application, and digital accounting records are hosted on a server in the data processing department. Each day, the computer in the data processing center scans the inventory records looking for items that must be replenished. For each item below its reorder point, the system creates a digital purchase order and prints two hard copies. A technician in the data center sends the purchase orders to the purchasing department clerk. Upon receipt of the purchase orders, the purchasing clerk reviews and signs them. He sends Copy 1 to the supplier and files Copy 2 in the purchases department. A few days later, the supplier ships the order and the goods arrive at the receiving department. The receiving clerk reviews the digital purchase order from his terminal, inspects the goods, creates a digital Receiving Report record, and prints two hard copies of the receiving report. The system automatically updates the inventory records to reflect the receipt of goods. The clerk sends Copy 1 of the receiving report with the goods to the stores, where they are secured.

Copy 2 is filed in the receiving department. A day or two later, the accounts payable clerk receives a hard-copy supplier's invoice (bill) for the items shipped. The clerk accesses the digital receiving report and purchase order from her terminal. She then reconciles these documents with the supplier's invoice. If all aspects of the order reconcile, the clerk records the purchase in the digital purchases journal and posts the amount owed to the accounts payable subsidiary account from her terminal. Each day, the computer application in the data processing department automatically scans the accounts payable subsidiary file for items that are due for payment and prints a two-part check. The system closes out the accounts payable record and creates a record in the digital cash disbursements journal. A data processing clerk then sends the check to the Cash Disbursement department where it is approved, signed, and distributed to the supplier. The check copy is filed in the Cash Disbursements department.

Required

Prepare a data flow diagram and a system flowchart of the expenditure cycle procedures previously described.

18. CODING SCHEME

Devise a coding scheme using block and sequential codes for the following chart of accounts for Jensen Camera Distributors.

- Cash
- Accounts Receivable
- Office Supplies Inventory
- Prepaid Insurance
- Inventory

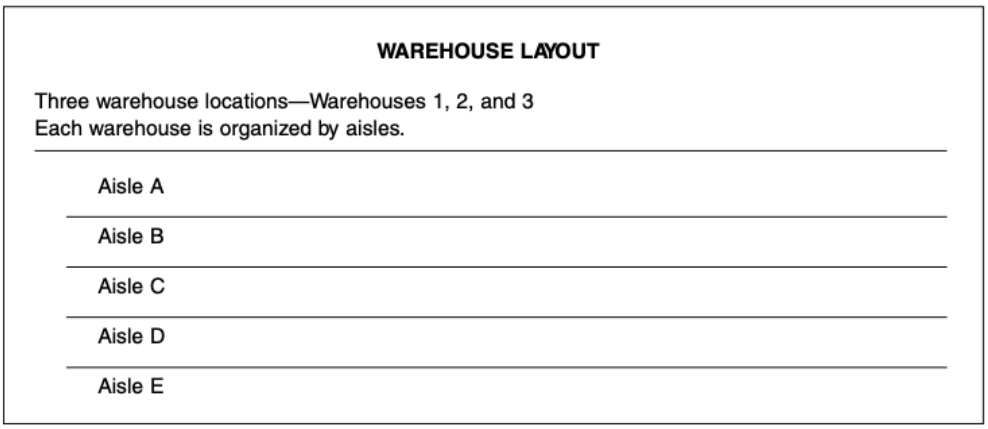
- Investments in Marketable Securities
- Delivery Truck
- Accumulated Depreciation—Delivery Truck
- Equipment
- Accumulated Depreciation—Equipment
- Furniture and Fixtures
- Accumulated Depreciation—Furniture and Fixtures
- Building
- Accumulated Depreciation—Building
- Land
- Accounts Payable
- Wages Payable
- Taxes Payable
- Notes Payable
- Bonds Payable
- Common Stock
- Paid-In Capital in Excess of Par
- Treasury Stock
- Retained Earnings
- Sales
- Sales Returns and Allowances
- Dividend Income
- Cost of Goods Sold
- Wages Expense
- Utility Expense
- Office Supplies Expense

- Insurance Expense
- Depreciation Expense
- Advertising Expense
- Fuel Expense
- Interest Expense

19. CODING SCHEME

Devise a coding scheme for the warehouse layout shown in Problem 19. Be sure to use an appropriate coding scheme that allows the inventory to be located efficiently from the picking list.

PROBLEM 19: CODING SCHEME



(continued)

PROBLEM 19: CODING SCHEME *(continued)*

WAREHOUSE LAYOUT

Each aisle is separated into a right and left side, with 7 shelves of goods and 17 partitions, with each storage area called a "bin."

7																
6																
5																
4																
3																
2																
1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17

Chapter 3: The Revenue Cycle: Sales to Cash Collections

Integrative Case

Alpha Omega Electronics Alpha Omega Electronics (AOE) manufactures a variety of inexpensive consumer electronic products, including calculators, digital clocks, radios, pagers, toys, games, and small kitchen appliances. Like most manufacturers, AOE does not sell its products directly to individual consumers, but only to retailers. Figure 3-1 shows a partial organization chart for AOE.

Linda Spurgeon, president of AOE, called an executive meeting to discuss two pressing issues. First, AOE has been steadily losing market share for the past three years. Second, cash flow problems have necessitated increased short-term borrowing. At the executive meeting, Trevor Whitman, vice president of marketing, explained that one reason for AOE's declining market share is that competitors are apparently providing better customer service. When Linda asked for specifics, however, Trevor admitted that his opinion was based on recent conversations with two major customers. He also admitted that he could not readily identify AOE's 10 most profitable customers. Linda then asked Elizabeth Venko, the controller, about AOE's cash flow problems. Elizabeth explained that the most recent accounts receivable aging schedule indicated a significant increase in the number of past-due customer accounts. Consequently, AOE has had to increase its short-term borrowing because of delays in collecting customer payments. In addition, the Best Value Company, a retail chain that has been one of AOE's major customers, recently went bankrupt. Elizabeth admitted that she is unsure whether AOE will be able to collect the large balance due from Best Value.

Linda was frustrated with the lack of detailed information regarding both issues. She ended the meeting by asking Elizabeth and Trevor to work with Ann Brandt, vice president of information systems, to develop improved reporting systems so that AOE could more closely monitor and take steps to improve both customer service and cash flow management. Specifically, Linda asked Elizabeth, Trevor, and Ann to address the following issues:

1. How could AOE improve customer service? What information does marketing need to perform its tasks better?

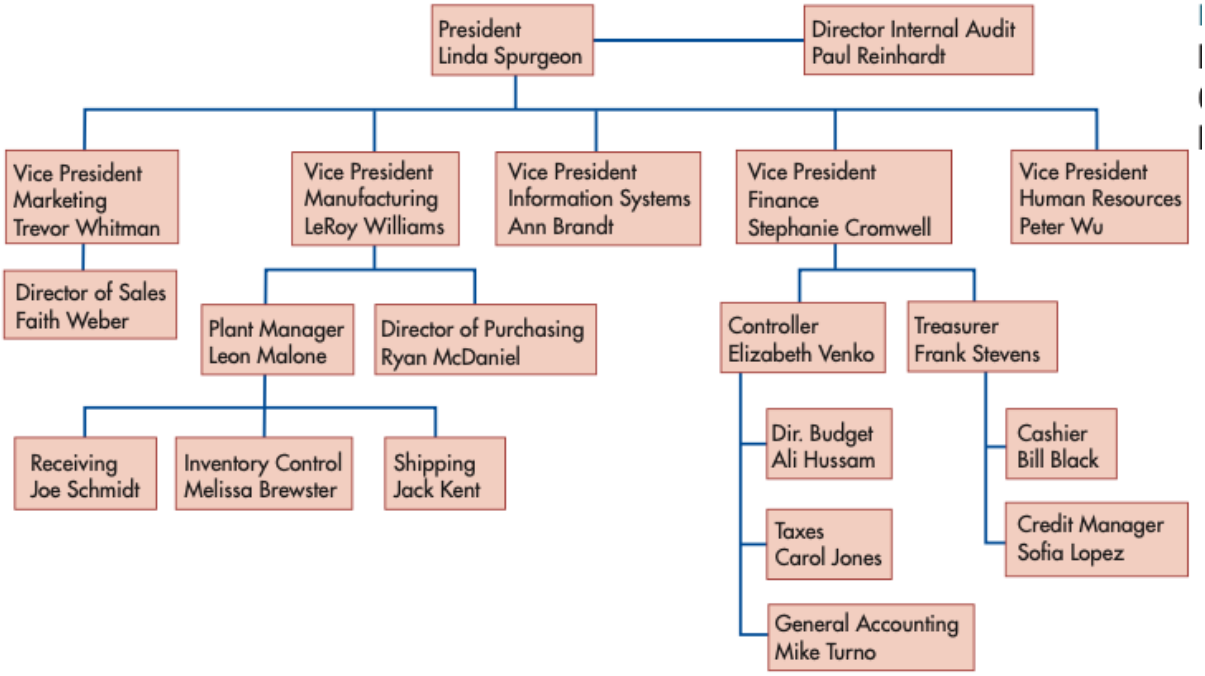
2. How could AOE identify its most profitable customers and markets?

3. How can AOE improve its monitoring of credit accounts? How would any changes in credit policy affect both sales and uncollectible accounts?

4. How could AOE improve its cash collection procedures?

The AOE case shows how deficiencies in the information system used to support revenue cycle activities can create significant problems for an organization. As you read this chapter, think about how a well-designed information system can improve both the efficiency and effectiveness of an organization's revenue cycle activities.

Figure 3-1



Introduction

The **revenue cycle** is a recurring set of business activities and related information processing operations associated with providing goods and services to customers and collecting cash in payment for those sales (Figure 3-2). The primary external exchange of information is with customers. Information about revenue cycle activities also flows to the other accounting cycles. For example, the expenditure and production cycles use information about sales transactions to initiate the purchase or production of additional inventory to meet demand. The human resources management/payroll cycle uses information about sales to calculate sales commissions and bonuses. The general ledger and reporting function uses information produced by the revenue cycle to prepare financial statements and performance reports.

The revenue cycle's primary objective is to provide the right product in the right place at the right time for the right price. To accomplish that objective, management must make the following key decisions:

● To what extent can and should products be customized to individual customers' needs and desires?

● How much inventory should be carried, and where should that inventory be located?

● How should merchandise be delivered to customers? Should the company perform the shipping function itself or outsource it to a third party that specializes in logistics?

● What are the optimal prices for each product or service?

● Should credit be extended to customers? If so, what credit terms should be offered? How much credit should be extended to individual customers?

● How can customer payments be processed to maximize cash flow?

The answers to those questions guide how an organization performs the four basic revenue cycle activities depicted in Figure 3-3:

1. Sales order entry

2. Shipping

3. Billing

4. Cash collections

This chapter explains how an organization's information system supports each of those activities. We begin by describing the design of the revenue cycle information system and the basic controls necessary to ensure that it provides management with reliable information. We then discuss in detail each of the four basic revenue cycle activities. For each activity, we, describe how the information needed to perform and manage those activities is collected, processed, and stored. We also explain the controls necessary to ensure not only the reliability of that information but also the safeguarding of the organization's resources.

Figure 3-2

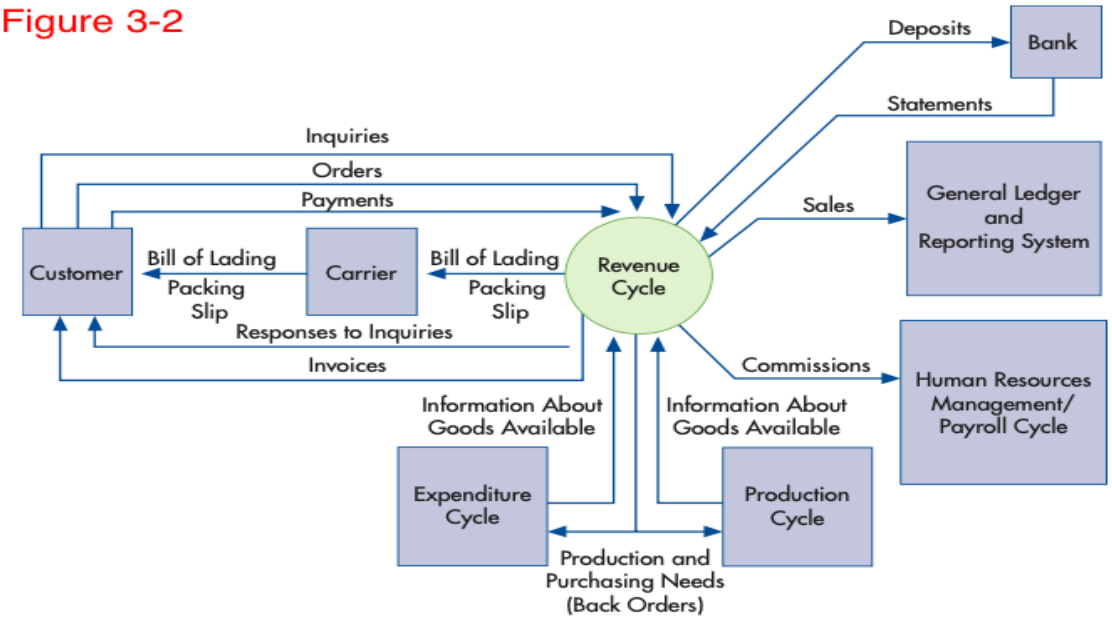
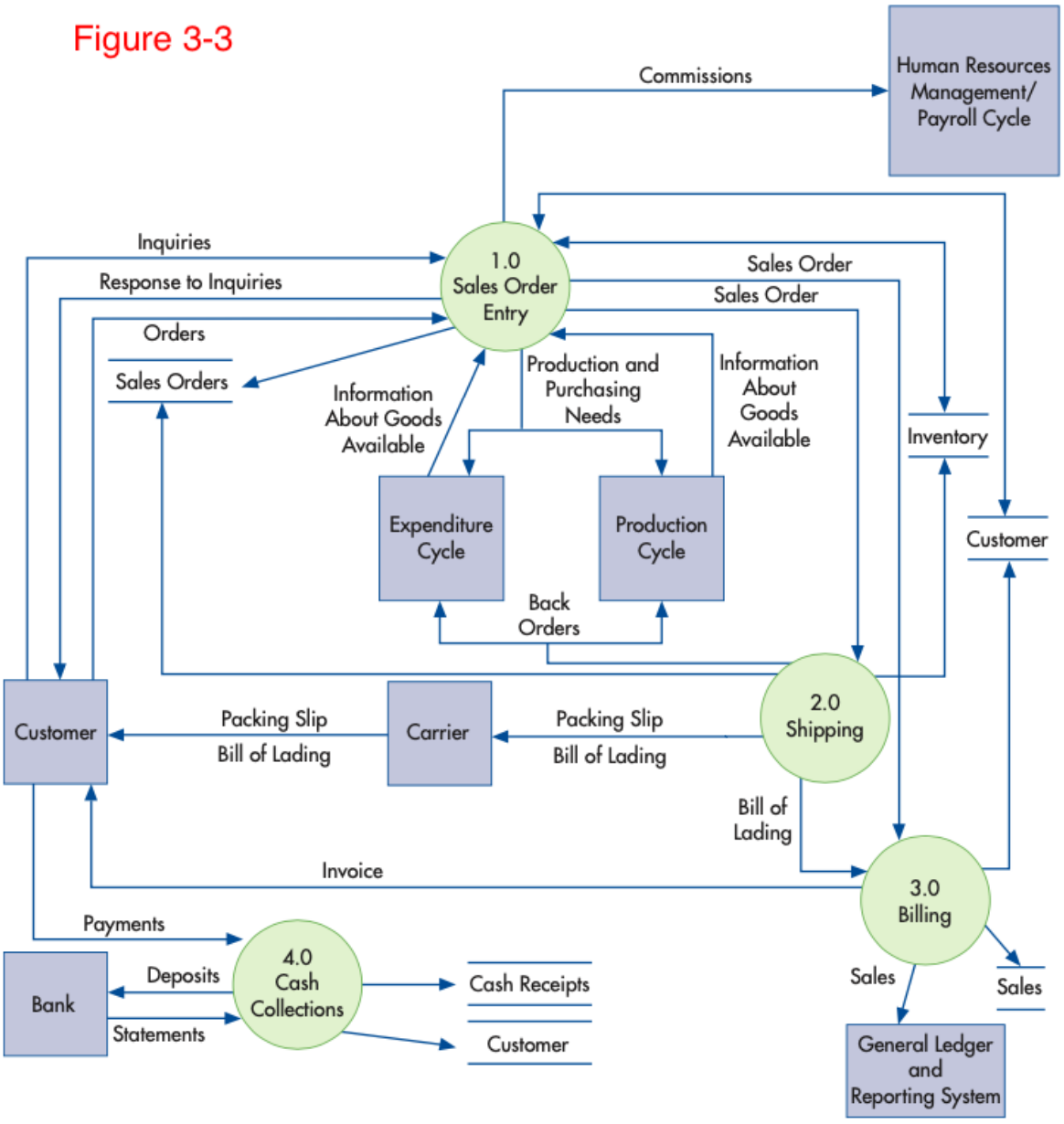


Figure 3-3



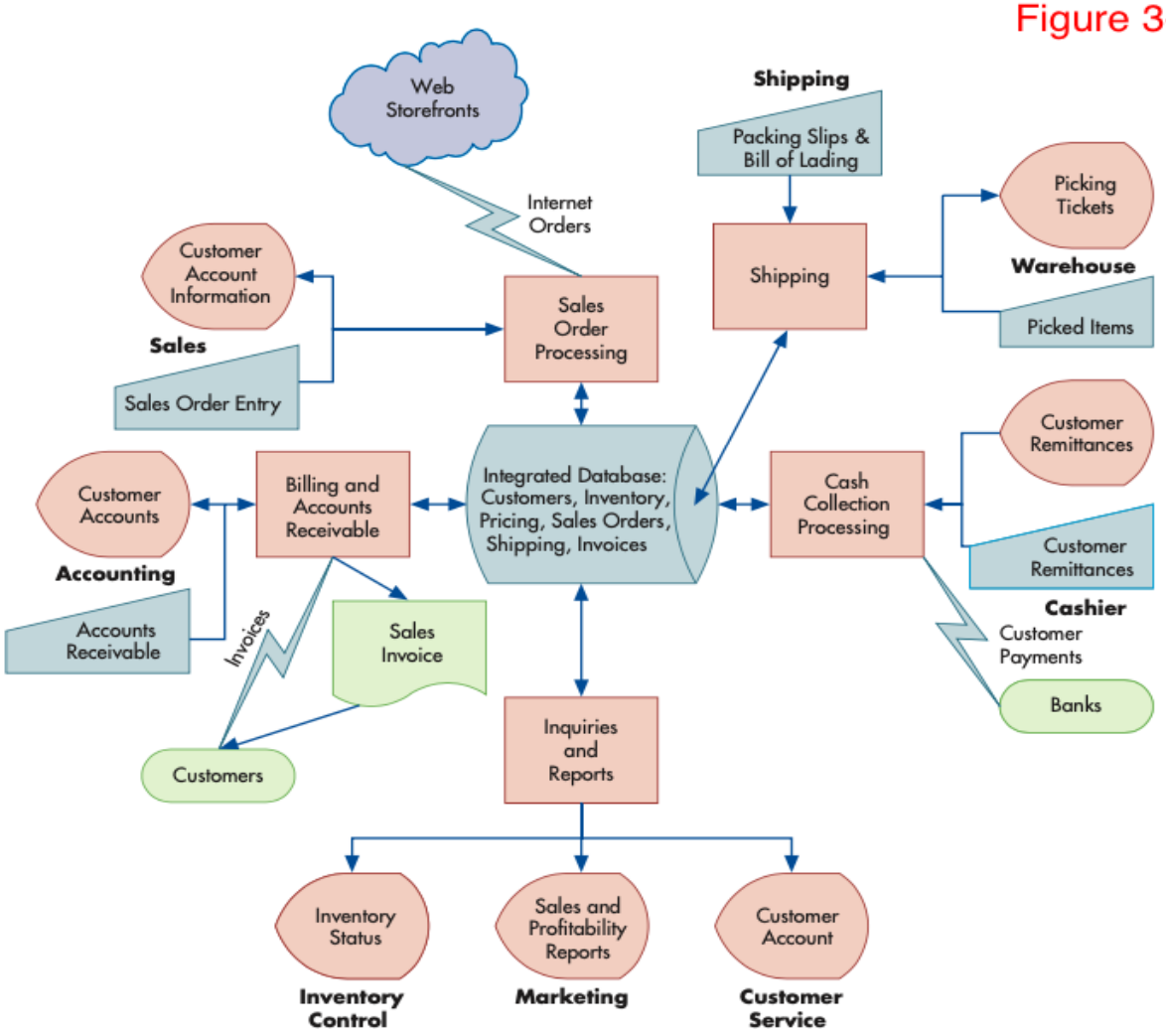
Revenue Cycle Information System

Like most large organizations, AOE uses an enterprise resource planning (ERP) system. Figure 3-4 shows the portion of the ERP system that supports AOE's revenue cycle business activities.

Process

AOE's customers can place orders directly via the Internet. In addition, salespeople use portable laptops to enter orders when calling on customers. The sales department enters customer orders received over the telephone, by fax, or by mail. Regardless of how an order is initially received, the system quickly verifies customer creditworthiness, checks inventory availability, and notifies the warehouse and shipping departments about the approved sale. Warehouse and shipping employees enter data about their activities as soon as they are performed, thereby updating information about inventory status in real time. Nightly, the invoice program runs in batch mode, generating paper or electronic invoices for customers who require invoices. Some of AOE's customers still send checks to one of the regional banks with which AOE has established electronic lockboxes, but an increasing number use their bank's online bill paying service. Each day, the bank sends AOE a file containing remittance data, which the cashier uses to update the company's cash account balances and the accounts receivable clerk uses to update customer accounts.

Figure 3-4



Threats and Controls

Figure 3-4 shows that all revenue cycle activities depend on the integrated database that contains information about customers, inventory, and pricing. Therefore, the first general threat listed in Table 3-1 is inaccurate or invalid master data. Errors in customer master data could result in shipping merchandise to the wrong location, delays in collecting payments because of sending invoices to the wrong address or making sales to customers that exceed their credit limits. Errors in inventory master data can result in failure to timely fulfill customer orders due to unanticipated

shortages of inventory, which may lead to loss of future sales. Errors in pricing master data can result in customer dissatisfaction due to overbilling or lost revenues due to underbilling.

Control 1.1 in Table 3-1 shows that one way to mitigate the threat of inaccurate or invalid master data is to use the various processing integrity controls to minimize the risk of data input errors. It is also important to use the authentication and authorization controls to restrict access to that data and configure the system so that only authorized employees can make changes to master data (control 1.2 in Table 3-1). This requires changing the default configurations of employee roles in ERP systems to appropriately segregate incompatible duties. For example, sales order entry staff should not be able to change master pricing data or customer credit limits. Similarly, the person who maintains customer account information should not be able to process cash collections from customers or issue credit memos to authorize writing off sales as uncollectible. However, because such preventive controls can never be 100% effective, Table 3-1 (control 1.3) also indicates that an important detective control is to regularly produce a report of all changes to master data and review them to verify that the database remains accurate.

A second general threat in the revenue cycle is unauthorized disclosure of sensitive information, such as pricing policies or personal information about customers. Table 3-1 (control 2.1) shows that one way to mitigate the risk of this threat is to configure the system to employ strong access controls that limit who can view such information. It is also important to configure the system to limit employees' ability to use the system's built-in query capabilities to access only those specific tables and fields relevant to performing their assigned duties. In addition, sensitive data should be

encrypted (control 2.2) in storage to prevent IT employees who do not have access to the ERP system from using operating system utilities to view sensitive information. The organization should also design its Web sites to use SSL to encrypt information requested from customers while that information is in transit over the Internet.

A third general threat in the revenue cycle concerns the loss or destruction of master data. The best way to mitigate the risk of this threat is to employ the backup and disaster recovery procedures (control 3.1). A best practice is to implement the ERP system as three separate instances. One instance, referred to as production, is used to process daily activity. A second is used for testing and development. A third instance should be maintained as an online backup to the production system to provide near real-time recovery.

Accurate master data enables management to better use an ERP system's extensive reporting capabilities to monitor performance (see threat 4 in Table 3-1). Accountants should use their knowledge about the underlying business processes to design innovative reports (control 4.1) that provide management with insights beyond those provided by traditional financial statements. For example, companies have always closely monitored sales trends. Additional information is needed, however, to identify the causes of changes in that measure. Metrics such as revenue margin1 can provide such information. Revenue margin equals gross margin minus all expenses incurred to generate sales, including payroll, salesforce-related travel, customer service and support costs, warranty and repair costs, marketing and advertising expenses, and distribution and delivery expenses. Thus, revenue margin integrates the effects of changes in both productivity and customer behavior. Growth in revenue margin indicates that

customers are satisfied (as reflected in repeat sales), productivity is increasing (reflected in reduced costs per sale), or both. Conversely, a declining revenue margin indicates problems with customer retention, productivity, or both. Revenue margin is a metric to evaluate overall performance of revenue cycle activities. As we will see in the following sections, accountants can help managers design detailed reports and metrics that are relevant to evaluating each business activity.

Table 3-1 Threats and Controls in the Revenue Cycle

Activity	Threat	Controls (first number refers to the corresponding threat)
General issues throughout entire revenue cycle	1. Inaccurate or invalid Master data 2. Unauthorized disclosure of sensitive information 3. Loss or destruction of data 4. Poor performance	1.1 Data processing integrity controls 1.2 Restriction of access to master data 1.3 Review of all changes to master data 2.1 Access controls 2.2 Encryption 3.1 Backup and disaster recovery procedures 4.1 Managerial reports
Sales order entry	5. Incomplete/inaccurate orders 6. Invalid orders 7. Uncollectible accounts 8. Stockouts or excess inventory 9. Loss of customers	5.1 Data entry edit controls (see Chapter 10) 5.2 Restriction of access to master data 6.1 Digital signatures or written signatures 7.1 Credit limits 7.2 Specific authorization to approve sales to new customers or sales that exceed a customer's credit limit 7.3 Aging of accounts receivable 8.1 Perpetual inventory control system 8.2 Use of bar codes or RFID 8.3 Training 8.4 Periodic physical counts of inventory 8.5 Sales forecasts and activity reports

		9.1 CRM systems, self-help Web sites, and proper evaluation of customer service ratings
Shipping	10. Picking the wrong items or the wrong quantity 11. Theft of inventory 12. Shipping errors (delay or failure to ship, wrong quantities, wrong items, wrong addresses, duplication)	10.1 Bar-code and RFID technology 10.2 Reconciliation of picking lists to sales order details 11.1 Restriction of physical access to inventory 11.2 Documentation of all inventory transfers 11.3 RFID and bar-code technology 11.4 Periodic physical counts of inventory and reconciliation to recorded quantities 12.1 Reconciliation of shipping documents with sales orders, picking lists, and packing slips 12.2 Use RFID systems to identify delays 12.3 Data entry via bar-code scanners and RFID 12.4 Data entry edit controls (if shipping data entered on terminals) 12.5 Configuration of ERP system to prevent duplicate shipments

Billing	13. Failure to bill 14. Billing errors 15. Posting errors in accounts receivable 16. Inaccurate or invalid credit memos	13.1 Separation of billing and shipping functions 13.2 Periodic reconciliation of invoices with sales orders, picking tickets, and shipping documents 14.1 Configuration of system to automatically enter pricing data 14.2 Restriction of access to pricing master data 14.3 Data entry edit controls 14.4 Reconciliation of shipping documents (picking tickets, bills of lading, and packing list) to sales orders 15.1 Data entry controls 15.2 Reconciliation of batch totals 15.3 Mailing of monthly statements to customers 15.4 Reconciliation of subsidiary accounts to general ledger 16.1 Segregation of duties of credit memo authorization from both sales order entry and customer account maintenance 16.2 Configuration of system to block credit memos unless there is either corresponding documentation of return of damaged goods or specific authorization by management
Cash collections	17. Theft of cash 18. Cash flow problems	17.1 Segregation duties—the person who handles (deposits) payments from customers should not also a. Post remittances to customer accounts. b. Create or authorize credit memos. c. Reconcile the bank account. 17.2 Use of EFT, FEDI, and lockboxes to minimize handling of customer payments by employees 17.3 Obtain and use a UPIC to receive EFT and FEDI payments from customers. 17.4 Immediately upon opening mail, create list of all customer payments received. 17.5 Prompt, restrictive endorsement of all customer checks 17.6 Having two people open all mail likely to contain customer payments

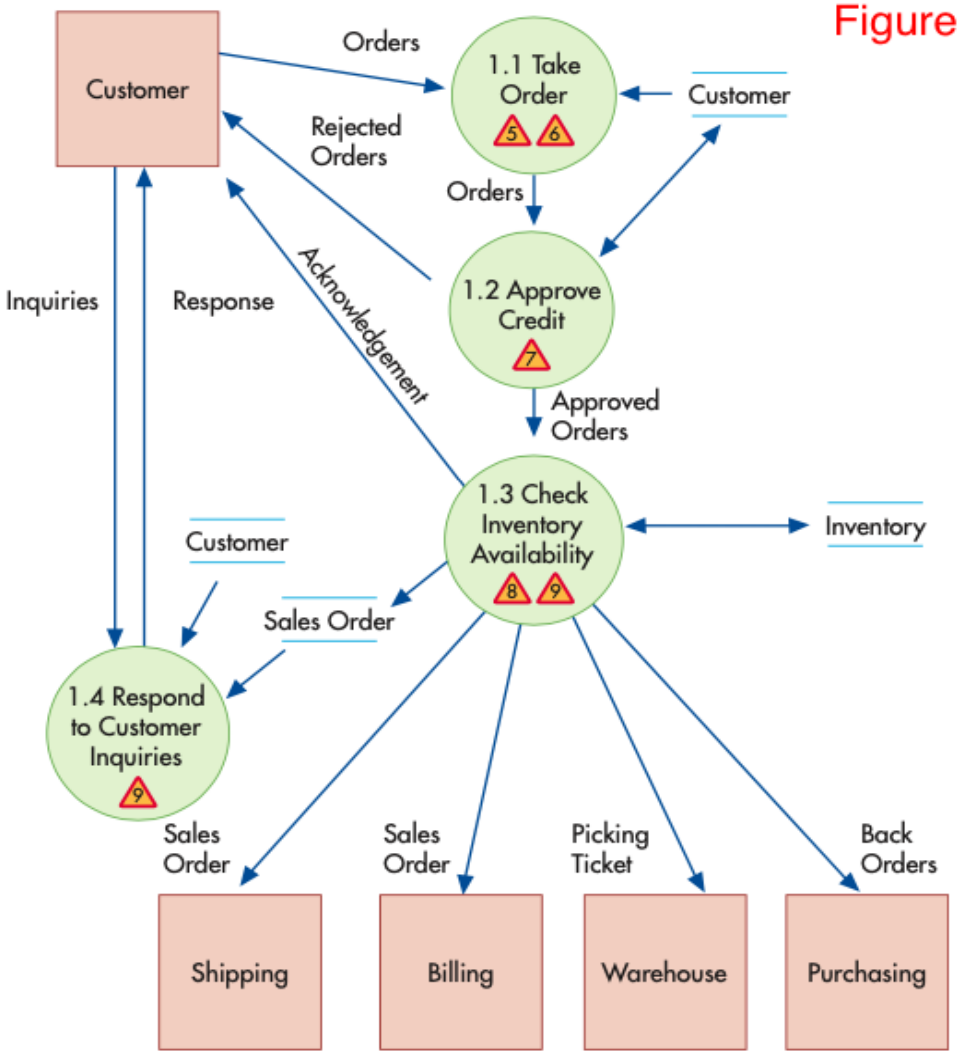
		17.7 Use of cash registers 17.8 Daily deposit of all cash receipts 18.1 Lockbox arrangements, EFT, or credit cards 18.2 Discounts for prompt payment by customers 18.3 Cash flow budgets

Sales Order Entry

The revenue cycle begins with the receipt of orders from customers. The sales department, which reports to the vice president of marketing (refer to Figure 3-1), typically performs the sales order entry process, but increasingly customers are themselves entering much of this data through forms on a company's Web site storefront.

Figure 3-5 shows that the sales order entry process entails three steps: taking the customer's order, checking and approving customer credit, and checking inventory availability. Figure 3-5 also includes an important related event that may be handled either by the sales order department or by a separate customer service department (which typically also reports to the vice president of marketing): responding to customer inquiries.

Figure 3-5



Taking Customer Orders

Customer order data are recorded on a sales order document. In the past, organizations used paper documents; today, as Figure 3-6 shows, the **sales order** document is usually an electronic form displayed on a computer monitor screen (interestingly, many ERP systems continue to refer to these data entry screens as documents). Examination of Figure 3-6 reveals that the sales order contains information about item numbers, quantities, prices, and other terms of the sale.

Process In the past, customer orders were entered into the system by employees. Increasingly, organizations seek to leverage IT to have customers do more of the data entry themselves. One way to accomplish this is to have customers complete a form on the company's Web site. Another is for customers to use **electronic data interchange (EDI)** to submit the order electronically in a format compatible with the company's sales order processing system. Both techniques improve efficiency and cut costs by eliminating the need for human involvement in the sales order entry process. Focus 3-1 describes how another recent IT development, QR codes, can further improve the efficiency and effectiveness of interacting with customers.

Besides cutting costs, Web sites also provide opportunities to increase sales. One technique, used by many Internet retailers, is to use sales history information to create marketing messages tailored to the individual customer. For example, once an Amazon.com customer selects a book, the Web site suggests related books that other customers have purchased when they bought the one the customer has already selected. Amazon.com and other Internet retailers also use sales history data to create customized electronic coupons that they periodically send to customers to encourage additional purchases. Another technique involves the use of interactive sales order entry systems that allow customers to customize products to meet their exact needs. For example, visitors to Dell Computer's Web site can try numerous combinations of components and features until they find a configuration that meets their needs at a price they can afford. Such interactive sales order entry systems not only increase sales, but also help improve cash flow in two ways. First, because many sales are built to order, less capital needs to be tied up in carrying a large inventory of finished

goods. Second, the build to order model allows companies to collect all or part of the payment in advance, possibly even before they have to pay for the raw materials.

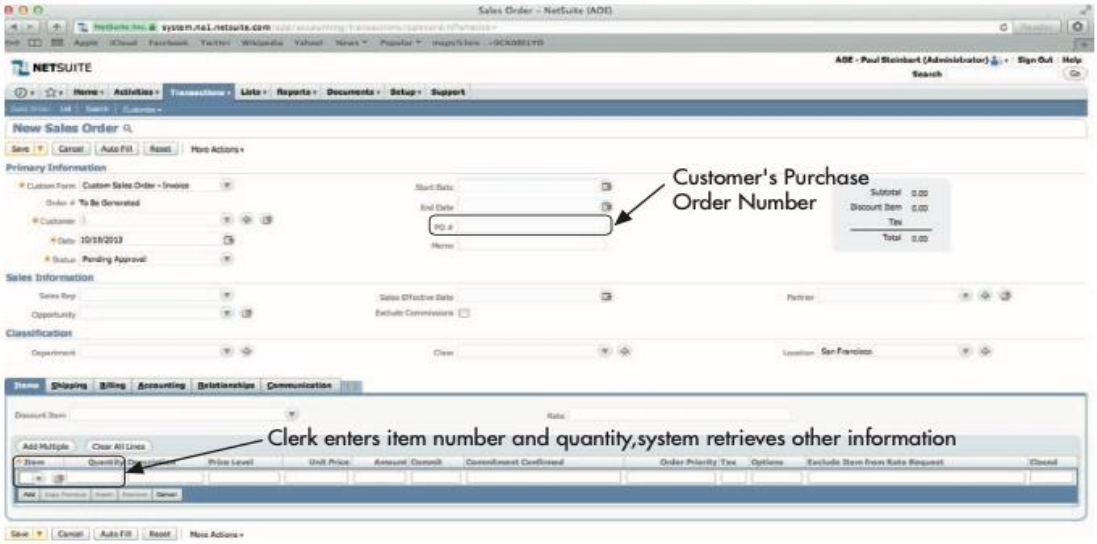
The effectiveness of a Web site depends largely on its design, however. Therefore, companies should regularly review records of customer interaction on their Web sites to quickly identify potential problems. A hard-to-use Web site may actually hurt sales by frustrating customers and creating ill will. Conversely, a well-designed Web site can provide useful insights. For example, when managers at National Semiconductor noticed a marked increase in customer interest in the company's new heat sensors, they ramped up production so that the company was able to satisfy increased demand for those products.

Like AOE, many companies continue to employ a sales staff in addition to using a Web site storefront, because of the benefits associated with face-to-face contact with existing and prospective business customers. Information technology provides many opportunities to improve sales force efficiency and effectiveness, a process referred to as sales force automation. Storing promotional information online is cheaper than printing and mailing those materials to sales representatives. E-mail and instant messaging (IM) reduce the costs and time it takes to inform sales staff of pricing changes and sales promotions. Both techniques also can be used to provide sales staff with last-minute reminders about a particular customer's special needs and interests and to enable management to quickly approve special deals. E-mail and IM also reduce the need for salespeople to return to the home office, thereby increasing

the proportion of time they can spend with customers. Technology also enhances the quality of sales presentations. Laptop computers and tablets

enable salespeople to make multimedia presentations, which improves their ability to demonstrate and explain the capabilities and features of complex technical products.

Figure 3-6



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Focus 3-1

QR codes are two-dimensional bar codes that can be scanned with a smartphone. They provide potential customers with access to multimedia anywhere at anytime. For example, consider a charity fund-raising event such as an outdoor concert. QR codes can be printed on posters, displayed on video screens, and included in the program. When attendees scan the code, they are directed to a mobile website where they can make a donation via their smartphone. Such a process is likely to result in a higher percentage of attendees actually donating, because they can do so at the time of the event, rather than hoping that when they get home where they can use their laptop or desktop to access the charity's website. QR codes can also increase sales by enhancing customer service. For example, in South Korea the grocery chain Tesco places display cases stocked with commonly purchased items at subway stops. Consumers can scan the QR codes next to the items they want, then enter their account number, and the groceries are delivered to their home within an hour. QR codes also facilitate real-time changes to advertising: the seller need only log in to their account, change the content at that one central location, and every subsequent time that a potential customer scans a QR code in a magazine, transportation stop, or other location, they will see the new updated information.

Threats and Controls A basic threat during sales order entry is that important data about the order will be either missing or inaccurate (threat 5 in Table 3-1). This not only creates inefficiencies (someone will have to call the customer back and reenter the order in the system), but also may negatively affect customer perceptions and, thereby, adversely affect future sales. ERP systems use a variety of data entry edit controls to mitigate this threat. For

example, completeness checks can ensure that all required data, such as both shipping and billing addresses, are entered. Automatic lookup of reference data already stored in the customer master file, such as customer addresses, prevents errors by eliminating data entry. To illustrate, examine the sales order entry screen depicted in Figure 3-6. In the header section (the top portion of the screen), the salesperson need only enter the name of the customer in the sold-to and ship-to fields, and the system pulls the rest of the information from the customer master file. In the detail section (the lower portion of the figure), the salesperson needs to enter only the item number and quantity ordered, and the rest of the information is pulled from the inventory and pricing master files. Note that by looking up the reference data, the ERP system is necessarily performing a validity check of the customer name and inventory item number entered by the salesperson. ERP systems should also be configured to perform reasonableness tests to compare the quantity ordered with item numbers and past sales history.

Of course, all of these built-in controls presuppose that the master data is accurate, which is why Table 3-1 also indicates the need to restrict access to the integrated database (control 5.2) to prevent unauthorized changes that could destroy the integrity of the data. In addition, all of these data entry edit controls need to be incorporated on Web sites to ensure that customers accurately and completely enter all required data and in the EDI system used to accept electronic orders from customers.

A second threat associated with the sales order entry activity concerns the legitimacy of orders (threat 6 in Table 3-1). If a company ships merchandise to a customer and the customer later denies having placed the order, there is a potential loss of assets. For paper-based transactions, the legitimacy of customer orders is established by the customer’s signature.

Digital signatures (control 6.1) provide similar assurance of legitimacy and the evidence to support nonrepudiation for electronic transactions.

Finally, accountants can help managers to better monitor sales activity by using their knowledge about business processes to design reports that focus on key performance drivers. For example, reports that break down sales by salesperson, region, or product provide a means to evaluate sales order entry efficiency and effectiveness. Reports that show marginal profit contribution by product, distribution channel, region, salesperson, or customer can provide additional insights.

Credit Approval

Most business-to-business sales are made on credit. Therefore, another revenue cycle threat listed in Table 3-1 (threat 7) is the possibility of making sales that later turn out to be uncollectible. Requiring proper authorization for each credit sale diminishes this threat.

For existing customers with well-established payment histories, a formal credit check for each sale is usually unnecessary. Instead, management gives sales staff general authorization to approve orders from customers in good standing, meaning those without past-due balances, provided that such sales do not increase the customer's total account balance beyond their credit limit (control 7.1). A **credit limit** is the maximum allowable account balance that management wishes to allow for a customer based on that customer's past credit history and ability to pay. Thus, for existing customers, credit approval simply involves checking the customer master file to verify the account exists, identifying the customer's credit limit, and verifying that the amount of the order plus any current account balance does not exceed this limit. This can be done automatically by the system.

The system can also automatically flag orders that require specific authorization because they exceed a customer's preapproved credit limit. For such cases, and for sales to new customers, Table 3-1 shows that someone *other than the sales representative* should specifically approve extension of credit (control 7.2). This is especially important if the sales staff is paid on commission because their motivation is to make sales, not focus on collectability. The organization chart for AOE (see Figure 3-1) shows how most companies segregate these duties. The credit manager, who sets credit policies and approves the extension of credit to new customers and the raising of credit limits for existing customers, is independent of the marketing function. To enforce this segregation of duties in ERP systems, sales order entry clerks should be granted read-only access to information about individual customer credit limits; the ability to actually change credit limits should be granted only to the credit manager. Figure 3-7 shows some of the information the system makes available to help the credit manager decide whether to adjust a customer's credit limit. The quality of those decisions depends upon maintaining accurate and current information about account balances, sales, and customer remittances.

To be effective, credit approval must occur *before* the goods are released from inventory and shipped to the customer. Nevertheless, problems will occur, and some customers will end up not paying off their accounts. Therefore, careful monitoring of accounts receivable (control 7.3) is extremely important. A useful report for doing this is an **accounts receivable aging report**, which lists customer account balances by length of time outstanding (Figure 3-8). The information provided by such reports is useful for projecting the timing of future cash inflows related to sales, deciding whether to increase the credit limit for specific customers, and for

estimating bad debts. Management needs to regularly review the accounts receivable aging report because prompt attention to customers who fall behind in their payments can minimize losses. Such a report could have enabled AOE to spot problems with the Best Value Company earlier, so that it could have stopped making additional credit sales. In addition, reports that show trends in bad debt expense can help management decide whether changes are needed in credit policies.

Figure 3-7

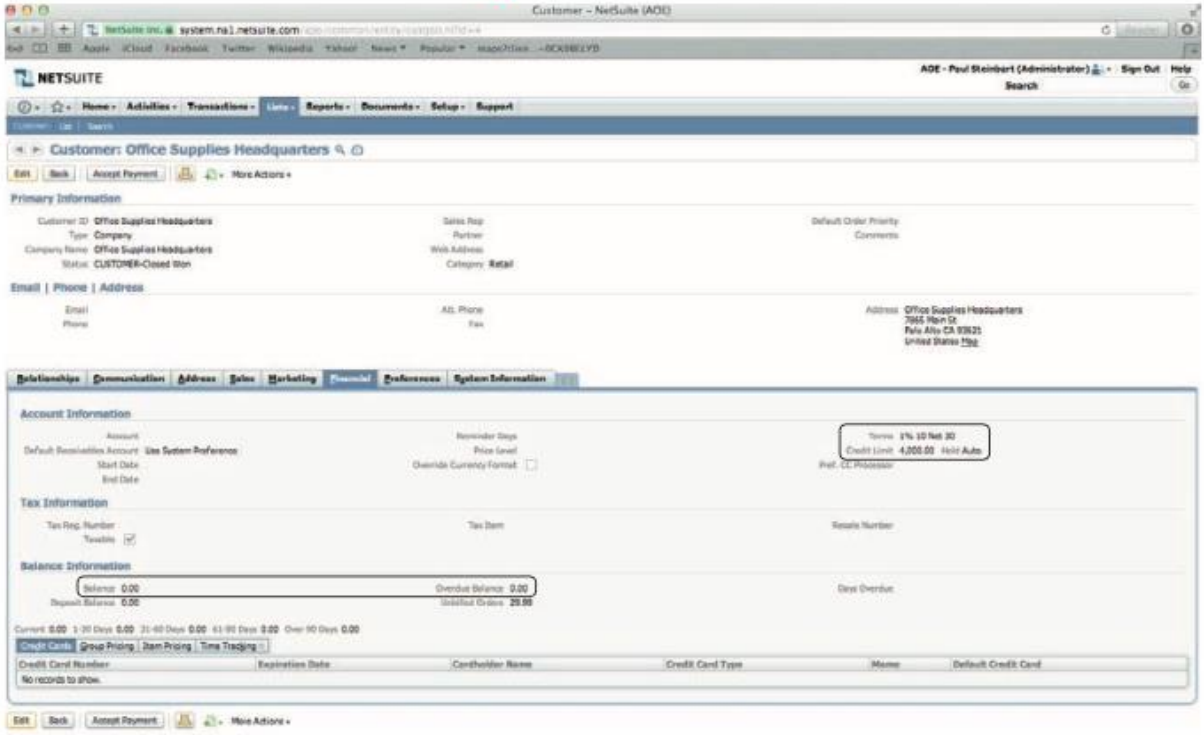

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Figure 3-8

Customer	Amount	Current	1–30 Days Past Due	31–60 Days Past Due	61–90 Days Past Due	Over 90 Days Past Due
Able						
Invoice 221	$3,450	$3,450				
Invoice 278	2,955	2,955				
Total	$6,405	$6,405				
Baker						
Invoice 178	$4,500			$4,500		
Invoice 245	2,560	2,560				
Total	$7,060	$2,560		$4,500		
Other Accounts	$185,435	$137,935	$28,500	$5,500	$2,500	$11,000
Totals	$198,900	$146,900	$28,500	$10,000	$2,500	$11,000

Checking Inventory Availability

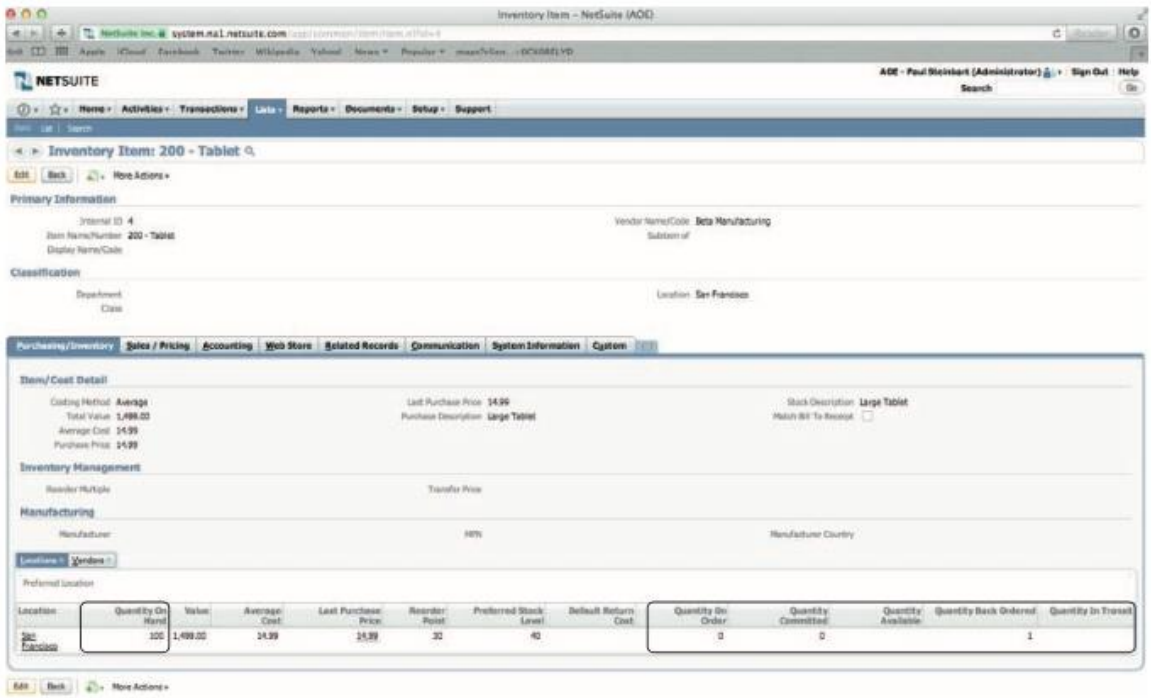
In addition to checking a customer's credit, salespeople also need to determine whether sufficient inventory is available to fill the order, so that customers can be informed of the expected delivery date.

Process Figure 3-9 shows an example of the information typically available to the sales order staff: quantity on hand, quantity already committed to other customers, and quantity available. If sufficient inventory is available to fill the order, the sales order is completed, and the quantity-available field in the inventory file for each item ordered is reduced by the amount ordered. The shipping, inventory control, and billing departments are then notified of the sale, and an acknowledgment may be sent to the customer. If there is not sufficient inventory on hand to fill the order, a **back order** authorizing the purchase or production of those items must be created. In manufacturing companies, creating a back order involves notifying the production department to initiate the production of the requested items. In retail

companies, the purchasing department would be notified about the need to order the required items.

Once inventory availability has been determined, the system then generates a **picking ticket** that lists the items and quantities of each item that the customer ordered. The picking ticket authorizes the inventory control function to release merchandise to the shipping department. Although traditionally a paper document, picking tickets today are often electronic forms that may be displayed on portable handheld devices or on monitors built into forklifts. To improve efficiency, the picking ticket often lists the items by the sequence in which they are stored in the warehouse, rather than in the order listed on the sales order.

Figure 3-9



Source: 2010 © NetSuite Inc.

Threats and Controls Accurate inventory records are important to prevent both stockouts and excess inventory (threat 8 in Table 3-1). Stockouts may result in lost sales if customers are not willing to wait and instead purchase from another source. Conversely, excess inventory increases carrying costs and may even require significant markdowns that reduce profitability. Frequent markdowns can change a company's image to that of a discount retailer, thereby conditioning customers to expect price cuts.

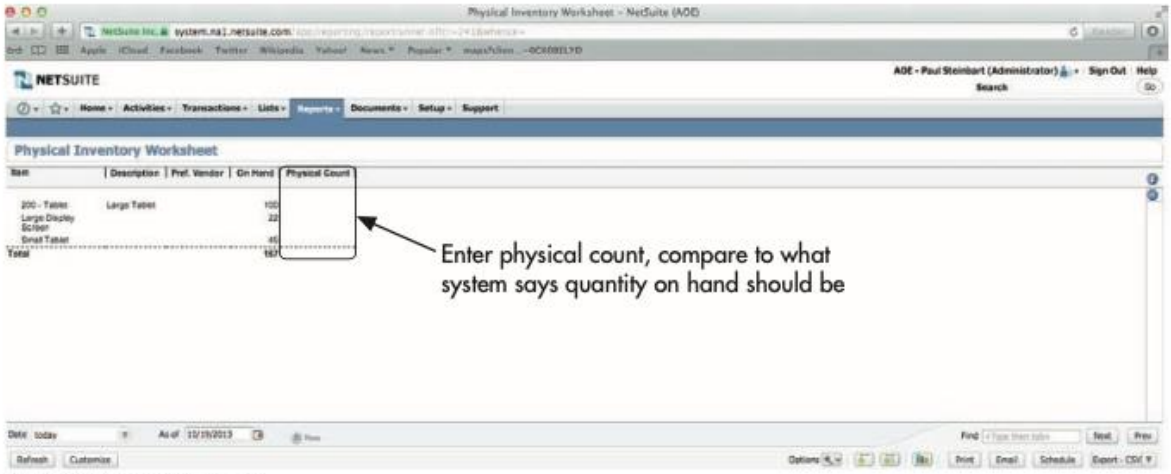
Integrated ERP systems, like the one depicted in Figure 3-4, facilitate the use of the perpetual inventory method, (control 8.1) which reduces the risk of unexpected stockouts or excessive inventories. However, the accuracy of the perpetual inventory records requires careful data entry during performance of revenue cycle activities. In particular, shipping and salesclerks must correctly record the quantity of items removed from inventory and delivered to customers. This task is particularly error-prone in retail establishments. For example, when customers purchase multiple items with the same price, the checkout clerks may scan only one item and then enter the total quantity purchased. Although this will generate the correct total sales amount, it will introduce errors into the inventory records. The recorded quantity- on-hand for the one item that was physically scanned will be too low, and the recorded quantity-on-hand for the other varieties of that item will be too high. Proper handling of sales returns is another task that contributes to inaccurate inventory records, particularly in retail establishments. In clothing stores, for example, when a customer returns a wrong sized item and exchanges it for another, the clerks should enter the exchange into the system. Often, especially during extremely busy sales periods, the clerks simply make the exchange and put the returned item back

on the shelf but fail to make the proper entry in the system. Consequently, the system's records for both items are inaccurate.

Replacing bar codes with radio-frequency identification (RFID) tags (control 8.2) can eliminate many of these problems because the data entry occurs automatically. For situations where use of RFID tags is uneconomical or not practical, training and regular reminders from management can reduce the frequency of the undesired behavior (control 8.3 in Table 3-1). Nevertheless, because the behaviors described above are likely to occur during particularly busy times, periodic physical counts of inventory (control 8.4) are necessary to verify the accuracy of recorded amounts. Figure 3-10 shows an example of a physical inventory worksheet. Notice that it lists each inventory item and the quantity that should be on hand, according to system records. It also includes a column to record the results of the physical count.

Sales forecasts (control 8.5 in Table 3-1) are another tool to help companies better predict inventory needs and thereby reduce the risk of stockouts or carrying excess inventory. Accountants can also prepare reports that enable sales managers to identify the need to adjust those forecasts. For example, reports about the frequency and size of back orders can identify items for which forecasts need to be adjusted to better avoid stockouts. Conversely, reports that break down sales by item can identify slow-moving products in time to prevent excessive stockpiling.

Figure 3-10



Source: 2010 © NetSuite Inc.

Responding to Customer Inquiries

Besides processing customer orders, as Figure 3-5 shows, the sales order entry process also includes responding to customer inquiries. Sometimes these inquiries precede an order, and often they occur after orders have been placed. In either case, responding to customer inquiries promptly and accurately is extremely important to a company's long-run success. The objective is to retain customers (threat 9 in Table 3-1). This is important because a general marketing rule of thumb is that it costs at least five times as much to attract and make a sale to a new customer as it does to make a repeat sale to an existing customer. One way to monitor retention performance is to periodically produce a report that "ages" customers by the number of years they have made purchases. However, retention requires more than merely satisfying customers. It requires creating loyalty. Research indicates that if customer satisfaction is rated on a 1-to-5 scale, with 5 representing completely satisfied and 1 representing completely dissatisfied, customers who rated their satisfaction level at 5 were many times more likely

to make repeat purchases than were customers who rated their satisfaction level only at 4. Moreover, that same research indicates that the key to generating total satisfaction, and thereby retaining customers, is the quality and nature of the post-sale customer contacts.

Customer service is so important that many companies use special software packages, called **customer relationship management (CRM) systems**, to support this vital process (control 9.1). CRM systems help organize detailed information about customers to facilitate more efficient and more personalized service. Customer service can be further improved by using data such as cumulative sales over multiple time periods to identify "preferred" customers. CRM systems also help generate additional sales. For example, after responding to a customer inquiry, a customer service representative can use information about customer preferences and transaction history to suggest other products that may be of interest to the customer. Detailed data about customer requirements and business practices can also be used to proactively contact customers about the need to reorder.

Many customer inquiries are routine, however. Consequently, companies can and should use IT to automate the response to common requests, such as questions about account balances and order status, so that sales order and customer service representatives can concentrate their time and effort on handling the more complex, nonroutine inquiries. For example, Web sites provide a cost-effective alternative to traditional toll-free telephone customer support, automating that process with a list of frequently asked questions (FAQs). Additional social media tools such as blogs and discussion boards can also be used to create virtual communities where customers can share information and useful tips with one another. Web sites

also enable customers to use PINs to directly access their account information and to check on the status of orders. These techniques can significantly reduce customer service costs. Wells Fargo, for example, found that customers with online access to their accounts made 40% fewer calls to the customer service department than did customers without such access. It is impossible, however, to anticipate every question customers may ask. Therefore, Web sites designed to provide customer service should include an IM or chat feature to enable customers to obtain real-time expert assistance and advice for dealing with special issues the FAQ list does not satisfactorily address. Finally, it is important for accountants to design reports that will assist managers in *properly* evaluating the performance of customer service representatives by incorporating both internal and external measures. Failure to include both types of data can result in reports that cause dysfunctional behavior. For example, reports that use only internal data, such as number of inquiries handled per unit of time, may encourage customer service representatives to try to maximize their efficiency at the expense of satisfying customers. Conversely, relying solely on customer satisfaction ratings removes incentives to be efficient.

Shipping

The second basic activity in the revenue cycle (circle 2.0 in Figure 3-3) is filling customer orders and shipping the desired merchandise. As Figure 3-11 shows, this process consists of two steps: (1) picking and packing the order and (2) shipping the order. The warehouse and shipping departments perform these activities, respectively. Both functions include custody of inventory and, as shown in Figure 3-1, report ultimately to the vice president of manufacturing.

Pick and Pack the Order

The first step in filling a customer order involves removing the correct items from inventory and packaging them for delivery.

Process The picking ticket generated by the sales order entry process triggers the pick and pack process. Warehouse workers use the picking ticket to identify which products, and the quantity of each product, to remove from inventory. Warehouse workers record the quantities of each item actually picked, either on the picking ticket itself (if a paper document is used) or by entering the data into the system (if electronic forms are used). The inventory is then transferred to the shipping department.

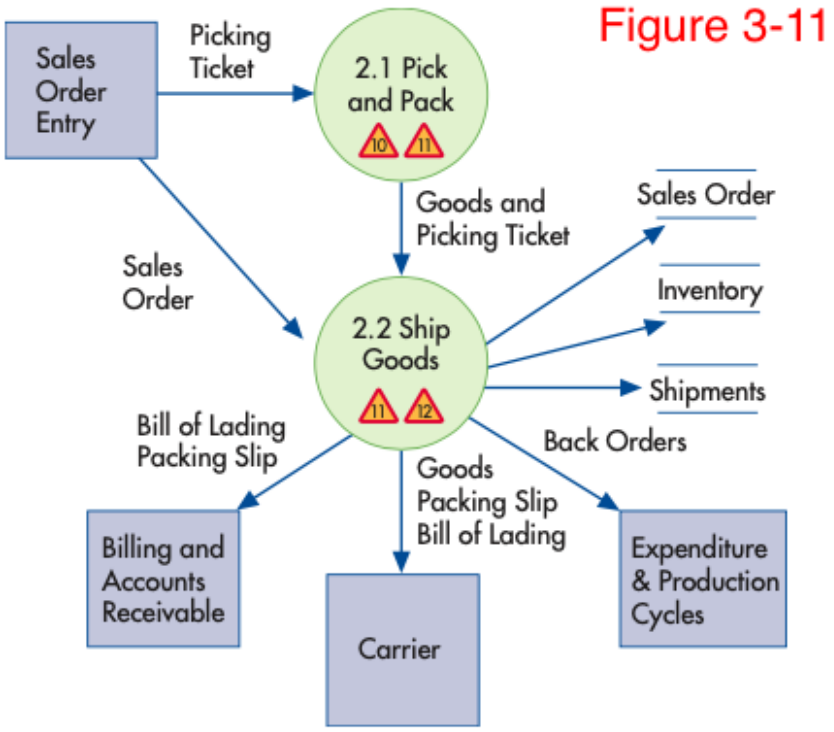


Figure 3-11

AOE, like many companies, has made significant investments in automated warehouse systems consisting of computers, bar-code scanners,

conveyer belts, and communications technology. The goal of such investments is to reduce the time and cost of moving inventory into and out of the warehouse while also improving the accuracy of perpetual inventory systems. Wireless technology, in particular, increases warehouse productivity by eliminating the need for workers to repeatedly return to a centralized dispatch center to receive printed instructions. For example, JCPenney equips its forklifts with radio-frequency data communication (RFDC) terminals to provide drivers with information about which items to pick next and where they are located. At Corporate Express, an office supplies distributor in Broomfield, Colorado, warehouse workers wear headsets and listen to computer-synthesized voice instructions about what items to pick and package for delivery. The company reports that the oral instructions result in fewer mistakes than occur when drivers try to read a small terminal screen in dim light. Focus 3-2 explains how some companies use robots to totally automate order picking.

RFID tags improve the efficiency and accuracy of tracking inventory movement. With bar codes, the item or box must be positioned proper so that the bar code can be read by the scanner. Switching to an RFID tag eliminates this need to align items with scanners; instead, the tags can be read as the inventory moves throughout the warehouse. In addition, each RFID tag can store detailed information to facilitate proper storage and routing of the inventory item. For companies that handle large volumes of merchandise, such as Federal Express and UPS, RFID's ability to reduce by even a few seconds the time it takes to process each package can yield enormous cost savings.

Automated warehouse systems not only cut costs and improve efficiency in handling inventory but also can allow for more customer-

responsive shipments. For example, manufacturers can use bar-code and RFID systems in their warehouses to facilitate packing and shipping related items (e.g., matching shirts and ties) together. The cartons can then be either bar-coded or RFID-tagged so that retailers can quickly check in the merchandise and move it to the selling floor. These services not only save retailers time and money but also help improve turnover, thereby increasing the manufacturer's sales.

Threats and Controls One potential problem is the risk of picking the wrong items or in the wrong quantity (threat 10 in Table 3-1). The automated warehousing technologies described earlier can minimize the chance of such errors. Bar-code and RFID scanners (control 10.1), in particular, virtually eliminate errors when they are used by the system to automatically compare the items and quantities picked by warehouse workers with the information on sales orders (control 10.2).

Another threat involves the theft of inventory (threat 11). In addition to a loss of assets, theft also makes inventory records inaccurate, which can lead to problems in filling customer orders. Table 3-1 lists several control procedures that can reduce the risk of inventory theft. First, inventory should be kept in a secure location to which physical access is restricted (control 11.1). Second, all inventory transfers within the company should be documented (control 11.2). Inventory should be released to shipping employees based only on approved sales orders. Both warehouse and shipping employees should sign the document accompanying the goods (or make the appropriate acknowledgment of the transfer online) at the time the goods are transferred from inventory to shipping. This procedure facilitates tracking the cause of any inventory shortages, and the accountability provided encourages employees to prepare and maintain accurate records.

The use of wireless communications technologies and RFID tags (control 11.3) can provide real-time tracking of inventory in transit, which may help reduce theft. Finally, recorded amounts of inventory should be periodically reconciled with physical counts of inventory on hand (control 11.4), and the employees responsible for inventory custody should be held accountable for any shortages.

As with the other steps in the revenue cycle, accountants can help managers better monitor performance by designing useful reports. Note that the order-picking process does not involve any direct interaction with customers. Therefore, reports using only internally generated measures such as orders filled per unit of time, are sufficient.

Focus 3-2

Companies such as Amazon.com, Crate & Barrel, Dillard's, the Gap, and Walgreens are using robots built by Kiva Systems (kivasystems.com) to dramatically improve the efficiency and effectiveness of their warehouse operations. Whereas in most warehouses workers must roam the warehouse (either on foot or on fork lifts) to pick inventory ordered by customers, workers in warehouses that use kiva systems' battery-powered robots remain at stations around the perimeter of the room. The orange-colored robots use a combination of optical scanning technology, bar codes, and wireless communications to locate items. Inventory is stored on movable shelving units, called pods, which the robots can go under and "lift." The robots then bring the pods to the worker, who removes the desired quantity of items from the shelves and then packs the items in boxes to be shipped to customers. Eliminating the need for workers to travel around the warehouse often results in one worker being able to pack up to three times as many orders in a given time period. By having the same worker fill an entire order, the system also reduces the opportunity for errors that can occur when several different workers sequentially fill portions of an order.

Ship the Order

After the merchandise has been removed from the warehouse, it is shipped to the customer.

Process The shipping department should compare the physical count of inventory with the quantities indicated on the picking ticket and with the quantities indicated on the sales order. Discrepancies can arise either because the items were not stored in the location indicated on the picking ticket or because the perpetual inventory records were inaccurate. In such

cases, the shipping department needs to initiate the back ordering of the missing items and enter the correct quantities shipped on the packing slip.

After the shipping clerk counts the goods delivered from the warehouse, the sales order number, item number(s), and quantities are entered using online terminals. This process updates the quantity-on-hand field in the inventory master file. It also produces a packing slip and multiple copies of the bill of lading. The **packing slip** (see Figure 3-12) lists the quantity and description of each item included in the shipment. The **bill of lading** is a legal contract that defines responsibility for the goods in transit. It identifies the carrier, source, destination, and any special shipping instructions, and it indicates who (customer or vendor) must pay the carrier (see Figure 3-13). A copy of the bill of lading and the packing slip accompany the shipment. If the customer is to pay the shipping charges, this copy of the bill of lading may serve as a *freight bill*, to indicate the amount the customer should pay to the carrier. In other cases, the freight bill is a separate document.

One important decision that needs to be made when filling and shipping customer orders concerns the choice of delivery method. Traditionally, many companies have maintained their own truck fleets for deliveries. Increasingly, however, manufacturers are outsourcing this function to commercial carriers such as DHL, Federal Express, Ryder System, Inc., Schneider Logistics, UPS, and YRC. Outsourcing deliveries reduces costs and allows manufacturers to concentrate on their core business activity (the production of goods). Selecting the proper carrier, however, requires collecting and monitoring information about carrier performance (e.g., percentage of on-time deliveries and damage claims)

because customers will blame the company, not the carrier, for delivery problems.

Another important decision concerns the location of distribution centers. Increasingly, many customers are asking suppliers and manufacturers to deliver products only when needed. Consequently, suppliers and manufacturers must use logistics software tools to identify the optimal locations to store inventory in order to minimize the total amount of inventory carried and to meet each customer's delivery requirements. Logistics software also helps optimize daily activities, such as how to most efficiently use 17 available trucks to make 300 deliveries to various locations in one metropolitan area.

Globalization adds further complexity to outbound logistics. The efficiency and effectiveness of different distribution methods, such as trucking or rail, differ around the world. Taxes and regulations in various countries can also affect distribution choices. Therefore, an organization's information system must include logistics software that can maximize the efficiency and effectiveness of its shipping function.

Figure 3-12

Packing Slip

Order Date	Order #
9/13/2014	458

AOE
2431 Bradford Lane
San Francisco CA 94403
US

Ship To
Hardware City
4742 Mesa Drive
Mesa AZ 85284
United States

Ship Date	Ship Via	Tracking #
9/15/2014	UPS Ground	

Item	Description	Order	B/O	Shipped
Nikon Pix 5000	Mega Zoom for those close up shots	4		4
Warranty 1 yr $100–500	1 yr parts and labor warranty on any hardware priced between $100–500	4		4

AOE

Customer Return Form

Ship Returns To
2431 Bradford Lane
San Francisco CA 94493
US

R.A. #	Customer	Order #
	Hardware City	458

Item	Quantity	Reason for Returning

Threats and Controls Table 3-1 indicates that two potential problems are theft (threat 11) and shipping errors (threat 12). We discussed the various controls to reduce the threat of theft in the prior section. Regular reconciliation of information about shipments with sales orders (control 12.1) enables timely detection of delay or failure to ship goods to customers. In addition, RFID systems (control 12.2) can provide real-time information on shipping status and thus provide additional information about possible delays. If the seller learns that a shipment is going to be late, prompt

notification can help the customer revise its plans accordingly. The cost of providing such notifications is minimal, especially if done via e-mail or IM, but the effort is likely to significantly improve customer satisfaction and loyalty.

Shipping the wrong items or quantities of merchandise and shipping to the wrong location can cause customer dissatisfaction, resulting in the loss of future sales. Shipping errors may also result in the loss of assets if customers do not pay for goods erroneously shipped. To minimize the risk of shipping errors, ERP systems like the one depicted in Figure 3-4 should be configured to compare the quantities and item numbers entered by shipping employees to the information on the sales order and to display a warning about any discrepancies so that the problem can be corrected prior to shipment. Of course, the effectiveness of this control depends upon the accuracy of the information collected about outgoing shipments. To reduce data entry errors by shipping employees, bar codes and RFID tags should be used whenever possible (control 12.3). If shipping data must be entered manually at a terminal, data entry controls such as field checks, limit or range checks, and completeness tests are necessary (control 12.4).

Duplicate shipments result in increased costs associated with shipping and then processing the return of merchandise. To mitigate this threat, ERP systems should be configured to “block” the line items on sales orders once shipping documents are printed (control 12.5), to prevent using that same sales order to authorize another shipment of the same goods to the same customer. Companies that still use paper documents can reduce the risk of duplicate shipments by sequentially prenumbering all shipping documents, requiring that they be matched with the supporting sales order and picking ticket, and then marking those documents in a manner that prevents their reuse.

Figure 3-13

STRAIGHT BILL OF LADING — SHORT FORM **Not Negotiable.**

Shipper's No.

Carrier **Carrier's No.**

RECEIVED, subject to the classifications and tariffs in effect on the date of the issue of this Bill of Lading.

at _____ **20**____ **from** _____

the property described below, in apparent good order, except as noted (contents and condition of contents of packages unknown), marked, consigned, and destined as indicated below, which said carrier (the word carrier being understood throughout this contract as meaning any person or corporation in possession of the property under the contract) agrees to carry to its usual place of delivery at said destination, if on its route, otherwise to deliver to another carrier on the route to said destination. It is mutually agreed, as to each carrier of all or any of said property over all or any portion of said route to destination, and as to each party at any time interested in any or all of said property, that every service to be performed hereunder shall be subject to all terms and conditions of the Uniform Domestic Straight Bill of Lading set forth (1) in Uniform Freight Classificationin effect on the date hereof, if this is a rail or a rail-water shipment, or (2) in the applicable motor carrier classification or tariff if this is a motor carrier shipment.

Shipper hereby certifies that he is familiar with all the terms and conditions of the said bill of lading, including those on the back thereof, set forth in the classification or tariff which governs the transportation of this shipment, and the said terms and conditions are hereby agreed to by the shipper and accepted for himself and his assigns.

Consigned to _____

(Mail or street address of consignee — For purposes of notification only.)

Destination _____ State _____ Zip Code _____ County _____

Delivery Address ★ _____

(★ To be filled in only when shipper desires and governing tariffs provide for delivery thereat.)

Route _____

Delivering Carrier Car or Vehicle Initials No.

No. Packages	Kind of Package, Description of Articles, Special Marks, and Exceptions	*Weight (Sub. to Cor.)	Class or Rate	Check Column

Subject to Section 7 of Conditions of applicable bill of lading, if this shipment is to be delivered to the consignee without recourse on the consignor, the consignor shall sign the following statement.

The carrier shall not make delivery of this shipment without payment of freight and all other lawful charges.

(Signature of Consignor.)

If charges are to be prepaid, write or stamp here, "To Be Prepaid."

*If the shipment moves between two ports by a carrier by water, the law requires that the bill of lading shall state whether it is "carrier's or shipper's weight."

NOTE — Where the rate is dependent on value, shippers are required to state specifically in writing the agreed or declared value of the property.

The agreed or declared value of the property is hereby specifically stated by the shipper to be not exceeding

per

Received $ _____ to apply in prepayment of the charges on the property described hereon.

Agent or Cashier

Per _____

amount prepaid

Charges advanced:
$

†"The fiber boxes used for this shipment conform to the specifications set forth in the box maker's certificate thereon, and all other requirements of Uniform Freight Classification."

†Shipper's imprint in lieu of stamp; not a part of bill of lading approved by the Interstate Commerce Commission.

_____ Shipper, per _____ Agent, Per _____

Permanent post office address of shipper, _____

Billing

The third basic activity in the revenue cycle (circle 3.0 in Figure 3-3) involves billing customers. Figure 3-14 shows that this involves two separate, but closely related, tasks: invoicing and updating accounts receivable, which are performed by two separate units within the accounting department.

Invoicing

Accurate and timely billing for shipped merchandise is crucial. The invoicing activity is just an information processing activity that repackages and summarizes information from the sales order entry and shipping activities. It requires information from the shipping department identifying the items and quantities shipped and information about prices and any special sales terms from the sales department.

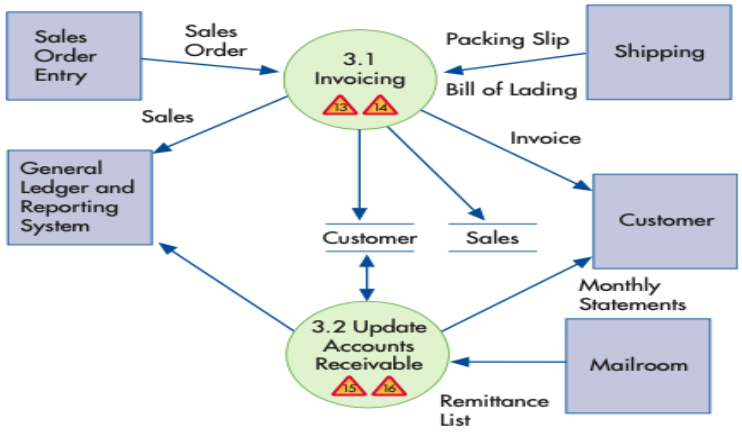
Process The basic document created in the billing process is the **sales invoice** (Figure 3-15), which notifies customers of the amount to be paid and where to send payment. Like many companies, AOE still prints paper invoices that it mails to many of its smaller customers. Larger customers, however, receive invoices via EDI. EDI not only eliminates printing and postage costs, but also the labor involved in performing those tasks. For companies that generate hundreds of thousands of sales invoices annually, saving even a few seconds per invoice can yield significant cost reductions. EDI invoices and online bill payment also benefit customers by reducing their time and costs, which should increase both satisfaction and loyalty.

In fact, a well-designed accounting system can entirely eliminate the need to create and store invoices, at least with customers that have sophisticated systems of their own. To understand this concept, reexamine the information included in a typical sales invoice (see Figure 3-15). The invoice indicates the quantity of each item sold and the price charged for that

item; but the price is usually set at the time the order is placed, and the actual quantity sold is known at the time the merchandise is shipped to the customer. Thus, the selling company's accounting system already contains all the information needed to calculate the amount of the sale at the time the goods are shipped. Indeed, invoices are often printed in a batch process without any manual data entry. Conversely, the buyer knows the price at the time the order is placed and knows the quantity purchased when the goods are received. Consequently, if both companies have accurate transaction processing systems, it may be possible to establish an agreement in which the buyer will automatically remit payments within a specified number of days after receiving the merchandise. The seller sends an electronic notification, usually via e-mail, when the goods are shipped, and the customer sends an electronic acknowledgment when the goods are received. Ford is just one of many companies that have established such relationships with their major suppliers. Note that the seller can still monitor and determine accounts receivable by reconciling shipments to customer remittances because accounts receivable represents all shipments for which the seller has not yet been paid. The attraction of such invoiceless billing is that it saves both the seller and buyer considerable amounts of time and money by eliminating the need to perform a traditional business process (invoicing) that does not provide any new information.

An integrated ERP system also provides the opportunity to merge the billing process with the sales and marketing function by using data about a customer's past purchase history to send information about related products and services. Such customized advertising may generate additional sales with little if any incremental costs.

Figure 3-14



AOE
2431 Bradford Lane
San Francisco, CA
99403

Figure 3-15

Invoice

Date	Invoice #
9/16/2014	3091380

Bill To	Ship To
Hardware City 35 Appliance Way Phoenix AZ 85201 United States	Hardware City 4742 Mesa Drive Mesa AZ 85284 United States

Terms	Due Date	PO #	Sales Rep	Ship Via	Tracking Numbers
Net 30	10/16/2014		JKL	UPS Ground	

Item	Qty	Description	Price	Amount
Nikon Pix 5000	4	Mega Zoom for those close up shots	200.00	800.00
Warranty 1 yr $100–500	4	1 yr parts and labor warranty on any hardware priced between $100–500	19.95	79.80

Subtotal	879.80
Shipping Cost (UPS Ground)	30.04
Total	$909.84

Threats and Controls One threat associated with the invoicing process is a failure to bill customers (threat 13 in Table 3-1), which results in the loss of assets and erroneous data about sales, inventory, and accounts receivable. Segregating the shipping and billing functions (control 13.1) reduces the risk that this occurs intentionally. Otherwise, an employee performing both functions could ship merchandise to friends without billing them. To reduce the risk of unintentional failure to bill, ERP systems need to be configured to regularly compare sales orders, picking tickets, and shipping documents with sales invoices to produce reports of shipments for which an invoice has not been created (control 13.2). (For invoiceless systems, this control involves matching sales orders to shipping documents.) Management needs to regularly review such reports and take corrective action. In paper-based systems, prenumbering all documents and periodically accounting for them identifies shipments that have not been invoiced.

Billing errors (threat 14 in Table 3-1), such as pricing mistakes and billing customers for items not shipped or on back order, represent another potential threat. Overbilling can result in customer dissatisfaction, and underbilling results in the loss of assets. Incorrect calculation of sales taxes can result in fines and penalties. Pricing mistakes can be avoided by having the system retrieve the appropriate data from the pricing master file (control 14.1) and by restricting the ability of employees to make changes to that data (control 14.2). If employees must enter billing data manually, the use of the data entry edit controls can minimize errors (control 14.3). Mistakes involving quantities shipped can be caught by reconciling the quantities listed on the packing slips with those on the sales order (control 14.4).

Maintain Accounts Receivable

The accounts receivable function, which reports to the controller, performs two basic tasks: It uses the information on the sales invoice to debit customer accounts and subsequently credits those accounts when payments are received.

Process The two basic ways to maintain accounts receivable are the open-invoice and the balance-forward methods. The two methods differ in terms of when customers remit payments, how those payments are applied to update the accounts receivable master file, and the format of the monthly statement sent to customers. Under the **open-invoice method**, customers typically pay according to each invoice. Usually, two copies of the invoice are mailed to the customer, who is requested to return one copy with the payment. This copy is a turnaround document called a **remittance advice**. Customer payments are then applied against specific invoices. In contrast, under the **balance-forward method**, customers typically pay according to the amount shown on a monthly statement, rather than by individual invoices. The **monthly statement** lists all transactions, including both sales and payments, that occurred during the past month and informs customers of their current account balances (Figure 3-16). The monthly statement often has a tear-off portion containing preprinted information, including the customer's name, account number, and balance. Customers are asked to return this stub, which serves as a remittance advice, with payment. Remittances are applied against the total account balance, rather than against specific invoices.

Figure 3-16

MONTHLY STATEMENT March 2014

Alpha Omega Electronics
2431 Bradford Lane
San Francisco, CA 99403

Hardware City
35 Appliance Way
Phoenix, AZ 85201

Invoice Number	Date	Current	Past Due 1–30	Past Due 31–60	Past Due 61–90	Past Due Over 90
34567	3/20/2014	4292.50				
34591	3/27/2014	2346.50				
	Totals	6639.00				
				Total Amount Due	6639.00	

Please detach here and return with remittance

Bill date 03/31/2014
Account number 73256
Payment due 04/10/2014
Total amount due 6639.00
Amount enclosed

Pay To: AOE
PO Box 7341
San Francisco, CA 99403-7341

One advantage of the open-invoice method is that it is conducive to offering discounts for prompt payment, as invoices are individually tracked and aged. It also results in a more uniform flow of cash collections throughout the month. A disadvantage of the open-invoice method is the added complexity required to maintain information about the status of each individual invoice for each customer. Consequently, the open-invoice method is typically used by business whose customers are primarily other businesses, because the number of individual transactions is relatively small

and the dollar value of those transactions is high. Companies with large numbers of customers who make many small purchases each month, such as utility companies, credit card issuers (e.g., Citibank), or national retail chains (e.g., Sears and JCPenney) typically use the balance-forward method. For them, this method is more efficient and reduces costs by avoiding the need to process cash collections for each individual sale. It is also more convenient for the customer to make one monthly remittance.

Many companies that use the balance-forward method use a process called cycle billing to prepare and mail monthly statements to their customers. Under **cycle billing**, monthly statements are prepared for subsets of customers at different times. For example, the customer master file might be divided into four parts, and each week monthly statements would be prepared for one-fourth of the customers. Cycle billing produces a more uniform flow of cash collections throughout the month and reduces the time that the computer system is dedicated to printing monthly statements. Cycle billing can significantly affect processing requirements. Consider the case of a utility company serving several million customers in a large metropolitan area. If it prepared monthly statements for all its customers at the same time, and it took 10 seconds to print out each one, its printers would be tied up for several days.

Image processing technology can further improve the efficiency and effectiveness of managing customer accounts. The digital images of customer remittances and invoices can be stored electronically and then be easily retrieved, manipulated, and integrated with other images and data to produce various types of output. Doing so provides employees fast access to all documents relating to a customer and eliminates the time wasted searching through file cabinets for lost paperwork. If a customer needs a

duplicate copy of a monthly statement or an invoice to replace a lost original, it can be retrieved, printed, and faxed while the employee is talking to the customer on the phone. Image processing also can facilitate resolving customer complaints, because the same image can be viewed simultaneously by more than one person. Thus, a customer account representative and a credit manager could both review an image of a document in question while discussing the problem with the customer on the telephone. Image processing also reduces the space and cost associated with storing paper documents. The savings in this area can be substantial: One optical disk can store thousands of documents, in a fraction of the space.

Adjustments to a customer's account are sometimes necessary. For example, customer accounts may be credited to reflect either the return of items or allowances granted for damaged goods. To credit a customer's account for returned goods, the credit manager must obtain information from the receiving dock that the goods were actually returned and placed back in inventory. Upon notification from the receiving department that the goods have been returned, the credit manager issues a **credit memo** (Figure 3-17), which authorizes the crediting of the customer's account. If the damage to the goods is minimal, the customer may agree to keep them for a price reduction. In such cases, the credit manager issues a credit memo to reflect the amount that should be credited to the customer's account. A copy of the credit memo is sent to accounts receivable to authorize an adjustment to the customer's account balance; another copy is sent to the customer.

After repeated attempts to collect payment have failed, it may be necessary to write off a customer's account. In such cases, the credit manager issues a credit memo to authorize the write-off. Unlike the cases

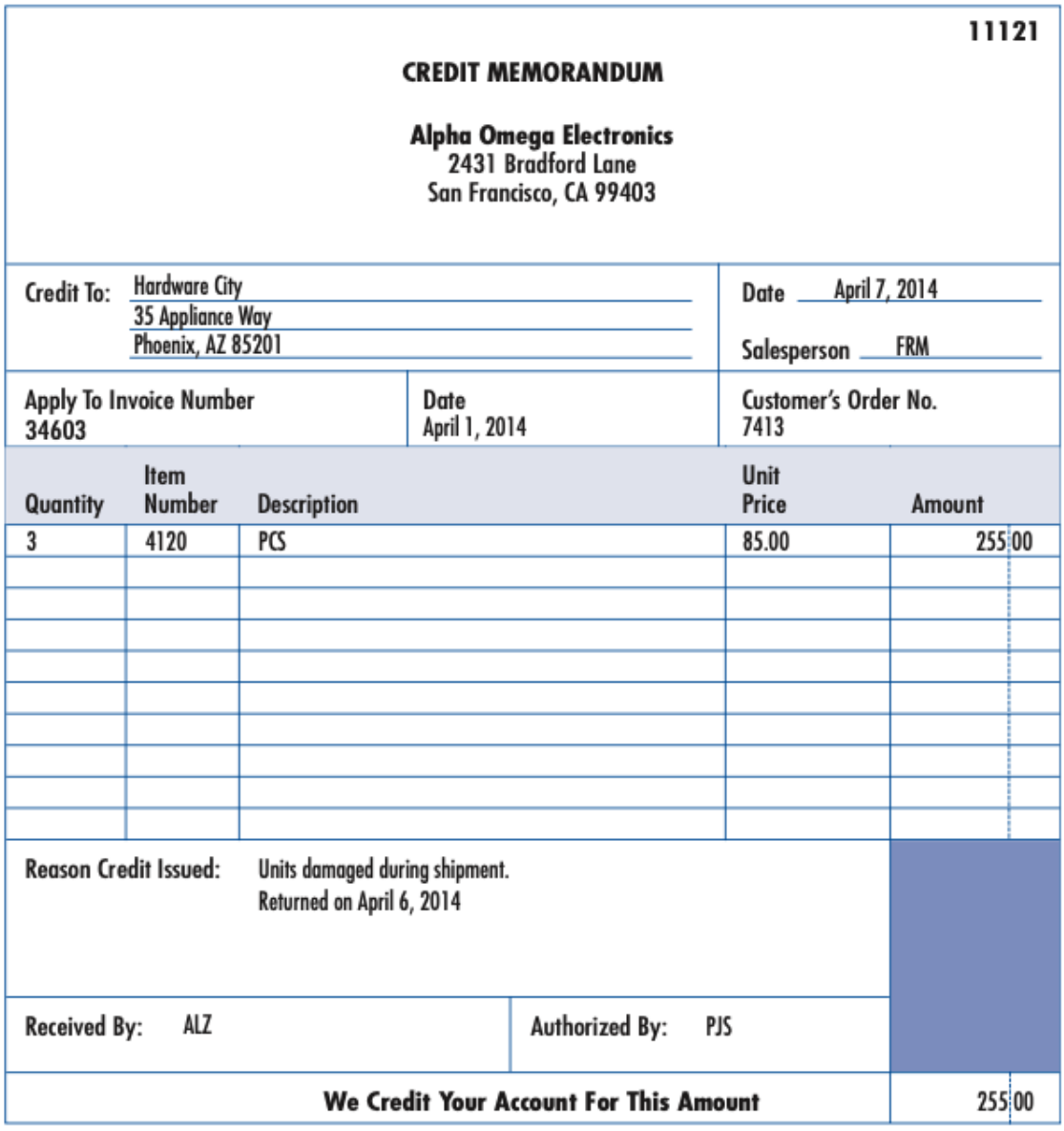
involving damaged or returned goods, however, a copy of the credit memo used to authorize the write-off of an account is not sent to the customer.

Threats and Controls Errors in maintaining customer accounts (threat 15 in Table 3-1) can lead to the loss of future sales and also may indicate possible theft of cash. The data entry edit checks can minimize the risk of errors in maintaining customer accounts (control 15.1). For example, validity checks and closed-loop verification can ensure that the correct customer account is being updated, and field checks can ensure that only numeric data is entered for sales and payments. Customer payments are often processed in batches, so batch totals (control 15.2) can provide an additional means to detect posting errors. Specifically, the sum of all customer payments processed should equal the change to the total of all customer account balances. To ensure that all remittances were processed, the number of customer accounts updated should be compared with the number of checks received. These reconciliations should be performed by someone other than the individual involved in processing the original transactions because (1) it is easier to catch someone else's mistakes than one's own, and (2) it provides a means to identify possible cases of fraud. Mailing monthly account statements to every customer (control 15.3) provides an additional independent review of posting accuracy because customers will complain if their accounts have not been properly credited for payments they remitted. In legacy systems, another important control to verify the accuracy of updates to accounts receivable involved reconciling the subsidiary accounts receivable records with the general ledger (control 15.4). After customer payments are processed, the sum of all individual customer account balances (the accounts receivable subsidiary file) should equal the total balance of the accounts receivable control account in the general ledger. If

the two are not equal, an error in posting has probably occurred, and all transactions just entered should be reexamined. In ERP systems, however, postings to general ledger control accounts can occur only through the subsidiary ledger and are only made by the system itself. Although this eliminates the possibility of discrepancies between the subsidiary and general ledger arising from data entry errors, configuration errors may sometimes allow errors to occur.

Threat 16 listed in Table 3-1 is that an employee may issue credit memos to write-off account balances for friends or to cover up the theft of cash or inventory. Proper segregation of duties (control 16.1) can reduce the risk of this threat. To prevent employees making sales to friends that are then written off, the ERP system should be configured so that the person who can issue credit memos does not also have rights to enter sales orders or to maintain customer accounts. The system should also be configured to match all credit memos to sales invoices. In addition, the system should be configured to block credit memos for which there does not exist validated documentation that the goods have been returned by the customer (control 16.2). Blocking forces specific managerial review and approval of cases where the company agrees to let the customer both keep the merchandise and receive credit.

Figure 3-17



11121

CREDIT MEMORANDUM

Alpha Omega Electronics
2431 Bradford Lane
San Francisco, CA 99403

Credit To: Hardware City
35 Appliance Way
Phoenix, AZ 85201

Date April 7, 2014

Salesperson FRM

Apply To Invoice Number 34603

Date April 1, 2014

Customer's Order No. 7413

Quantity	Item Number	Description	Unit Price	Amount
3	4120	PCS	85.00	255 00

Reason Credit Issued: Units damaged during shipment.
Returned on April 6, 2014

Received By: ALZ

Authorized By: PJS

We Credit Your Account For This Amount 255 00

Cash Collections

The final step in the revenue cycle is collecting and processing payments from customers (circle 4.0 in Figure 3-3).

Process

Because cash and customer checks can be stolen so easily, it is important to take appropriate measures to reduce the risk of theft. As

discussed more fully in the section on controls, this means that the accounts receivable function, which is responsible for recording customer remittances, should not have physical access to cash or checks. Instead, the cashier, who reports to the treasurer (see Figure 3-1), handles customer remittances and deposits them in the bank.

How then, does the accounts receivable function identify the source of any remittances and the applicable invoices that should be credited? One method involves mailing the customer two copies of the invoice and requesting that one be returned with the payment. This remittance advice is then routed to accounts receivable, and the actual customer payment is sent to the cashier. An alternative solution is to have mailroom personnel prepare a **remittance list**, which is a document identifying the names and amounts of all customer remittances and send it to accounts receivable. Yet another alternative is to photocopy all customer remittances and send the copies to accounts receivable while forwarding the actual remittances to the cashier for deposit.

Managing cash flow is important to overall profitability, as the AOE case showed. Therefore, companies are continually seeking ways to speed up the receipt of payments from customers. One way to do this when customers send payments directly to the company is to use Remote Deposit Capture software to scan customer checks and then transmit an encrypted digital file to the bank. Doing so eliminates the time and cost associated with going to the bank to make a physical deposit.

Another way to speed up the processing of customer payments involves the use of a lockbox arrangement with a bank. A **lockbox** is a postal address to which customers send their remittances. The participating bank picks up the checks from the Post Office box and deposits them in the

company's account. The bank then sends the remittance advices, an electronic list of all remittances, and photocopies of all checks to the company. Having customers send payments to a lockbox eliminates the delay associated with processing customer remittances before depositing them. Cash flow can be further improved by selecting several banks around the country to maintain lockboxes, with the locations chosen to minimize the time customer checks are in the mail. Similarly, establishing lockbox arrangements with foreign banks reduces the time it takes to collect payments from sales to international customers.

Information technology can provide additional efficiencies in the use of lockboxes. In an **electronic lockbox** arrangement, the bank electronically sends the company information about the customer account number and the amount remitted as soon as it receives and scans those checks. This method enables the company to begin applying remittances to customer accounts before the photocopies of the checks arrive.

Lockbox arrangements, however, eliminate only those delays that are associated with internal processing of remittances mailed directly to the company. With **electronic funds transfer (EFT)**, customers send their remittances electronically to the company's bank and thus eliminate the delay associated with the time the payment is in the mail system. EFT also reduces the time lag before the bank makes the deposited funds available to the company. EFT is usually accomplished through the banking system's Automated Clearing House (ACH) network.

EFT, however, involves only the transfer of funds. To properly credit customer accounts, companies also need additional data about each remittance, such as invoice numbers and discounts taken. Although every bank can do EFT through the ACH system, not every bank possesses the

EDI capabilities necessary to process the related remittance data. Consequently, many companies have had to separate the EFT and EDI components of processing customer payments, as shown in the top panel of Figure 3-18. This complicates the selling company's task of properly crediting customer accounts for payments because information about the total amount of funds received arrives separately from information about the invoices that payment should be applied against. Similarly, the customer's task is complicated by the need to send information about the payment to two different parties.

Financial electronic data interchange (FEDI) solves these problems by integrating the exchange of funds (EFT) with the exchange of the remittance data (EDI). As shown in the lower panel of Figure 3-18, the customer sends both remittance data and funds transfer instructions together. Similarly, the seller receives both pieces of information simultaneously. Thus, FEDI completes the automation of both the billing and cash collections processes. To fully reap the benefits of FEDI, however, requires that both the selling company and its customers use banks that are capable of providing EDI services.

Companies can also speed the collection process by accepting credit cards or procurement cards (a special type of credit card that will be discussed in Chapter 4). The benefit is that the card issuer usually transfers the funds within two days of the sale. This benefit must be weighed against the costs of accepting such cards, which typically range from 2% to 4% of the gross sales price.

Threats and Controls

The primary objective of the cash collections function is to safeguard customer remittances. Special control procedures must be utilized because

cash is so easy to steal (threat 17 in Table 3-1). Segregation of duties is the most effective control procedure for reducing the risk of such theft (control 17.1). Employees who have physical access to cash should not have responsibility for recording or authorizing any transactions involving its receipt. Specifically, the following pairs of duties should be segregated:

1. *Handling cash or checks and posting remittances to customer accounts.* A person performing both of these duties could commit the special type of embezzlement called *lapping*. Therefore, only the remittance data should be sent to the accounts receivable department, with customer payments being sent to the cashier. Such an arrangement establishes two mutually independent control checks. First, the total credits to accounts receivable recorded by the accounting department should equal the total debit to cash representing the amount deposited by the cashier. Second, the copy of the remittance list that is sent to the internal audit department can be compared with the validated deposit slips and bank statements to verify that all checks the organization received were deposited. Finally, the monthly statements mailed to customers provide another layer of control, because customers would notice the failure to properly credit their accounts for payments remitted.

2. *Handling cash or checks and authorizing credit memos.* A person performing both of these duties could conceal theft of cash by creating a credit memo equal to the amount stolen.

3. *Handling cash or checks and reconciling the bank statement.* An important detective control is reconciliation of the bank account statement with the balance of cash recorded in the company's information system. Having this reconciliation performed by someone who does not have access to cash or customer remittances provides an independent check on the

cashier and prevents manipulation of the bank statement to conceal the theft of cash.

In ERP systems, employee roles must be properly configured to segregate these combinations of incompatible duties. In addition, the system should be configured to require specific approval by an appropriate manager of high-risk transactions, such as issuing credit memos without requiring the customer to return the merchandise.

In general, the handling of money and checks within the organization should be minimized. The optimal methods are a bank lockbox arrangement or the use of EFT, FEDI, or credit cards for customer payments (control 17.2), which totally eliminates employee access to customer payments. When customers pay via EFT or FEDI, sellers should obtain a **universal payment identification code (UPIC)** from their bank (control 17.3). The UPIC is a number that enables customers to remit payments via an ACH credit without requiring the seller to divulge detailed information about its bank account. The costs of these arrangements must be weighed against the benefits of reduced internal processing costs and faster access to customer payments. If customer payments must be processed internally, prompt documentation of remittances is crucial, because the risk of loss is greatest at the time of first receipt. Therefore, a list of all checks received should be prepared *immediately* after opening the mail (control 17.4). The checks should also be restrictively endorsed at that time (control 17.5). To further minimize the risk of misappropriating any cash or checks received, two people should open all incoming mail (control 17.6).

Retail stores and organizations that receive cash directly from customers should use cash registers that automatically produce a written record of all cash received (control 17.7). In these situations, customers also

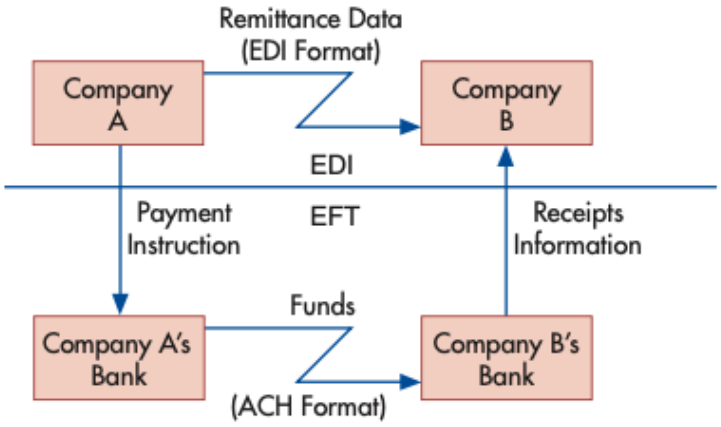
can play a role in controlling cash collections. For example, many stores use signs to inform customers that their purchase is free if they fail to get a receipt or that receipts marked with a red star entitle them to a discount. Such policies encourage customers to watch that employees actually ring up the cash sale and do so correctly.

All customer remittances should be deposited, intact, in the bank each day (control 17.8). Daily deposits reduce the amount of cash and checks at risk of theft. Depositing all remittances intact, and not using any of them for miscellaneous expenditures, facilitates reconciliation of the bank statement with the records of sales, accounts receivable, and cash collections. ERP systems should be configured to require that all cash collections transactions be processed through an approved list of bank accounts.

Finally, as the AOE case illustrated, cash flow problems are a serious concern (threat 18 in Table 3-1). The use of lockbox arrangements, EFT, credit cards, and offering discounts for early payment can speed up cash collections (controls 18.1 and 18.2). However, the best control procedure to reduce the risk of unanticipated cash shortfalls is to use a **cash flow budget** (control 18.3). As Figure 3-19 shows, a cash flow budget presents estimates of cash inflows (projected collections from sales) and outflows (outstanding payables). A cash flow budget can alert an organization to a pending short-term cash shortage, thereby enabling it to plan ahead to secure short-term loans at the best possible rates. Conversely, an organization that knows a surplus of cash is pending can take steps to invest those excess funds to earn the best possible returns. Regular monitoring of a cash flow budget would have helped AOE avoid the need for short-term borrowing at unfavorable rates.

Figure 3-18

Nonintegrated EDI and EFT



FEDI

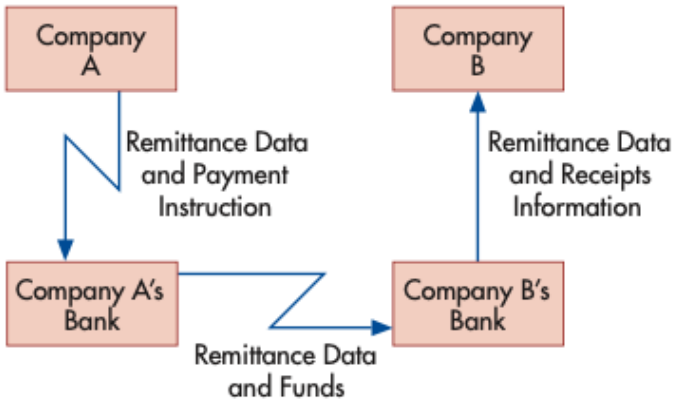


Figure 3-19

	January	February	March	April
Beginning Balance	10,000	11,000	8,000	8,000
Projected Cash Receipts:				
Cash Sales	7,000	8,500	8,000	9,000
Collections on Account	26,000	29,000	28,000	30,000
Total Cash Available (A)	43,000	48,500	44,000	47,000
Projected Cash Disbursements (B)	(32,000)	(41,000)	(39,000)	(36,000)
Projected Ending Cash Balance (C = A − B)	11,000	7,500	5,000	11,000
Desired Minimum Balance (D)	8,000	8,000	8,000	8,000
Amount Needed to Borrow	0	500	3,000	0
Ending Balance	11,000	8,000	8,000	11,000

Summary and Case Conclusion

An organization's accounting system should be designed to maximize the efficiency and effectiveness with which the four basic revenue cycle activities (sales order entry, shipping, billing, and cash collections) are performed. It must also incorporate adequate internal control procedures to mitigate such threats as uncollectible sales, billing errors, and lost or misappropriated inventory and cash. Control procedures also are needed to ensure that the information provided for decision making is both accurate and complete. Finally, to facilitate strategic decision making, the accounting system should be designed to accommodate the integration of internally generated data with data from external sources.

At the next executive meeting, Elizabeth summarized the proposals that she, Trevor, and Ann developed to provide the information needed to better manage customer relationships and cash flows. Among the recommendations were the following:

1. Equip the sales force with wireless-enabled pen-based tablets. Trevor Whitman, vice president of marketing, believes that AOE will still need its sales staff to visit existing customers to identify which additional products

can be profitably carried. Sales staff also will continue to make cold calls on prospective customers to try to convince them to carry AOE's products. As they walk down store aisles, sales representatives can check off the items that need to be restocked and then write in the appropriate quantities. When the order is complete, they can transmit the order back to headquarters. The system can check the customer's credit status and inventory availability and confirm orders within minutes, including an estimated delivery date. After the customer approves the order, the system will immediately update all affected files so that current information about inventory status is available to other sales representatives.

2. Improve warehouse and shipping efficiency by replacing bar codes with RFID tags.

3. Improve billing process efficiency by increasing the number of customers who agree to participate in invoiceless sales relationships and, when possible, by using EDI to transmit invoices to those customers who still require them.

4. In an effort to improve customer service, periodically survey and monitor customer satisfaction with AOE's products and performance.

5. Improve efficiency of cash collections by encouraging customers to use EFT and, preferably, FEDI to remit payments. Obtain a UPIC from their bank to avoid having to share detailed bank account information with customers. Monthly develop and monitor cash flow budgets to anticipate short-term borrowing needs.

Linda Spurgeon approved these proposals. She then asked Elizabeth and Ann to turn their attention to solving several problems related to AOE's expenditure cycle business activities.

Exercises

1. Which activity is part of the sales order entry process?

a. setting customer credit limits

b. preparing a bill of lading

c. checking customer credit

d. approving sales returns

2. Which document often accompanies merchandise shipped to a customer?

a. picking ticket

b. packing slip

c. credit memo

d. sales order

3. Which method is most likely used when a company offers customers discounts for prompt payment?

a. open-invoice method

b. balance-forward method

c. accounts receivable aging method

d. cycle billing method

4. Which of the following techniques is the most efficient way to process customer payments and update accounts receivable?

a. EFT

b. UPIC

c. FEDI

d. ACH

5. Which of the following revenue cycle activities can potentially be eliminated by technology?

a. sales order entry

b. shipping

c. billing

d. cash collections

6. The integrated database underlying an ERP system results in which of the following general threats to the revenue cycle?

a. inaccurate or invalid master data

b. unauthorized disclosure of sensitive information

c. loss or destruction of data

d. all of the above

7. Which document is used to authorize the release of merchandise from inventory control (warehouse) to shipping?

a. picking ticket

b. packing slip

c. shipping order

d. sales invoice

8. Which of the following provides a means both to improve the efficiency of processing customer payments and also to enhance control over those payments?

a. CRM

b. lockboxes

c. aging accounts receivable

d. EDI

9. For good internal control, who should approve credit memos?

a. credit manager

b. sales manager

c. billing manager

d. controller

10. For good internal control over customer remittances, the mailroom clerk should separate the checks from the remittance advices and send the customer payments to which department?

a. billing

b. accounts receivable

c. cashier

d. sales

Discussion Questions

1. Customer relationship management systems hold great promise, but their usefulness is determined by the amount of personal data customers are willing to divulge. How can companies encourage customers to share useful personal information?

2. Some products, such as music and software, can be digitized. How does this affect each of the four main activities in the revenue cycle?

3. Many companies use accounts receivable aging schedules to project future cash inflows and bad-debt expense. Review the information typically presented in such a report (see Figure 3-8). Which specific metrics can be

calculated from those data that might be especially useful in providing early warning about looming cash flow or bad-debt problems?

4. Table 3-1 suggests that restricting physical access to inventory is one way to reduce the threat of theft. How can information technology help accomplish that objective?

5. Invoiceless pricing has been adopted by some large businesses for business-to-business transactions. What are the barriers, if any, to its use in sales to consumers?

6. If AOE decides to begin selling directly to individual consumers, what changes will it need to make in its business processes?

Problems

1. Match the term in the left column with its definition in the right column.

1. CRM system
2. Open-invoice method
3. Credit memo
4. Credit limit
5. Cycle billing
6. FEDI
7. Remittance advice
8. Lockbox
9. Back order
10. Picking ticket
11. Bill of lading

a. Document used to authorize reducing the balance in a customer account

b. Process of dividing customer account master file into subsets and preparing invoices for one subset at a time

c. System that integrates EFT and EDI information

d. System that contains customer-related data organized in a manner to facilitate customer service, sales, and retention

e. Electronic transfer of funds

f. Method of maintaining accounts receivable that generates one payment for all sales made the previous month

g. Method of maintaining customer accounts that generates payments for each individual sales transaction

h. Maximum possible account balance for a customer

i. Electronic invoicing

j. Post Office box to which customers send payments

k. Document used to indicate stockouts exist

l. Document used to establish responsibility for shipping goods via a third party

m. Document that authorizes removal of merchandise from inventory

n. Turnaround document returned by customers with payments

2. What internal control procedure(s) would provide protection against the following threats?

a. Workers on the shipping dock steal goods, claiming that the inventory shortages reflect errors in the inventory records.

b. An employee posts the sales amount to the wrong customer account because he incorrectly keys the customer account number into the system.

c. An employee makes a credit sale to a customer who is already four months behind in making payments on his account.

d. An employee authorizes a credit memo for a sales return when the goods were never actually returned.

e. An employee writes off a customer's accounts receivable balance as uncollectible to conceal the theft of subsequent cash payments from that customer.

f. Customers are billed for the quantity ordered, but the quantity shipped is actually less because some items have been back ordered.

g. The mailroom clerk steals checks and then endorses them for deposit into the clerk's personal bank account.

h. The cashier steals funds by cashing several checks from customers.

i. A waiter steals cash by destroying the customer sales ticket for customers who paid cash.

j. Goods are shipped to a customer, but that customer is not billed.

k. A business loses sales because of stockouts of several products for which the computer records indicated there was adequate quantity on hand.

l. A business experiences unauthorized disclosure of the buying habits of several well-known customers.

m. A business loses all information about amounts owed by customers in New York City because the master database for that office was destroyed in a fire.

n. The company's Web site is unavailable for seven hours because of a power outage.

o. Customers' credit card numbers are intercepted and stolen while being sent to the company's Web site.

p. A salesclerk sells a $7,000 wide-screen TV to a friend and alters the price to $700.

q. A shipping clerk who is quitting to start a competing business copies the names of the company's 500 largest customers and offers them lower prices and better terms if they purchase the same product from the clerk's new company.

r. A fire in the office next door damages the company's servers and all optical and magnetic media in the server room. The company immediately implements its disaster recovery procedures and shifts to a backup center several miles away. The company has made full daily backups of all files and has stored a copy at the backup center. However, none of the backup copies are readable.

3. For good internal control, which of the following duties can be performed by the same individual? Explain your answer.

1. Approving changes to customer credit limits
2. Sales order entry
3. Shipping merchandise
4. Billing customers
5. Depositing customer payments
6. Maintaining accounts receivable
7. Issuing credit memos
8. Reconciling the organization's bank accounts
9. Checking inventory availability

4. O'Brien Corporation is a midsized, privately owned industrial instrument manufacturer supplying precision equipment to manufacturers in the Midwest. The corporation is 10 years old and uses an integrated ERP system. The administrative offices are located in a downtown building, and

the production, shipping, and receiving departments are housed in a renovated warehouse a few blocks away.

Customers place orders on the company's Web site, by fax, or by telephone. All sales are on credit, FOB destination. During the past year, sales have increased dramatically, but 15% of credit sales have had to written off as uncollectible, including several large online orders to first-time customers who denied ordering or receiving the merchandise.

Customer orders are picked and sent to the warehouse, where they are placed near the loading dock in alphabetical sequence by customer name. The loading dock is used both for outgoing shipments to customers and for receipt of incoming deliveries. There are 10 to 20 incoming deliveries every day, from a variety of sources.

The increased volume of sales has resulted in a number of errors in which customers were sent the wrong items. There have also been some delays in shipping because items that supposedly were in stock could not be found in the warehouse. Although a perpetual inventory is maintained, there has been no physical count of inventory for two years. When an item is missing, the warehouse staff writes the information down in a log book. Once a week, the warehouse staff uses the log book to update the inventory records.

The system is configured to prepare the sales invoice only after shipping employees enter the actual quantities sent to a customer, thereby ensuring that customers are billed only for items actually sent and not for anything on back order.

Required

a. Identify at least three weaknesses in O'Brien Corporation's revenue cycle procedures, explain the associated problem, and propose a solution. Present

your answer in a three-column table with these headings: Weakness, Problem, Solution.

b. Draw a BPMN diagram to depict O'Brien Corporation's revenue cycle revised to incorporate your solutions to step a. (*CMA Examination, adapted*)

5. Parktown Medical Center, Inc., is a small health care provider owned by a publicly held corporation. It employs 7 salaried physicians, 10 nurses, 3 support staff, and 3 clerical workers. The clerical workers perform such tasks as reception, correspondence, cash receipts, billing, and appointment scheduling. All are adequately bonded.

Most patients pay for services rendered by cash or check on the day of their visit. Sometimes, however, the physician who is to perform the respective services approves credit based on an interview. When credit is approved, the physician files a memo with one of the clerks to set up the receivable using data the physician generates.

The servicing physician prepares a charge slip that is given to one of the clerks for pricing and preparation of the patient's bill. At the end of the day, one of the clerks uses the bills to prepare a revenue summary and, in cases of credit sales, to update the accounts receivable subsidiary ledger.

The front office clerks receive cash and checks directly from patients and give each patient a prenumbered receipt. The clerks take turns opening the mail. The clerk who opens that day's mail immediately stamps all checks "for deposit only." Each day, just before lunch, one of the clerks prepares a list of all cash and checks to be deposited in Parktown's bank account. The office is closed from 12 noon until 2:00 p.m. for lunch. During that time, the office manager takes the daily deposit to the bank. During the lunch break

the clerk who opened the mail that day uses the list of cash receipts and checks to update patient accounts.

The clerks take turns preparing and mailing monthly statements to patients with unpaid balances. One of the clerks writes off uncollectible accounts only after the physician who performed the respective services believes the account will not pay and communicates that belief to the office manager. The office manager then issues a credit memo to write off the account, which the clerk processes.

The office manager supervises the clerks, issues write-off memos, schedules appointments for the doctors, makes bank deposits, reconciles bank statements, and performs general correspondence duties.

Additional services are performed monthly by a local accountant who posts summaries prepared by the clerks to the general ledger, prepares income statements, and files the appropriate payroll forms and tax returns.

Required

a. Identify at least three weaknesses in Parktown's revenue cycle procedures, explain the associated problem, and propose a solution. Present your answer in a three-column table with these headings: Weakness, Problem, Solution.

b. Draw a BPMN diagram to depict Parktown's revenue cycle revised to incorporate your solutions to step a. (*CPA Examination, adapted*)

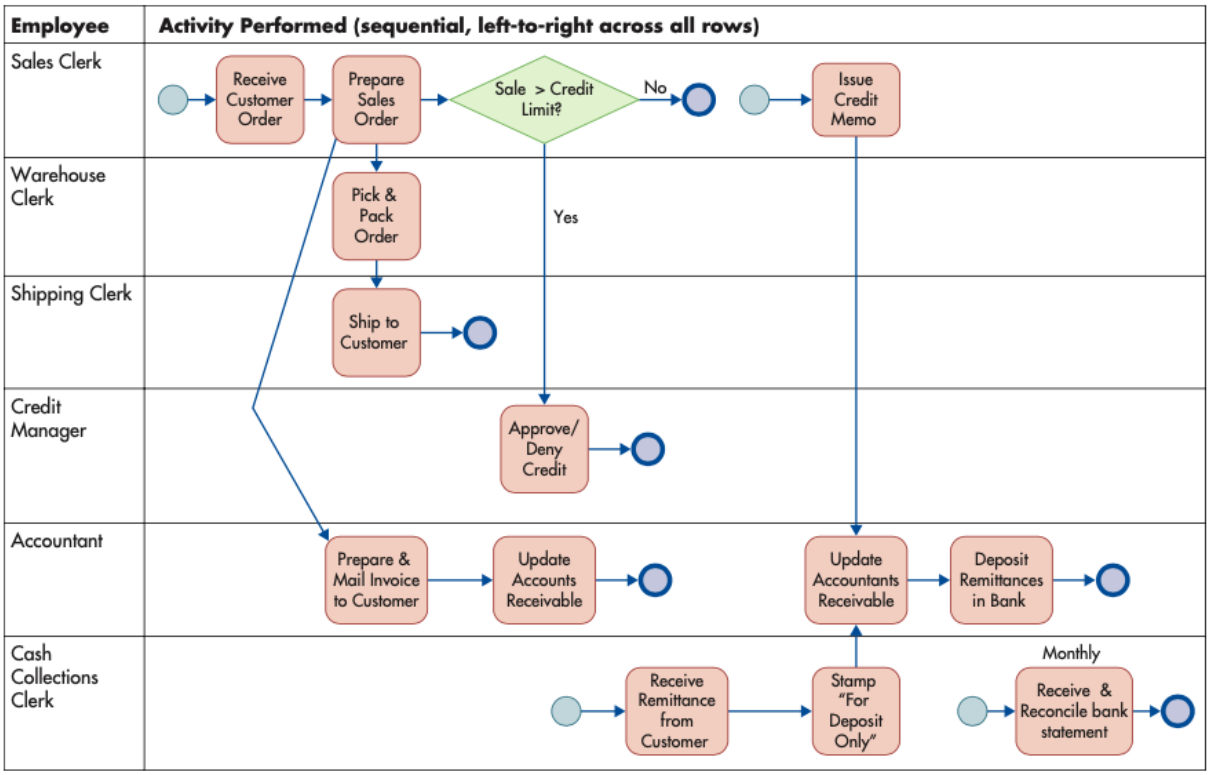
6. Figure 3-20 depicts the activities performed in the revenue cycle by the Newton Hardware Company.

Required

a. Identify at least three weaknesses in Newton Hardware's revenue cycle. Explain the resulting threat and suggest methods to correct the weakness.

b. Identify ways to use IT to streamline Newton's revenue cycle activities. Describe the control procedures required in the new system. (*CPA Examination, adapted*)

Figure 3-20



7. The Family Support Center is a small charitable organization. It has only four full-time employees: two staff, an accountant, and an office manager. The majority of its funding comes from two campaign drives, one in the spring and one in the fall. Donors make pledges over the telephone. Some donors pay their pledge by credit card during the telephone campaign, but many prefer to pay in monthly installments by check. In such cases, the donor pledges are recorded during the telephone campaign, and the donors are then mailed pledge cards. Donors mail their contributions directly to the charity. Most donors send a check, but occasionally some send cash. Most

donors return their pledge card with their check or cash donation, but occasionally the Family Support Center receives anonymous cash donations. The procedures used to process donations are as follows:

Sarah, a staff member who has worked for the Family Support Center for 12 years, opens all mail. She sorts the donations from the other mail and prepares a list of all donations, indicating the name of the donor (or anonymous), amount of the donation, and the pledge number (if the donor returned the pledge card). Sarah then sends the list, cash, and checks to the accountant.

The accountant enters the information from the list into the computer to update the Family Support Center's files. The accountant then prepares a deposit slip (in duplicate) and deposits all cash and checks into the charity's bank account at the end of each day. No funds are left on the premises overnight. The validated deposit slip is then filed by date. The accountant also mails an acknowledgment letter thanking each donor. Monthly, the accountant retrieves all deposit slips and uses them to reconcile the Family Support Center's bank statement. At this time, the accountant also reviews the pledge files and sends a follow-up letter to those people who have not yet fulfilled their pledges.

Each employee has a computer workstation that is connected to the internal network. Employees are permitted to surf the Web during lunch hours. Each employee has full access to the charity's accounting system, so that anyone can fill in for someone else who is out sick or on vacation. Each Friday, the accountant makes a backup copy of all computer files. The backup copy is stored in the office manager's office.

Required

a. Identify two major control weaknesses in the Family Support Center's cash receipts procedures. For each weakness you identify, suggest a method to correct that weakness. Your solution must be specific—*identify which specific employees should do what. Assume that no new employees can be hired.*

b. Describe the IT control procedures that should exist in order to protect the Family Support Center from loss, alteration, or unauthorized disclosure of data.

8. Match the threats in the first column to the appropriate control procedures in the second column (more than one control may address the same threat).

Threat

1. Uncollectible sales
2. Mistakes in shipping orders to customers
3. Crediting customer payments to the wrong account
4. Theft of customer payments
5. Theft of inventory by employees
6. Excess inventory
7. Reduced prices for sales to friends
8. Orders later repudiated by customers who deny placing them
9. Failure to bill customers
10. Errors in customer invoices
11. Cash flow problems
12. Loss of accounts receivable data
13. Unauthorized disclosure of customer personal information
14. Failure to ship orders to customers

Applicable Control Procedures

a. Restricted access to master data

b. Encryption of customer information while in storage

c. Backup and disaster recovery procedures

d. Digital signatures

e. Physical access controls on inventory

f. Segregation of duties of handling cash and maintaining accounts receivable

g. Reconciliation of packing lists with sales orders

h. Reconciliation of invoices with packing lists and sales orders

i. Use of bar codes or RFID tags

j. Periodic physical counts of inventory

k. Perpetual inventory system

l. Use of either EOQ, MRP, or JIT inventory control system

m. Lockboxes or electronic lockboxes

n. Cash flow budget

o. Mailing of monthly statements to customers

p. Credit approval by someone not involved in sales

q. Segregation of duties of shipping and billing

r. Periodic reconciliation of prenumbered sales orders with prenumbered shipping documents

Chapter 4: The Expenditure Cycle: Purchasing to Cash Disbursements

Integrative Case Alpha Omega Electronics

Although the new enterprise resource planning (ERP) system at Alpha Omega Electronics (AOE) has enabled the company to slash its costs associated with purchasing and accounts payable, Linda Spurgeon, AOE's president, is convinced that additional improvements are needed. She is particularly concerned about issues recently raised by LeRoy Williams, vice president of manufacturing for AOE. LeRoy is upset because several production runs were delayed at the Wichita plant because components that AOE's inventory records indicated as being in stock actually were not on hand. There were also delays at the Dayton plant because suppliers either did not deliver components on time or delivered substandard products.

Linda asked Elizabeth Venko, the controller, and Ann Brandt, AOE's vice president of information systems, for some recommendations on how AOE's new ERP system could help solve these problems. Specifically, she asked Elizabeth and Ann to address the following issues:

1. What must be done to ensure that AOE's inventory records are current and accurate to avoid unexpected components shortages like those experienced at the Wichita plant?

2. How could the problems at the Dayton plant be avoided in the future? What can be done to ensure timely delivery of quality components?

3. Is it possible to reduce AOE's investment in materials inventories?

4. How could the information system provide better information to guide planning and production?

5. How could IT be used to further reengineer expenditure cycle activities?

As this case reveals, deficiencies in the information system used to support expenditure cycle activities can create significant financial problems for an organization. Current and accurate information about inventories, suppliers, and the status of outstanding purchase orders is crucial for managing the expenditure cycle effectively. As

you read this chapter, think about how to solve AOE's problems with its expenditure cycle activities.

Introduction

The **expenditure cycle** is a recurring set of business activities and related information processing operations associated with the purchase of and payment for goods and services (Figure 4-1). This chapter focuses on the acquisition of raw materials, finished goods, supplies, and services.

In the expenditure cycle, the primary external exchange of information is with suppliers (vendors). Within the organization, information about the need to purchase goods and materials flows to the expenditure cycle from the revenue and production cycles, inventory control, and various departments. Once the goods and materials arrive, notification of their receipt flows back to those sources from the expenditure cycle. Expense data also flow from the expenditure cycle to the general ledger and reporting function for inclusion in financial statements and various management reports.

The primary objective in the expenditure cycle is to minimize the total cost of acquiring and maintaining inventories, supplies, and the various services the organization needs to function. To accomplish this objective, management must make the following key decisions:

- What is the optimal level of inventory and supplies to carry?
- Which suppliers provide the best quality and service at the best prices?
- How can the organization consolidate purchases across units to obtain optimal prices?
- How can information technology (IT) be used to improve both the efficiency and accuracy of the inbound logistics function?

● How can the organization maintain sufficient cash to take advantage of any discounts suppliers offer?

● How can payments to vendors be managed to maximize cash flow?

The answers to those questions guide how an organization performs the four basic expenditure cycle activities depicted in Figure 4-2:

1. Ordering materials, supplies, and services

2. Receiving materials, supplies, and services

3. Approving supplier invoices

4. Cash disbursements

This chapter explains how an organization's information system supports each of those activities. We begin by describing the design of the expenditure cycle information system and the basic controls necessary to ensure that it provides management with reliable information to assess operational efficiency and effectiveness. We then discuss in detail each of the four basic expenditure cycle activities. For each activity, we describe how the information needed to perform and manage those activities is collected, processed, and stored. We also explain the controls necessary to ensure not only the reliability of that information but also the safeguarding of the organization's resources.

Figure 4-1

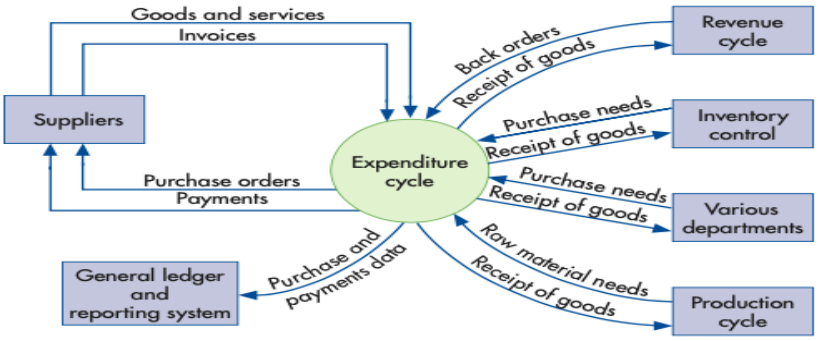
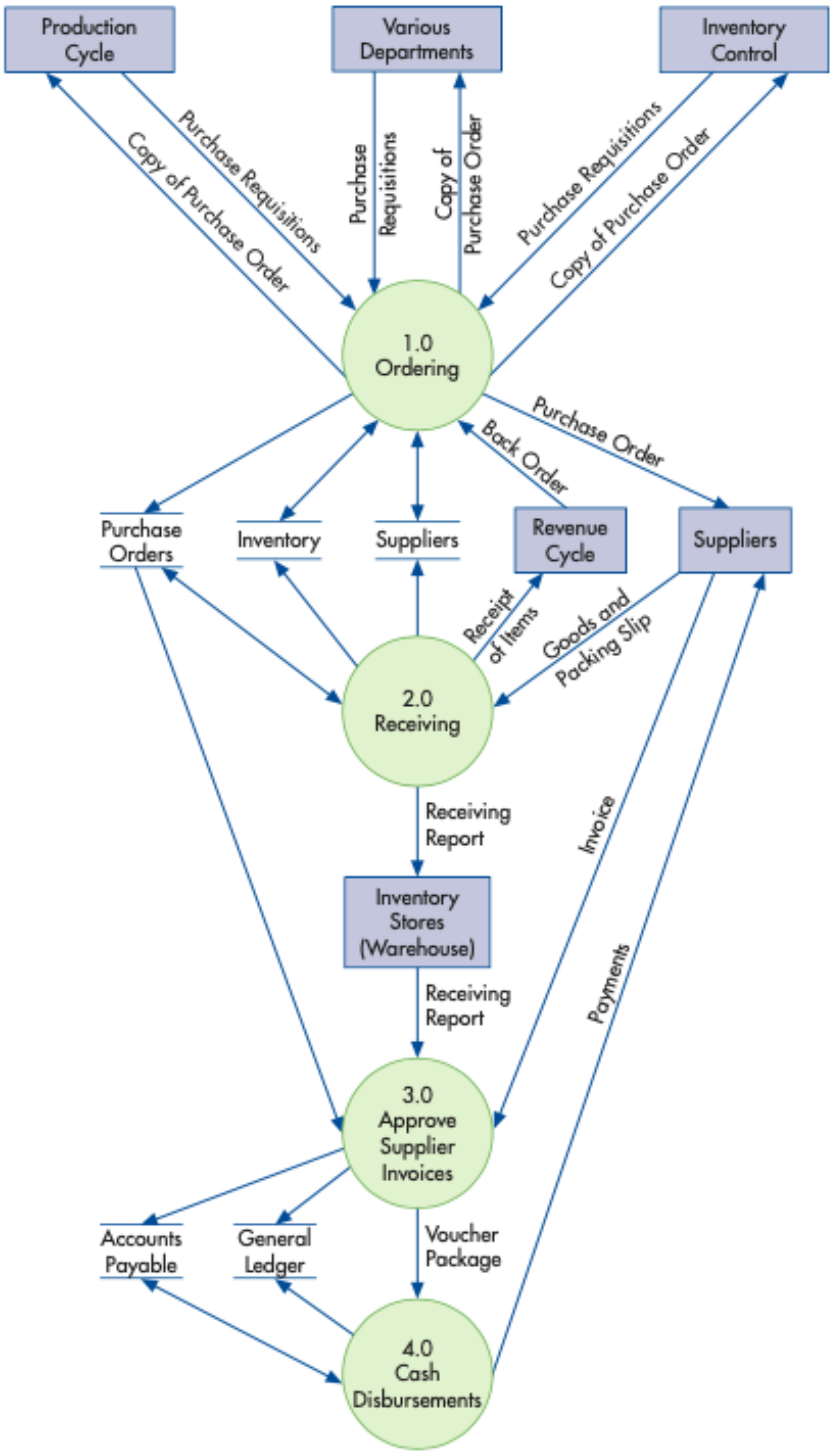


Figure 4-2


Production Cycle
Various Departments
Inventory Control
Purchase Requisitions
Copy of Purchase Order
Purchase Requisitions
Copy of Purchase Order
Purchase Requisitions
Copy of Purchase Order
1.0 Ordering
Purchase Order
Back Order
Purchase Orders
Inventory
Suppliers
Revenue Cycle
Suppliers
Receipt of Items
Goods and Packing Slip
2.0 Receiving
Receiving Report
Inventory Stores (Warehouse)
Receiving Report
Invoice
Payments
3.0 Approve Supplier Invoices
Accounts Payable
General Ledger
Voucher Package
4.0 Cash Disbursements

Expenditure Cycle Information System

As Table 4-1 shows, the activities in the expenditure cycle are mirror images of the basic activities performed in the revenue cycle. These close linkages between the buyer's expenditure cycle activities and the seller's revenue cycle activities have important implications for the design of both parties' accounting information systems. Specifically, by applying new IT developments to reengineer expenditure cycle activities, companies create opportunities for suppliers to reengineer their revenue cycle activities. Conversely, using IT to redesign a company's revenue cycle can create opportunities for customers to modify their own expenditure cycles. In fact, the changes in one company's operations may *necessitate* corresponding changes in the operations of other companies with which it does business. For example, the major automobile manufacturers and many large retailers, such as Walmart, require their suppliers to transmit invoices via electronic data interchange (EDI), or they will not do business with them. Consequently, those suppliers must modify their accounting information systems to incorporate the use of EDI.

Process

Like most large organizations, AOE uses an ERP system. Figure 4-3 shows the portion of the ERP system that supports AOE's expenditure cycle business activities.

Although Figure 4-3 shows that AOE's inventory control department has primary responsibility for ensuring an adequate quantity of materials and supplies, any department can submit a request to purchase items. Once a purchase request has been approved, the system searches the inventory master file to identify the preferred supplier for that item. The system then creates a purchase order that is sent to the supplier via EDI. (If necessary,

paper copies are printed and mailed.) The receiving department has access to the open purchase order file so that it can plan for and verify the validity of deliveries. Accounts payable is notified of orders so that it can plan for pending financial commitments. The department that generated the purchase requisition is also notified that its request has been approved.

Major suppliers send electronic notification of coming deliveries, which enables AOE to plan to have adequate staffing to process incoming shipments at its warehouses. When a shipment arrives, the receiving-dock workers use the inquiry processing system to verify that an order is expected from that supplier. Most suppliers bar-code or RFID (radio frequency identification) tag their products to facilitate the counting of the goods. Receiving-dock workers inspect the goods and use an online terminal to enter information about the quantity and condition of items received. The system checks that data against the open purchase order, and any discrepancies are immediately displayed on the screen so that they can be resolved. The exact time of the delivery also is recorded to help evaluate supplier performance.

Upon transfer of the goods to the warehouse, the inventory clerk verifies the count of the items and enters that data in the system. For suppliers who do not send invoices, the system automatically schedules a payment according to the terms agreed upon when the order was placed. Accounts payable clerks enter information from suppliers who send EDI, and sometimes paper, invoices. The system then compares the supplier invoice with the information contained in the purchase order and receiving report to ensure accuracy and validity. For purchases of supplies or services that do not usually involve purchase orders and receiving reports, the invoice is sent to the appropriate supervisor for approval. The supplier invoice itself is also

checked for mathematical accuracy. The system automatically schedules invoices for payment by due date.

AOE, like most companies, uses batch processing to pay its suppliers. Each day, the treasurer uses the inquiry processing system to review the invoices that are due and approves them for payment. AOE makes payments to some of its larger suppliers using financial electronic data interchange (FEDI) but still prints paper checks for many of its smaller suppliers. When an electronic funds transfer (EFT) payment is authorized or a check is printed, the system updates the accounts payable, open-invoice, and general ledger files. For each supplier, the totals of all vouchers are summed, and that amount is subtracted from the balance field in that supplier's master file record. The relevant purchase orders and receiving reports are flagged to mark that those transactions have been paid. The invoices that are paid are then deleted from the open-invoice file. A remittance advice is prepared for each supplier, which lists each invoice being paid and the amounts of any discounts or allowances taken. For payments made by EFT, the remittance data accompany the EFT payment as part of the FEDI package. For payments made by check, the printed remittance advice accompanies the signed check. After all disbursement transactions have been processed, the system generates a summary journal entry, debiting accounts payable and crediting cash, and posts that entry to the general ledger.

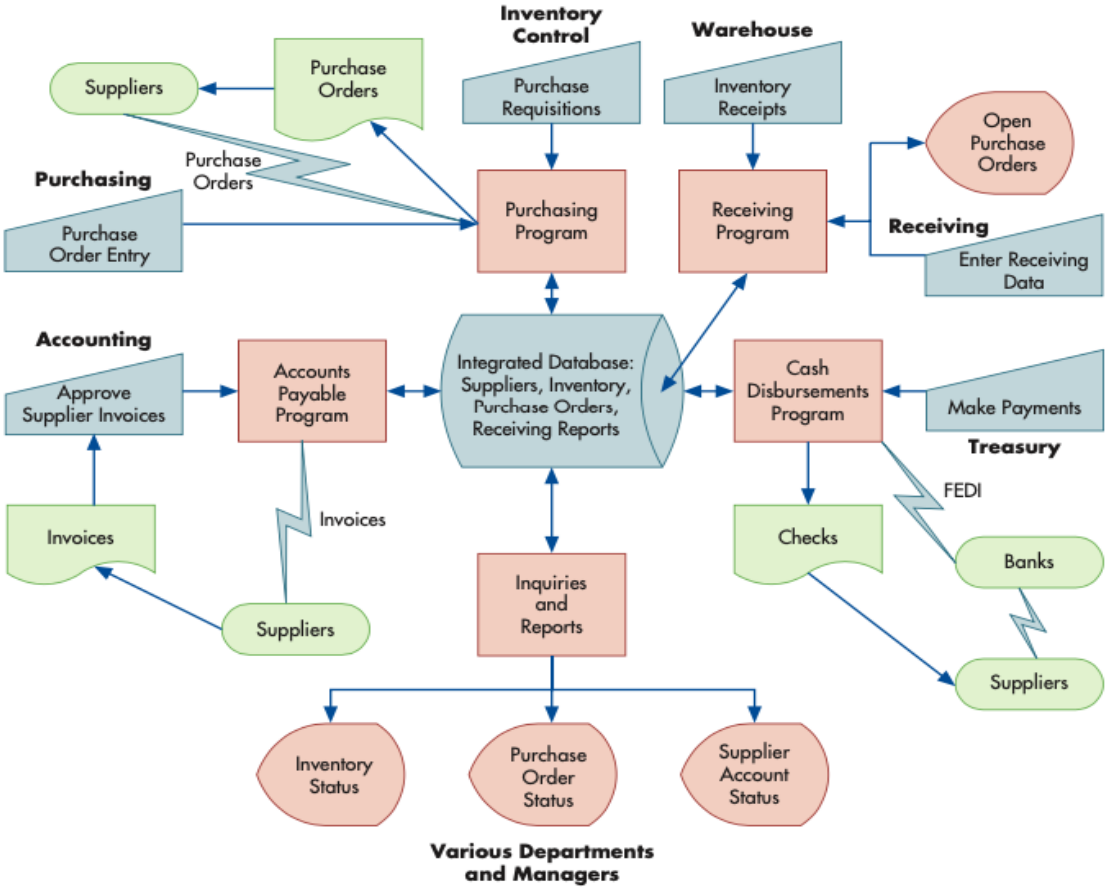
The cashier reviews checks against the supporting documents and then signs them. Checks above a specified amount also require a second signature by the treasurer or another authorized manager. The cashier then mails the signed checks and remittance advices to the suppliers. EFT transactions are also performed by the cashier and reviewed by the treasurer.

The easy access to up-to-date, accurate information enables managers to closely monitor performance. However, the quality of decisions depends upon the accuracy of the information in the database. We now discuss the general threats associated with the expenditure cycle activities and explain the controls that can mitigate them.

Table 4-1

REVENUE CYCLE ACTIVITY	EXPENDITURE CYCLE ACTIVITY
Sales order entry—process orders from customers	Ordering of materials, supplies, and services—send orders to suppliers
Shipping—deliver merchandise or services to customers (outbound logistics)	Receiving—receive merchandise or services from suppliers (inbound logistics)
Billing—send invoices to customers	Processing invoices—review and approve invoices from suppliers
Cash collections—process payments from customers	Cash disbursements—process payments to suppliers

Figure 4-3



Threats and Controls

Figure 4-3 shows that all expenditure cycle activities depend on the integrated database that contains information about suppliers, inventory, and purchasing activities. Therefore, the first general threat listed in Table 4-2 is inaccurate or invalid master data. Errors in the supplier master data could result in ordering from unapproved suppliers, purchasing materials of inferior quality, untimely deliveries, sending payments to the wrong address, and fraudulent disbursements to fictitious suppliers. Errors in the inventory master data can result in production delays due to unanticipated shortages of key materials or unnecessary purchases and excess inventory. Errors in the purchasing master data can result in unauthorized purchases and failure to take advantage of negotiated discounts.

Table 4-2 shows that one way (control 1.1) to mitigate the threat of inaccurate or invalid master data is to employ the data processing integrity controls. It is also important to restrict access to expenditure cycle master data and configure the system so that only authorized employees can make changes to master data (control 1.2). This requires changing the default configurations of employee roles in ERP systems to appropriately segregate incompatible duties. For example, consider the situation where an accounts payable clerk enters the name of a supplier who is not currently on the list of approved suppliers. The default configuration of many ERP systems would result in a prompt query as to whether the clerk wants to create a new supplier record. This violates proper segregation of duties by permitting the person responsible for recording payments to suppliers to also authorize the creation of new accounts. Similarly, the default configurations of many ERP systems permit accounts payable staff not only to read the prices of various products and the current balances owed to suppliers but also to change the

values of those data items. These examples are just some of the many configuration settings that need to be reviewed to ensure proper segregation of duties. However, because such preventive controls can never be 100% effective, Table 4-2 also indicates that an important detective control is to regularly produce a report of all changes to master data and review them to verify that the database remains accurate (control 1.3).

A second general threat in the expenditure cycle is unauthorized disclosure of sensitive information, such as banking information about suppliers and special pricing discounts offered by preferred suppliers. Table 4-2 shows that one way to mitigate the risk of this threat is to configure the system to employ strong access controls that limit who can view such information (control 2.1). It is also important to configure the system to limit employees' ability to use the system's built-in query capabilities to specific tables and fields. In addition, sensitive data should be encrypted (control 2.2) in storage to prevent IT employees who do not have access to the ERP system from using operating system utilities to view sensitive information. Information exchanged with suppliers over the Internet should also be encrypted during transmission.

As Table 4-2 shows, a third general threat in the expenditure cycle concerns the loss or destruction of master data. The best way to mitigate the risk of this threat is to employ the backup and disaster recovery procedures (control 3.1). A best practice is to implement the ERP system as three separate instances. One instance, referred to as *production*, is used to process daily activity. A second is used for testing and development. A third instance should be maintained as an online backup to the production system to provide near real-time recovery.

An ERP system's extensive reporting capabilities (control 4.1) can be used to monitor the threat of poor performance. Because inventory represents a sizable investment of working capital, reports that help manage inventory are especially valuable. A key measure to evaluate inventory management is inventory turnover, which is the ratio of cost of goods sold divided by inventory on hand. Consider the following example: annual sales are $500 million, and annual cost of goods sold total $360 million. An inventory turnover ratio of 1 means that the company is effectively carrying a year's supply of inventory, tying up $360 million. Improving the inventory turnover ratio to 3 would reduce that unprofitable investment to $120 million, thereby freeing up $240 million that could be used for other purposes.

Accountants need to understand how business activities are performed in order to design other reports that can help management better manage inventory. For example, it is useful to monitor the percentage of requisitions that are filled from inventory on hand. For critical items, this should be close to 100% to avoid stockouts and delays in filling customer orders. For most items, however, such a high fill rate is undesirable because it requires carrying too much inventory. Other reports can help management identify the relative importance of various inventory items. For example, it may be useful to classify items along several dimensions, such as frequency of purchase, frequency of use or resale, and contribution to profitability. Items that are frequently purchased and used and that make a significant contribution to profitability are of high importance and should be managed so as to maintain high fill rates. In contrast, management may wish to consider eliminating items that are seldom purchased, infrequently used, and that do not contribute much to profitability. As we will see in the following sections, accountants can help managers by designing a variety of detailed reports

and metrics that are relevant to evaluating each business activity in the expenditure cycle.

Table 4-2 Threats and Controls in the Expenditure Cycle		
Activity	**Threat**	**Controls (first number refers to the corresponding threat)**
General issues throughout entire expenditure cycle	1. Inaccurate or invalid master data 2. Unauthorized disclosure of sensitive information 3. Loss or destruction of data 4. Poor performance	1.1 Data processing integrity controls 1.2 Restriction of access to master data 1.3 Review of all changes to master data 2.1 Access controls 2.2 Encryption 3.1 Backup and disaster recovery procedures 4.1 Managerial reports
Ordering	5. Stockouts and excess inventory 6. Purchasing items not needed 7. Purchasing at inflated prices 8. Purchasing goods of inferior quality 9. Unreliable suppliers 10. Purchasing from Unauthorized suppliers 11. Kickbacks	5.1 Perpetual inventory system 5.2 Bar coding or RFID tags 5.3 Periodic physical counts of inventory 6.1 Perpetual inventory system 6.2 Review and approval of purchase requisitions 6.3 Centralized purchasing function 7.1 Price lists 7.2 Competitive bidding 7.3 Review of purchase orders 7.4 Budgets 8.1 Purchasing only from approved suppliers 8.2 Review and approval of purchases from new suppliers 8.4 Tracking and monitoring product quality by supplier 8.3 Holding purchasing managers responsible for rework and scrap costs

		9.1 Requiring suppliers to possess quality certification (e.g., ISO 9000) 9.2 Collecting and monitoring supplier delivery performance data 10.1 Maintaining a list of approved suppliers and configuring the system to permit purchase orders only to approved suppliers 10.2 Review and approval of purchases from new suppliers 10.3 EDI-specific controls (access, review of orders, encryption, policy) 11.1 Prohibit acceptance of gifts from suppliers 11.2 Job rotation and mandatory vacations 11.3 Requiring purchasing agents to disclose financial and personal interests in suppliers 11.4 Supplier audits
Receiving	12. Accepting unordered items 13. Mistakes in counting 14. Verifying receipt of services 15. Theft of inventory	12.1 Requiring existence of approved purchase order prior to accepting any delivery 13.1 Do not inform receiving employees about quantity ordered 13.2 Require receiving employees to sign receiving report 13.3 Incentives 13.4 Use of bar codes and RFID tags 13.5 Configuration of the ERP system to flag discrepancies between received and ordered quantities that exceed tolerance threshold for investigation 14.1 Budgetary controls 14.2 Audits 15.1 Restriction of physical access to inventory 15.2 Documentation of all transfers of inventory between receiving and inventory employees

		15.3 Periodic physical counts of inventory and reconciliation to recorded quantities 15.4 Segregation of duties: custody of inventory versus receiving
Approving supplier invoices	16. Errors in supplier invoices 17. Mistakes in posting to accounts payable	16.1 Verification of invoice accuracy 16.2 Requiring detailed receipts for procurement card purchases 16.3 ERS 16.4 Restriction of access to supplier master data 16.5 Verification of freight bill and use of approved delivery channels 17.1 Data entry edit controls 17.2 Reconciliation of detailed accounts payable records with the general ledger control account
Cash disbursements	18. Failure to take advantage of discounts for prompt payment 19. Paying for items not received 20. Duplicate payments 21. Theft of cash 22. Check alteration 23. Cash flow problems	18.1 Filing of invoices by due date for discounts 18.2 Cash flow budgets 19.1 Requiring that all supplier invoices be matched to supporting documents that are acknowledged by both receiving and inventory control 19.2 Budgets (for services) 19.3 Requiring receipts for travel expenses 19.4 Use of corporate credit cards for travel expenses 20.1 Requiring a complete voucher package for all payments 20.2 Policy to pay only from original copies of supplier invoices

		20.3 Cancelling all supporting documents when payment is made 21.1 Physical security of blank checks and check-signing machine 21.2 Periodic accounting of all sequentially numbered checks by cashier 21.3 Access controls to EFT terminals 21.4 Use of dedicated computer and browser for online banking 21.5 ACH blocks on accounts not used for payments 21.6 Separation of check-writing function from accounts payable 21.7 Requiring dual signatures on checks greater than a specific amount 21.8 Regular reconciliation of bank account with recorded amounts by someone independent of cash disbursements procedures 21.9 Restriction of access to supplier master file 21.10 Limiting the number of employees with ability to create one-time suppliers and to process invoices from one-time suppliers 21.11 Running petty cash as an imprest fund 21.12 Surprise audits of petty cash fund 22.1 Check-protection machines 22.2 Use of special inks and papers 22.3 “Positive Pay” arrangements with banks 23.1 Cash flow budget

Ordering Materials, Supplies, and Services

The first major business activity in the expenditure cycle (circle 1.0 in Figure 4-2) is ordering inventory, supplies, or services. Figure 4-4 shows that this involves first identifying what, when, and how much to purchase, and then choosing from which supplier to purchase.

Identifying What, When, and How Much to Purchase

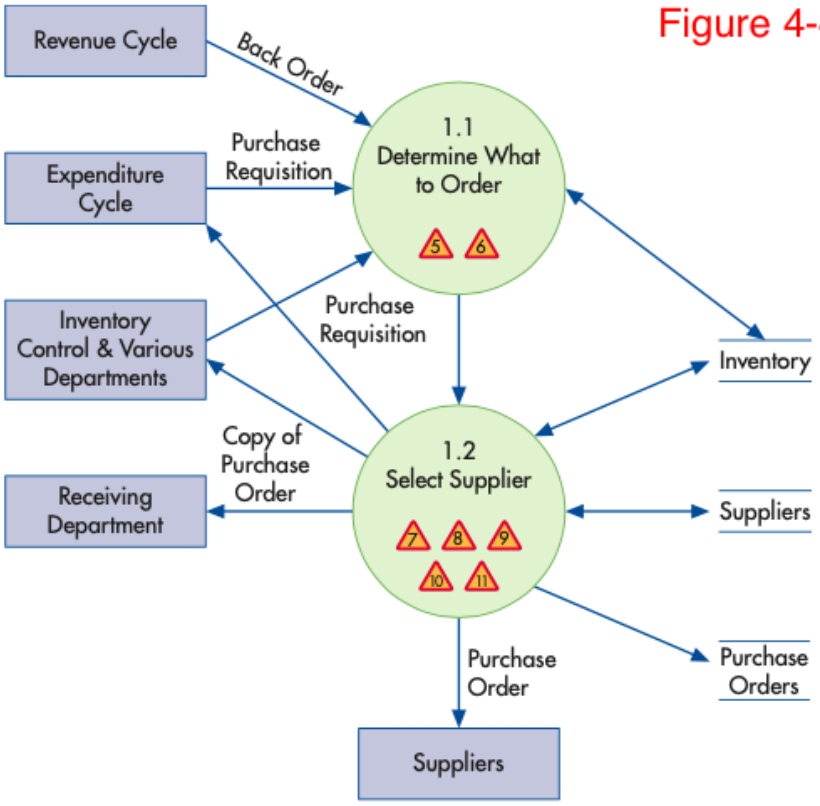
As the introductory case showed, inaccurate inventory records can create significant problems for organizations. Therefore, accountants and systems professionals need to understand best practices for managing inventory.

Process The traditional approach to managing inventory is to maintain sufficient stock so that production can continue without interruption even if inventory use is greater than expected or if suppliers are late in making deliveries. This traditional approach is often called the **economic order quantity (EOQ)** approach because it is based on calculating an optimal order size to minimize the sum of ordering, carrying, and stockout costs. *Ordering costs* include all expenses associated with processing purchase transactions. *Carrying costs* are those associated with holding inventory. *Stockout costs* are those that result from inventory shortages, such as lost sales or production delays.

Actual application of the EOQ approach varies depending on the type of item. For highcost or high-use items, such as the computer chips and displays AOE uses, all three types of costs are included in the formula. For low-cost or low-usage items, such as the screws and springs AOE uses to assemble its products, ordering and carrying costs are usually ignored, and the sole objective is to maintain sufficient inventory levels. The EOQ formula is used to calculate *how much* to order. The **reorder point** specifies *when* to

order. Companies typically set the reorder point based on delivery time and desired levels of safety stock to handle unexpected fluctuations in demand.

Figure 4-4



The traditional EOQ approach to inventory control often results in carrying significant amounts of inventory. The money invested in carrying inventory earns nothing. Consequently, in recent years many large U.S. manufacturing companies, including Xerox, Ford, Motorola, NCR, Intel, McDonnell Douglas, and Delco Electronics, have minimized or even eliminated the amount of inventory on hand by adopting either materials requirements planning or just-in- time inventory management systems.

Materials requirements planning (MRP) seeks to reduce required inventory levels by improving the accuracy of forecasting techniques to better schedule purchases to satisfy production needs. For example, the production planning department of a company using MRP would use sales forecasts to prepare a detailed schedule specifying the quantities of each finished product to manufacture in a specified time period, such as the next three months. This schedule and the engineering specifications for each product identify the quantities of raw materials, parts, and supplies needed in production and the point in time when they will be needed. Thus, MRP systems reduce uncertainties about when raw materials are needed and therefore enable companies to carry less inventory.

A **just-in-time (JIT) inventory system** attempts to minimize, if not totally eliminate, finished goods inventory by purchasing and producing goods only in response to actual, rather than forecasted, sales. Consequently, JIT systems are characterized by frequent deliveries of small amounts of materials, parts, and supplies directly to the specific locations that require them when they are needed, rather than by infrequent bulk deliveries to a central receiving and storage facility. Therefore, a factory using a JIT system will have multiple receiving docks, each assigned to accept deliveries of items needed at nearby work centers.

A major difference between MRP and JIT systems is production scheduling. MRP systems schedule production to meet forecasted sales, thereby creating an “optimal” quantity of finished goods inventory. JIT systems schedule production in response to customer demands, thereby virtually eliminating finished goods inventory, but they require carrying sufficient quantities of raw materials in order to quickly adjust production in response to consumer demand. Both MRP and JIT systems can reduce

costs and improve efficiency. Choosing between them depends, in part, on the types of products a company sells. MRP systems are more effectively used with products that have predictable patterns of demand, such as consumer staples. For such items, companies can plan purchases to minimize stockouts (with the resultant lost sales) while simultaneously minimizing the risk of overstocking and the subsequent costs of marking down or scrapping the excess inventory. In contrast, JIT inventory systems are especially useful for products that have relatively short life cycles and for which demand cannot be accurately predicted, such as toys associated with specific movies. In such cases, it is important that the business be able to quickly speed up production to meet unanticipated demand as well as to quickly stop production to avoid accumulating large inventories that must be marked down for clearance because the product is no longer in demand.

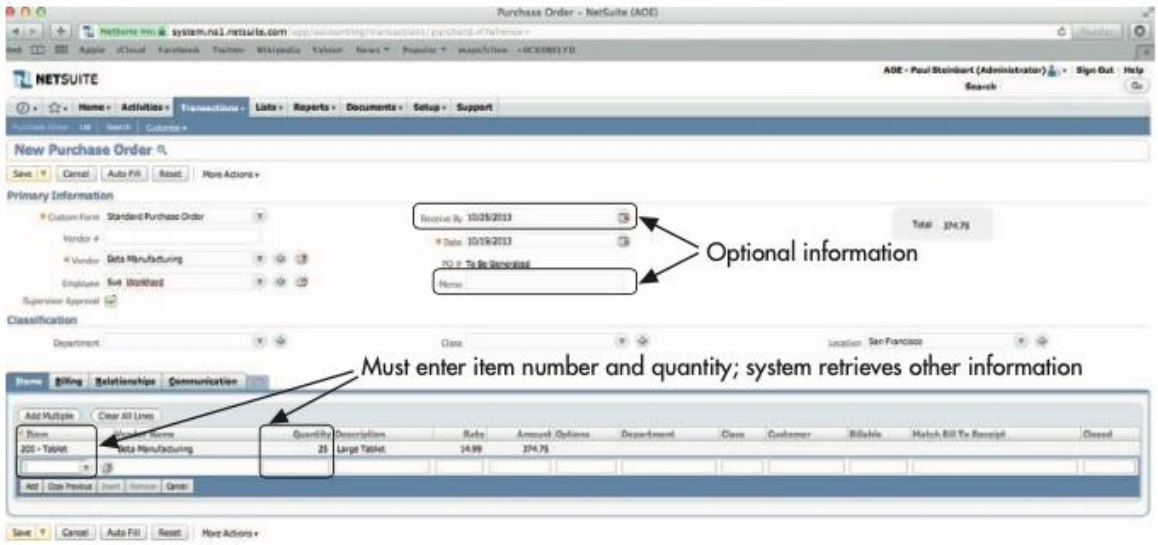
A request to purchase goods or supplies is triggered either by the inventory control function or when employees notice a shortage of materials. The advanced inventory control systems used in large manufacturing companies, such as IBM and Ford, automatically generate purchase requests when the quantity of an item on hand falls below its reorder point. In small companies, however, the employees who use the items note when stock is running low and request that it be reordered. Moreover, even in large companies, employees typically initiate requests to reorder office supplies.

Regardless of its source, the need to purchase goods or supplies often results in the creation of a **purchase requisition** that identifies the requisitioner; specifies the delivery location and date needed; identifies the item numbers, descriptions, quantity, and price of each item requested; and may suggest a supplier. The person approving the purchase requisition

indicates the department number and account number to which the purchase should be charged.

Figure 4-5 shows a typical purchase requisition data entry screen used in ERP systems. Minimizing the amount of data that must be manually entered improves both efficiency and accuracy. Thus, in Figure 4-5, the employee initiating the purchase request needs to complete only the supplier (vendor), date required, and location (where to ship the merchandise) fields in the header section (the top of the screen) and the item number and quantity requested in the details section. The system then pulls up all the other relevant information from the related master files. You probably noticed the similarity in design to the sales order entry data entry screen (see Figure 3-6). This is intentional; it makes it easier for employees to learn how to perform new job duties arising from promotions or transfers.

Figure 4-5



Source: 2010 © NetSuite Inc.

Threats and Controls Inaccurate inventory records can result in stockouts that lead to lost sales or to carrying excess inventory that increases costs (threat 5). To reduce the risk of these problems, the perpetual inventory method should be used to ensure that information about inventory stocks is always current (control 5.1). However, data entry errors can result in inaccurate perpetual inventory records because even expert typists do make mistakes. Therefore, using information technology (control 5.2) to eliminate the need for manual data entry can improve the accuracy of perpetual inventory records.

Bar-coding is one option, but it is not a panacea. Errors can still occur if employees attempt to save time by scanning one item and then manually entering the quantity. For example, a grocery store orders 12 varieties of a private-brand soda, the receiving clerk may scan only one can and then manually enter the number purchased. Since the flavors are all priced the same, the amount of the purchase is correctly calculated. The perpetual inventory records will be incorrect, however, because the exact count of the flavors purchased is not correctly recorded.

Affixing RFID tags to individual products eliminates the problems just discussed because the reader automatically records each item. RFID technology is also more efficient than bar codes because there is no need for a human to align the bar code on the product with the reader. However, RFID technology is more expensive than bar-coding and cannot be used for every type of product.

It is also important to periodically count inventory on hand and investigate any discrepancies between those counts and the perpetual inventory records (control 5.3 in Table 4-2). One annual physical inventory count will generally not be sufficient to maintain accurate inventory records,

especially for MRP and JIT systems. Instead, an *ABC cost analysis* should be used to classify items according to their importance: The most critical items (A items) should be counted most frequently, and the least critical items (C items) can be counted less often. If such interim counts reveal significant discrepancies with inventory records, a comprehensive count of all inventory should be immediately undertaken. This approach might have alerted management at AOE's Wichita plant in the chapter introductory case about shortages of key components early enough to avoid production delays.

Another threat is purchasing items that are not currently needed. Accurate perpetual inventory records (control 6.1) ensure the validity of purchase requisitions that the inventory control system automatically generates. Supervisors need to review and approve purchase requisitions (control 6.2) that individual employees initiate. A related problem is multiple purchases of the same item by different subunits of the organization. As a result, the organization may be carrying a larger inventory than desired and may fail to take advantage of volume discounts that might be available. A centralized purchasing function (control 6.3) mitigates this threat.

Choosing Suppliers

Once the need to purchase has been identified, the next step is to select a supplier. Purchasing agents (sometimes called buyers) usually perform this task. In manufacturing companies such as AOE, the purchasing function is closely related to the production cycle. Thus, as Figure 3-1 shows, Ryan McDaniel, the head of the purchasing department at AOE, reports directly to LeRoy Williams, the vice president of manufacturing.

Process Several factors should be considered when selecting suppliers:

- Price
- Quality of materials

● Dependability in making deliveries

Note that properly evaluating suppliers involves more than just comparing prices. Companies also incur costs, such as rework and scrap, related to the quality of the products purchased. There are also costs associated with supplier delivery performance (such as the problems described in the introductory case at AOE's Dayton plant). Supplier dependability is especially important for companies that use JIT systems because late deliveries can bring the entire system to a halt.

Once a supplier has been selected for a product, the supplier's identity should become part of the product inventory master record to avoid repeating the supplier selection process for every subsequent order. (In some cases, however, such as for the purchase of high-cost and low-usage items, management may explicitly want to reevaluate all potential suppliers each time that product is ordered.) A list of potential alternative suppliers for each item should also be maintained, in case the primary supplier is out of stock of a needed item.

A **purchase order** (Figure 4-6) is a document or electronic form that formally requests a supplier to sell and deliver specified products at designated prices. It is also a promise to pay and becomes a contract once the supplier accepts it. The purchase order includes the names of the supplier and purchasing agent, the order and requested delivery dates, the delivery location and shipping method, and information about the items ordered. Frequently, several purchase orders are generated to fill one purchase requisition, because different vendors may be the preferred suppliers for the various items requested. The quantity ordered may also differ from that requested, to allow the purchaser to take advantage of quantity discounts.

Many companies maintain special purchasing arrangements with important suppliers. A **blanket purchase order** is a commitment to purchase specified items at designated prices from a particular supplier for a set time period, often one year. Blanket purchase orders reduce the buyer's uncertainty about reliable sources of raw materials and help the supplier plan its capacity and operations more effectively.

The major cost driver in the purchasing function is the number of purchase orders processed. Thus, finding ways to reduce the number of orders processed and to streamline the steps involved can yield significant savings. Using EDI is one way to improve the purchasing process. EDI reduces costs by eliminating the clerical work associated with printing and mailing paper documents. The time between recognizing the need to reorder an item and subsequently receiving it also is reduced. Consequently, the risk of running out of stock is diminished, which can significantly increase profitability. In the past, EDI was expensive because it required the use of proprietary third-party networks and software. However, the development of standards for EDI over the Internet (EDINT), such as the AS2 protocol for secure electronic exchange of documents, has drastically cut the costs of EDI. For example, AS2 makes it possible for the sender to encode and the receiver to correctly decode purchase orders and other documents.

Vendor-managed inventory programs provide another means of reducing purchase and inventory costs. A **vendor-managed inventory** program essentially outsources much of the inventory control and purchasing function: Suppliers are given access to sales and inventory data and are authorized to automatically replenish inventory when stocks fall to predetermined reorder points. This arrangement cuts carrying costs by

reducing the amount of inventory on hand and lowers processing costs by eliminating the need to generate and exchange formal purchase orders.

Reverse auctions provide yet another technique to reduce purchasing-related expenses. In reverse auctions, suppliers compete with one another to meet demand at the lowest price. Although reverse auctions can yield significant cost savings, because the primary focus is on price, they are probably best suited to the purchase of commodity items rather than critical components for which quality, vendor reliability, and delivery performance are important.

One other way to reduce purchasing-related costs is to conduct a pre-award audit. Pre-award audits are typically used for large purchases that involve formal bids by suppliers. The internal auditor visits each potential supplier who has made the final cut in the contracting process to verify the accuracy of its bid. Pre-award audits often identify simple mathematical errors in complex pricing formulas and other discrepancies that, when corrected, can provide considerable savings.

EDI, vendor-managed inventory, reverse auctions, and pre-award audits are techniques for reducing the purchasing-related costs of raw materials and finished goods inventory. New IT developments can also change how companies account for their inventory. Traditionally, most companies have used the LIFO, FIFO, or weighted-average approaches to allocate costs to inventory and cost of goods sold. RFID, however, provides the capability to track individual inventory items. Thus, RFID makes it possible for companies to more accurately account for actual inventory-related costs by switching to the specific identification method for accounting for inventories.

Figure 4-6

Alpha Omega Electronics **No. 2463**

Billing Address: **2431 Bradford Lane**
San Francisco, CA 94403
(314) 467-2341

Reference the above number on all invoices and shipping documents

PURCHASE ORDER

To: Best Office Supply
4567 Olive Blvd.
Dayton, OH 33422-1234

Ship To: AOE, Inc.
1735 Sandy Dr.
Dayton, OH 33421–2243

Vendor Number:	Order Date:	Requisition Number:	Buyer:	Terms:
121	07/03/2014	89010	Fred Mozart	1/10, n/30

F.O.B.	Ship Via:	Delivery Date:	Remarks:
Destination	Your choice	07/15/2014	

Item	Item Number	Quantity	Description	Unit Price
1	32047	15 boxes	Xerox 4200 paper, 20 wt., 10 ream box	$33.99
2	80170	5 boxes	Moore 2600 continuous form, 20 lb.	$31.99
3	81756	20 boxes	CD cases, box of 10	$ 6.49
4	10407	100	700 MB CDs, 1 box	$19.99

Approved by: *Susan Beethoven*

Threats and Controls Table 4-2 lists five threats to placing orders with suppliers. One (threat 7) involves purchasing items at inflated prices. The cost of purchased components represents a substantial portion of the total cost of many manufactured products. Therefore, companies strive to secure the best prices for the items they purchase. Several procedures can help ensure that companies do not pay too much for specific products. Price lists for frequently purchased items should be stored in the computer and consulted when orders are made (control 7.1). The prices of many low-cost items can be readily determined from catalogs. Competitive, written bids

should be solicited for high-cost and specialized products (control 7.2). Purchase orders should be reviewed (control 7.3) to ensure that these policies have been followed.

Budgets (control 7.4) are also helpful in controlling purchasing expenses. Purchases should be charged to an account that is the responsibility of the person or department approving the requisition. Actual costs should be compared periodically with budget allowances. To facilitate control, these reports should highlight any significant deviations from budgeted amounts for further investigation (the principle of management by exception).

In attempting to obtain the lowest possible prices, another threat is purchasing inferior-quality products. Substandard products can result in costly production delays. Moreover, the costs of scrap and rework often result in higher total production costs than if higher-quality, more expensive materials had been initially purchased. Through experience, buyers often learn which suppliers provide the best-quality goods at competitive prices. Such informal knowledge should be incorporated into formal control procedures so that it is not lost when a particular employee leaves the company. One best practice is to establish lists of approved suppliers known to provide goods of acceptable quality (control 8.1). Purchase orders should be reviewed to ensure that only these approved suppliers are being used (control 8.2). In addition, the accounting information system should collect detailed product quality data (control 8.3). For example, AOE can measure the quality of a supplier’s products by tracking how often its items fail to pass inspection in the receiving department and the amount of production that has to be reworked or scrapped because of substandard materials. The purchasing manager should regularly review that data to maintain and revise

the list of approved suppliers. Finally, purchasing managers should be held accountable for the total cost of purchases, (control 8.4) which includes not only the purchase price but also the quality-related costs of rework and scrap. Doing this requires designing the system to track the latter costs so that they can be allocated back to the purchasing department.

As the introductory case demonstrated, another potential problem is unreliable performance by suppliers (threat 9 in Table 4-2). One way to reduce the risk of problems with supplier dependability is to require that suppliers be certified as meeting international quality standards such as ISO 9000 (control 9.1). However, the accounting information system should also be designed to capture and track information about supplier performance (control 9.2). For example, AOE can track actual delivery dates versus those promised. Indeed, the ERP system can be configured to automatically generate reports of purchase orders that have not been delivered within the promised time period.

Purchasing from unauthorized suppliers (threat 10) can result in numerous problems. Items may be of inferior quality or overpriced. The purchase may even cause legal problems. Various government agencies, such as the Office of Foreign Assets Control and the Bureau of Industry and Security in the Department of Commerce, maintain lists of individuals and companies with whom it is illegal to transact business. Payments to entities on such lists can result in substantial fines and, sometimes, imprisonment. Consequently, ERP systems should be configured to prevent issuing purchase orders to suppliers not in the approved master file (control 10.1). All purchase orders should be reviewed to ensure that only approved suppliers are used (control 10.2). It is especially important to restrict access

to the approved supplier list and to periodically review the list for any unauthorized changes.

Using EDI for purchase orders requires additional control procedures. Access to the EDI system should be controlled and limited to authorized personnel through the use of passwords, user IDs, access control matrices, and physical access controls. Procedures to verify and authenticate EDI transactions also are needed. Most EDI systems are programmed to send an acknowledgment for each transaction, which provides a rudimentary accuracy check. Further protection against transmission problems, which can result in the loss of orders, is provided by time-stamping and numbering all EDI transactions. Companies should maintain and periodically review a log of all EDI transactions to ensure that all have been processed and that established policies are being followed. Encryption can ensure the privacy of EDI transactions, which is especially important for competitive bids. Digital signatures should be used to ensure the authenticity of transactions.

Numerous policy-related threats also arise with EDI, each of which must be covered in the trading agreement. Examples of these types of issues include the following:

- At what point in the process can the order be canceled?
- Which party is responsible for the cost of return freight if contract terms are not followed?
- Which party is responsible for errors in bar codes, RFID tags, and labels?
- What happens if errors in the purchasing company's sales system cause additional errors in the amount of goods that suppliers provide?
- Can suppliers ship more inventory than ordered if doing so reduces total freight costs because it results in a full, rather than partial, truckload?

Table 4-2 shows that **kickbacks**, which are gifts from suppliers to purchasing agents for the purpose of influencing their choice of suppliers, are another threat. For the kickback to make economic sense, the supplier must find some way to recover the money spent on the bribe. This usually is accomplished by inflating the price of subsequent purchases or by substituting goods of inferior quality. Even if neither of these problems occurs, kickbacks impair the buyer's objectivity.

To prevent kickbacks, companies should prohibit purchasing agents from accepting any gifts (control 11.1) from potential or existing suppliers. (Trinkets that are clearly of inconsequential value may be allowed.) These policies should apply not only to gifts of tangible goods, but also to services. For example, meeting planners should be informed that it is against company policy to accept frequent-traveler points from hotels for booking the company's meetings there. Training employees how to respond to unsolicited "gifts" from suppliers is also important, because many kickback schemes are initiated when unethical suppliers send such "tokens of appreciation," usually in the form of cash, to unwary employees. Once the employee accepts the gift, the supplier threatens to disclose the payment to a supervisor unless the employee makes additional purchases from that supplier.

Job rotation (control 11.2) is another important control to reduce the risk of kickbacks: Purchasing agents should not deal with the same suppliers indefinitely, because doing so increases the risk that they may succumb to the constant temptations offered by an unethical supplier. If the organization is too small to rotate job duties across different purchasing agents, it should periodically conduct a detailed audit of the purchasing agent's activities. Purchasing agents should also be required to take their allotted vacation time

each year, because many frauds are discovered when the perpetrator is absent and unable to continue covering up the illicit activity. Finally, purchasing agents should be required to sign annual conflict of interest statements, (control 11.3) disclosing any financial interests they may have in current or potential suppliers.

Kickbacks are difficult to prevent, so detective controls are also necessary. Focus 4-1 discusses one particularly effective detection control: the supplier audit (control 11.4).

Focus 4-1

Supplier audits may be one of the best tools for assessing the effectiveness of expenditure cycle controls. It entails having an internal auditor visit a supplier's office to check its records. The objective is to identify suppliers likely to be associated with problems such as kickbacks. Red flags that indicate potential problems include:

1. A large percentage of the supplier's gross sales was to the company conducting the supplier audit.
2. The supplier's pricing methods differ from standard industry practice.
3. The supplier does not own the equipment it rents, but is itself renting that equipment from a third party.
4. Entertainment expenses are high in terms of a percentage of the supplier's gross sales.
5. The supplier submits altered or fictitious third-party invoices.
6. The supplier's address on its invoices is fictitious.

Supplier audits can yield substantial returns. One company recovered more than $250,000 for such problems as duplicate billings. Supplier audits also often uncover violations of the company's conflict of interest policy. Interestingly, many suppliers support the idea of supplier audits, because the process gives them a "good excuse" for not offering purchasing agents gifts or entertainment.

Receiving

The second major business activity in the expenditure cycle (circle 2.0 in Figure 4-2) is the receipt and storage of ordered items. Figure 4-7 shows these two steps as distinct processes because each is performed by a different organizational function. The receiving department is responsible for accepting deliveries from suppliers. It usually reports to the warehouse manager, who in turn reports to the vice president of manufacturing. The inventory stores department, which also reports to the warehouse manager, is responsible for storage of the goods. Information about the receipt of

ordered merchandise must be communicated to the inventory control function to update the inventory records.

Process

When a delivery arrives, a receiving clerk compares the purchase order number referenced on the supplier's packing slip with the open purchase order file to verify that the goods were ordered. The receiving clerk then counts the quantity of goods delivered. Before routing the inventory to the warehouse or factory, the receiving clerk also should examine each delivery for signs of obvious damage.

The **receiving report** documents details about each delivery, including the date received, shipper, supplier, and purchase order number (Figure 4-8). For each item received, it shows the item number, description, unit of measure, and quantity. The receiving report also contains space to identify the persons who received and inspected the goods as well as for remarks concerning the quality of the items received.

The three possible exceptions to this process are (1) receiving a quantity of goods different from the amount ordered, (2) receiving damaged goods, or (3) receiving goods of inferior quality that fail inspection. In all three cases, the purchasing department must resolve the situation with the supplier. Usually the supplier will give the buyer permission to correct the invoice for any discrepancies in quantity. In the case of damaged or poor-quality goods, a document called a debit memo is prepared after the supplier agrees to take back the goods or to grant a price reduction. The **debit memo** records the adjustment being requested. One copy of the debit memo is sent to the supplier, who subsequently creates and returns a credit memo in acknowledgment. The accounts payable department is notified and adjusts the account balance owed to that supplier. A copy of the debit memo

accompanies the goods to the shipping department to authorize their return to the supplier.

Figure 4-7

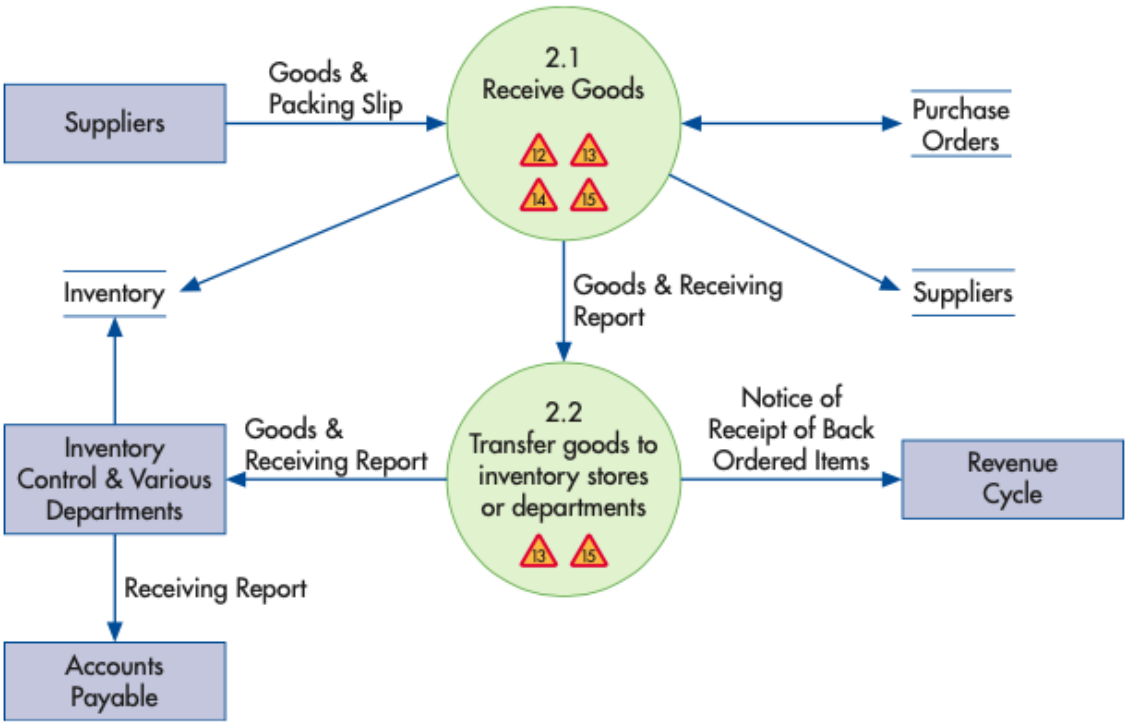
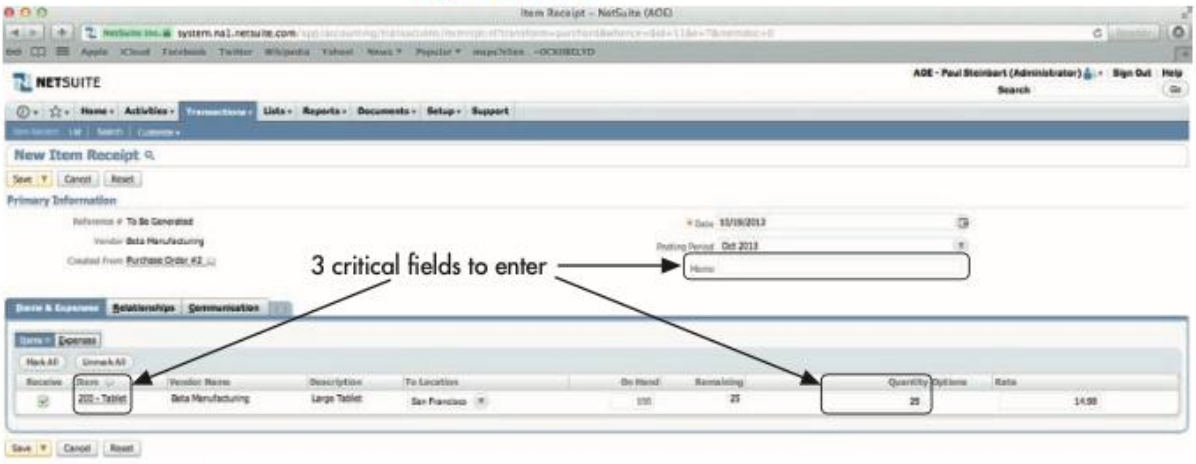


Figure 4-8



Source: 2010 © NetSuite Inc.

Counting and recording inventory deliveries is a labor-intensive task. One way for companies such as AOE to improve the efficiency of this process is to require suppliers to barcode or affix RFID tags to their products. Either approach streamlines the counting of items received but does not eliminate the need to inspect the quality.

EDI and satellite technology provide another way to improve the efficiency of inbound logistics. EDI advance shipping notices inform companies when products have been shipped. By using shipping companies whose trucks are equipped with data terminals linked to satellites, a business can track the exact location of all incoming shipments and ensure that adequate staff will be there to unload the trucks. Truck drivers also can be directed to pull up to specific loading docks closest to the place where the goods will be used.

Threats and Controls

Accepting delivery of unordered goods (threat 12) results in costs associated with unloading, storing, and later returning those items. The best control procedure to mitigate this threat is to instruct the receiving

department to accept only deliveries for which there is an approved purchase order (control 12.1). That is why Figure 4-7 shows the receiving department needs access to the open purchase orders file.

Another threat is making mistakes in counting items received. Correctly counting the quantity received is crucial for maintaining accurate perpetual inventory records. It also ensures that the company pays only for goods actually received. To encourage the receiving clerk to accurately count what was delivered, many companies design the inquiry processing system so that when reviewing open purchase orders, receiving-dock workers do not see the quantity ordered (control 13.1). (If paper documents are still used, the quantity-ordered field is blacked out on the receiving department's copy of the purchase order.) Nevertheless, the receiving clerk still knows the expected quantity of goods because suppliers usually include a packing slip with each order. Consequently, there is a temptation to do just a quick visual comparison of quantities received with those indicated on the packing slip, to quickly route the goods to where they are needed. Therefore, companies must clearly communicate to receiving clerks the importance of carefully and accurately counting all deliveries. An effective means of communication is to require receiving clerks not only to record the quantity received but also to sign the receiving report or enter their employee ID numbers in the system (control 13.2). Such procedures indicate an assumption of responsibility, which usually results in more diligent work. Some companies also offer bonuses (control 13.3) to receiving clerks for catching discrepancies between the packing slip and actual quantity received before the delivery person leaves. Wherever feasible, use of bar codes and RFID tags (control 13.4) can significantly reduce accidental mistakes in counting. Finally, the ERP system should be configured to automatically flag discrepancies

between receiving counts and order quantities that exceed a predetermined tolerance level so that they can be promptly investigated (control 13.5).

Thus far, the discussion has centered on the purchase of inventory items. Different procedures are needed to control the purchase of services, such as painting or maintenance work. The major challenge in this area is establishing that the services were actually performed (threat 14), which may be difficult. For example, visual inspection can indicate whether a room has been painted; it does not reveal, however, whether the walls were appropriately primed, unless the inspection was done during the painting process, which may not always be feasible.

One way to control the purchase of services is to hold the appropriate supervisor accountable for all such costs incurred by that department. The supervisor is required to acknowledge receipt of the services, and the related expenses are then charged to accounts for which he or she is responsible. Actual versus budgeted expenses should be routinely compared and any discrepancies investigated (control 14.1).

It is difficult to prevent fraudulent billing for services. Therefore, detective controls are also needed. One of the most effective techniques is for the internal audit function to periodically conduct detailed reviews of contracts for services, (control 14.2) including audits of supplier records, as discussed in Focus 4-1.

Theft of inventory is another threat. Several control procedures can be used to safeguard inventory against loss. First, inventories should be stored in secure locations with restricted access (control 15.1). Second, all transfers of inventory within the company should be documented (control 15.2). For example, both the receiving department and the inventory stores department should acknowledge the transfer of goods from the receiving dock into

inventory. Similarly, both the inventory stores and the production departments should acknowledge the release of inventory into production. This documentation provides the necessary information for establishing accountability for any shortages, thereby encouraging employees to take special care to record all inventory movements accurately. Third, it is important to periodically count the inventory on hand and to reconcile those counts with the inventory (control 15.3).

Finally, proper segregation of duties (control 15.4) can further help minimize the risk of inventory theft. Employees who are responsible for controlling physical access to inventory should not be able to adjust inventory records without review and approval. Neither the employees responsible for custody of inventory nor those authorized to adjust inventory records should be responsible for the receiving or shipping functions.

Approving Supplier Invoices

The third main activity in the expenditure cycle is approving supplier invoices for payment (circle 3.0 in Figure 4-2).

Process

The accounts payable department approves supplier invoices for payment. A legal obligation to pay suppliers arises at the time goods are received. For practical reasons, however, most companies record accounts payable only after receipt and approval of the supplier's invoice. This timing difference is usually not important for daily decision making, but it does require making appropriate adjusting entries to prepare accurate financial statements at the end of a fiscal period.

When a supplier's invoice is received, the accounts payable department is responsible for matching it with a corresponding purchase order and receiving report. This combination of the supplier invoice and

associated supporting documentation creates what is called a **voucher package**. Figure 4-9 shows an example of a data entry screen for approving a supplier invoice. Once the approver has verified that the company received what it had ordered, the invoice is approved for payment.

There are two ways to process supplier invoices, referred to as nonvoucher or voucher systems. In a **nonvoucher system**, each approved invoice (along with the supporting documentation) is posted to individual supplier records in the accounts payable file and is then stored in an open-invoice file. When a check is written to pay for an invoice, the voucher package is removed from the open-invoice file, the invoice is marked paid, and then the voucher package is stored in the paid-invoice file. In a **voucher system**, an additional document called a disbursement voucher is also created when a supplier invoice is approved for payment. The **disbursement voucher** identifies the supplier, lists the outstanding invoices, and indicates the net amount to be paid after deducting any applicable discounts and allowances.

Voucher systems offer three advantages over nonvoucher systems. First, they reduce the number of checks that need to be written, because several invoices may be included on one disbursement voucher. Second, because the disbursement voucher is an internally generated document, it can be prenumbered to simplify tracking all payables. Third, because the voucher provides an explicit record that a supplier invoice has been approved for payment, it facilitates separating the time of invoice approval from the time of invoice payment. This makes it easier to schedule both activities to maximize efficiency.

The accounts payable process, which matches supplier invoices to purchase orders and receiving reports, is a prime candidate for automation.

Large global companies can process over a million supplier invoices each year. Processing efficiency can be improved by requiring suppliers to submit invoices electronically, by EDI, and having the system automatically match those invoices to the appropriate purchase orders and receiving reports. Only those supplier invoices that fail this matching process need be processed manually.

Another option is to eliminate supplier invoices. After all, for most recurring purchases, companies know the prices of goods and services at the time they are ordered. Thus, as soon as receipt of the goods or services is verified, all the information required to pay the supplier is already known. This “invoiceless” approach is called **evaluated receipt settlement (ERS)**. ERS replaces the traditional three-way matching process (supplier invoice, receiving report, and purchase order) with a two-way match of the purchase order and receiving report (Figure 4-10). ERS saves time and money by reducing the number of documents that need to be matched and, hence, the number of potential mismatches. In fact, ERS systems are often configured to automate the two-way matching process and automatically generate payments; manual review is necessary only when there are discrepancies between the receiving report and purchase order. ERS also saves suppliers the time and expense of generating and tracking invoices. This is an example of how improvements in one company’s expenditure cycle processes provide benefits to another company’s revenue cycle processes. Finally, as Focus 4-2 shows, dramatic improvements can often result from reengineering the accounts payable process itself.

Noninventory purchases for supplies provide perhaps the biggest opportunity to improve the efficiency of accounts payable and cash disbursements. Noninventory purchases typically account for a large

proportion of accounts payable transactions but represent a small percentage of the total dollar value of all purchases. For example, an AICPA-sponsored survey found that over 60% of all invoices processed by accounts payable departments were for amounts under $2,000. Procurement cards provide one way to eliminate the need for accounts payable to process many such small invoices. A **procurement card** is a corporate credit card that employees can use only at designated suppliers to purchase specific kinds of items. Spending limits can be set for each card. In addition, the account numbers on each procurement card can be mapped to specific general ledger accounts, such as office supplies. Procurement cards simplify accounts payable because the company receives one monthly statement that summarizes noninventory purchases by account category. Procurement cards also improve the efficiency of the cash disbursement process because the company only has to make one payment for all noninventory purchases during a given time period, instead of making separate payments to various suppliers.

Figure 4-9

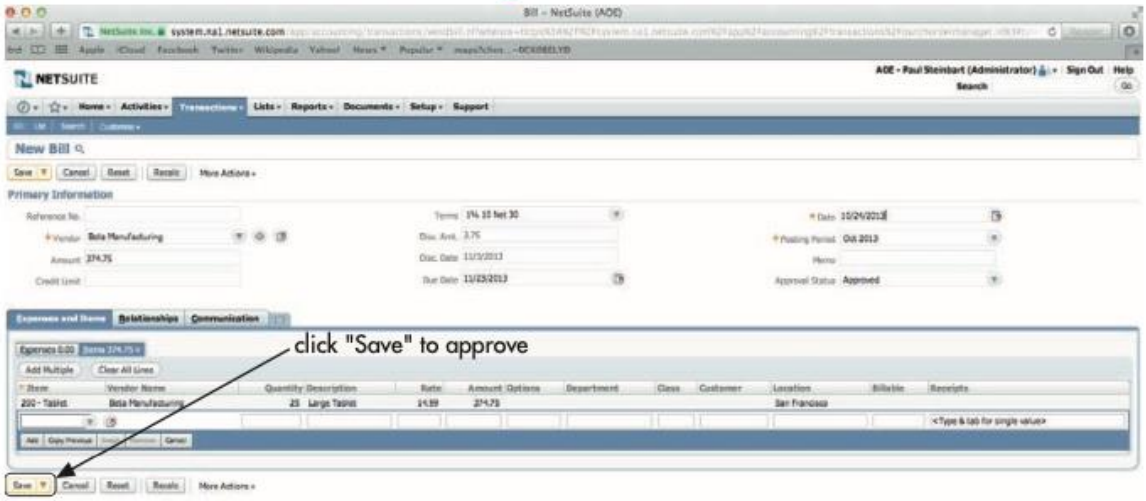


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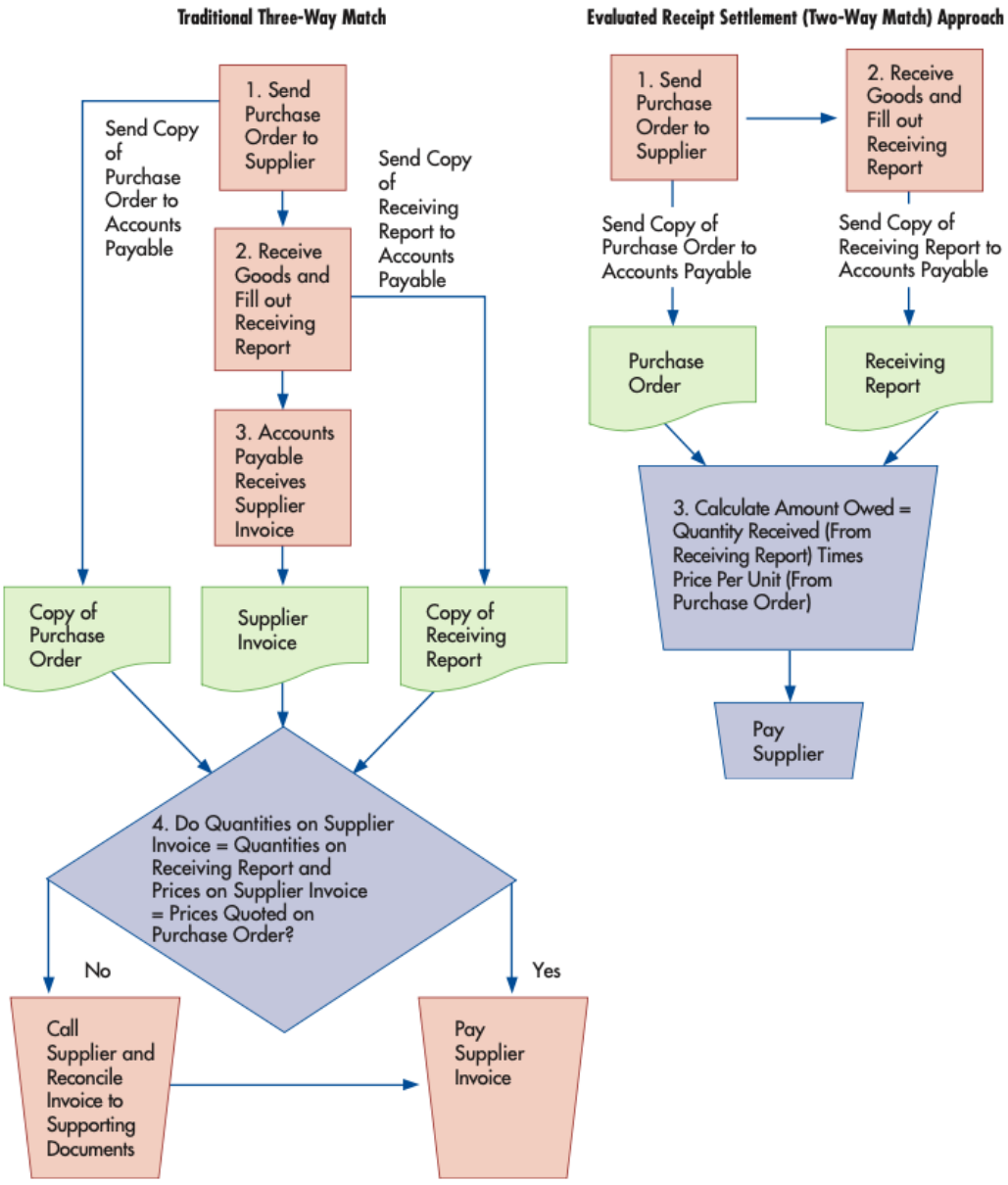
Figure 4-10



Threats and Controls

Table 4-2 indicates that one threat is errors on supplier invoices, such as discrepancies between quoted and actual prices charged or miscalculations of the total amount due. Consequently, the mathematical accuracy of supplier invoices must be verified (control 16.1) and the prices and quantities listed therein compared with those indicated on the purchase

order and receiving report. For procurement card purchases, users should be required to keep receipts (control 16.2) and verify the accuracy of the monthly statement. Adopting the ERS approach (control 16.3) eliminates the potential for errors in supplier invoices because companies pay by matching counts of what they receive with prices quoted when the goods were ordered. However, the use of ERS makes it important to control access to the supplier master file (control 16.4) and monitor all changes made to it because the supplier master file now contains information about the prices of the various items being purchased. Upon entry of data about the quantity of goods received, the system uses those prices to establish the amount to be paid to suppliers. Thus, unauthorized changes to those prices can result in overpayments to suppliers.

Even with ERS, freight expenses require special consideration because their complexity creates numerous opportunities for mistakes to occur. The best way to reduce freight-related threats is to provide the purchasing and accounts payable staffs with adequate training on transportation practices and terminology. For example, if the purchase contract says “full freight allowed,” then the supplier is responsible for the freight costs. When the purchasing organization is responsible for freight expenses, using a designated carrier for all incoming shipments can reduce costs. The discounts will only be realized, however, if suppliers comply with requests to use that carrier. Therefore, an important detective control is to have internal audit periodically verify the accuracy of freight bills and invoices to ensure that the company is not being charged for transportation costs that the supplier is supposed to pay (control 16.5).

Mistakes in recording and posting payments to suppliers (threat 17) result in additional errors in financial and performance reports that, in turn,

can contribute to poor decision making. The data entry and processing controls to ensure processing integrity (control 17.1) are necessary to prevent these types of problems. One such control is to compare the difference in supplier account balances with the total amount of invoices processed—before and after processing checks. The total of all supplier account balances (or unpaid vouchers) also should be reconciled periodically with the amount of the accounts payable control account in the general ledger (control 17.2).

Focus 4-2

Medtronic, Inc., a global medical technology company, is demonstrating that process improvement principles originally developed to improve manufacturing activities can also be successfully adopted to improve the accounts payable function. Like many manufacturers, Medtronic had successfully used both Six Sigma and Lean principles to streamline its work-flow activities and improve product quality. Six Sigma is a philosophy that focuses on improving quality by reducing mistakes. Lean analysis seeks to improve efficiency by eliminating bottlenecks and redundancies. Medtronic decided to try to apply these same techniques used in manufacturing to its accounts payable function. The initial motivation for doing so was the insight that financial transactions, just like manufacturing a product, involved moving an item (e.g., a supplier invoice) through a sequence of steps.

Medtronic initiated a series of intensive five-day projects, called *kaizen*, to apply Six Sigma and Lean principles to improve accounts payable. On day 1, a team consisting of accounts payable employees and manufacturing process improvement experts carefully studied how supplier invoices were processed, beginning with the time when mail was first opened all the way through printing and mailing checks. On day 2, the team measured the time it took to perform each step of the process and the volume of transactions passing through each step. On days 3 and 4, the team diagrammed the physical flow of all accounts payable documentation. They then rearranged cubicles and desks and added new wheeled carts and paper bins to slash the physical distance a supplier invoice traveled from 1,464 to 165 feet. They also modified the image-scanning process to be able to merge all supplier invoices (those for inventory purchases, with associated purchase orders, and those without purchase orders) into one queue. On day 5, the team walked the entire department through the reengineered work-flow process.

Medtronic's application of process improvement techniques yielded a dramatic improvement in the efficiency and effectiveness of its accounts payable function:

- The time required to open the mail and to sort, process, and record supplier invoices dropped from three days to one day.
- The number of invoices for which discounts for prompt payment were taken increased by 15%.
- Payment processing times were cut by 50%.

It is important to note that these benefits were obtained with the same employees who had been working in accounts payable prior to the reengineering effort. This shows that when companies are seeking to improve results, they should focus first on fixing the process, rather than on replacing the people who perform it.

Cash Disbursements

The final activity in the expenditure cycle is paying suppliers (circle 4.0 in Figure 4-2).

Process

The cashier, who reports to the treasurer, is responsible for paying suppliers. This segregates the custody function, performed by the cashier, from the authorization and recording functions, performed by the purchasing and accounts payable departments, respectively. Payments are made when accounts payable sends the cashier a voucher package. Although many payments continue to be made by check, the use of EFT and FEDI is increasing.

Threats and Controls

Failing to take advantage of purchase discounts for prompt payment (threat 18) can be costly. For example, a 1% discount for paying within 10 days instead of 30 days represents a savings of 18% annually. Proper filing can significantly reduce the risk of this threat. Approved invoices should be filed by due date, and the system should be designed to track invoice due dates and print a periodic list of all outstanding invoices (control 18.1). A cash flow budget (control 18.2) that indicates expected cash inflows and outstanding commitments also can help companies plan to utilize available purchase discounts. The information in this budget comes from a number of sources. Accounts receivable provides projections of future cash collections. The accounts payable and open purchase order files indicate the amount of current and pending commitments to suppliers, and the human resources function provides information about payroll needs.

Another threat is paying for goods not received. The best control to prevent this threat is to compare the quantities indicated on the supplier

invoice with the quantities entered by the inventory control person, who accepts the transfer of those goods from the receiving department. Many companies require the inventory control department to verify the quantities on the receiving report before it can be used to support payment of a supplier invoice (control 19.1). Verification that services (e.g., cleaning or painting) were performed in the manner billed is more difficult. Therefore, most companies rely on budgetary controls and careful review of departmental expenses (control 19.2) to indicate potential problems that need investigation.

Reimbursement of employees' travel and entertainment expenses warrants special attention because this is an area in which fraud often occurs and technological trends have made it easier for employees to submit fraudulent claims. For example, most airlines now encourage travelers to print their boarding passes at home. This saves the traveler time at check-in, but it also reduces the value of a boarding pass as supporting documentation for a claimed expense because the document can be altered by the traveler or printed but never used. Consequently, many organizations require employees to submit additional evidence, such as a conference agenda that identifies attendees, to prove that they actually took a trip (control 19.3). Another potential threat is for an employee to book multiple flights or hotels, cancel all but the cheapest ones, but submit a reimbursement claim for the most expensive option. The best way to prevent this problem is to require all employees to use corporate credit cards for travel (control 19.4), as this ensures that the organization will receive a complete audit trail of all charges *and* credits to the account.

Duplicate payments (threat 20) can happen for a variety of reasons. It may be a duplicate invoice that was sent after the company's check was

already in the mail, or it may have become separated from the other documents in the voucher package. Although the supplier usually detects a duplicate payment and credits the company's account, it can affect a company's cash flow needs. In addition, the financial records will be incorrect, at least until the duplicate payment is detected.

Several related control procedures can mitigate this threat. First (control 20.1), invoices should be approved for payment only when accompanied by a complete voucher package (purchase order and receiving report). Second, only the original copy of an invoice should be paid (control 20.2). Most duplicate invoices that suppliers send clearly indicate that they are not originals. Payment should never be authorized for a photocopy of an invoice. Third, when the check to pay for an invoice is signed, the invoice and the voucher package should be canceled (marked "paid") in a manner that would prevent their resubmission (control 20.3). Although ERS eliminates vendor invoices entirely, it is still important to mark all receiving reports as paid to avoid duplicate payments.

Probably the most serious threat associated with the cash disbursements function is theft or misappropriation of funds (threat 21). Because cash is the easiest asset to steal, access to cash, blank checks, and the check-signing machine should be restricted (control 21.1). Checks should be sequentially numbered and periodically accounted for (control 21.2) by the cashier.

EFT, either by itself or as part of FEDI, requires additional control procedures. Strict access controls over all outgoing EFT transactions (control 21.3) are important. Passwords and user IDs should be used to specifically identify and monitor each employee authorized to initiate EFT transactions. The location of the originating terminal should also be

recorded. EFT transactions above a certain threshold should require real-time supervisory approval. There should also be limits on the total dollar amount of transactions allowed per day per individual. All EFT transmissions should be encrypted to prevent alteration. In addition, all EFT transactions should be time-stamped and numbered to facilitate subsequent reconciliation. Special programs, called *embedded audit modules*, can be designed into the system to monitor all transactions and identify any that possess specific characteristics. A report of those flagged transactions then can be given to management and internal audit for review and, if necessary, more detailed investigation.

Online banking transactions require constant monitoring. Timely detection of suspicious transactions and prompt notification of the bank are necessary for recovering any funds that are fraudulently disbursed. A serious threat is that keystroke-logging software could infect the computer used for online banking and provide criminals with the organization's banking credentials. The best way to mitigate this threat is to designate a specific computer to be used for online banking (control 21.4), to restrict access to that computer to the treasurer or whoever is responsible for authorizing payments, and to use that computer only for online banking and no other activity. Companies should also consider placing Automated Clearing House (ACH) blocks, which instruct banks to not allow ACH debits (outflows) from specific accounts. For example, if a company makes all payments to its suppliers only from its main operating checking account, it may wish to instruct the bank to block all ACH debits from any of its other bank accounts (control 21.5).

Fraudulent disbursements, particularly the issuance of checks to fictitious suppliers, are a common type of fraud. Proper segregation of duties

(control 21.6) can significantly reduce the risk of this threat. The accounts payable function should authorize payment, including the assembling of a voucher package; however, only the treasurer or cashier should sign checks. To ensure that checks are sent to the intended recipients, the cashier should mail the signed checks rather than return them to accounts payable. The cashier also should cancel all documents in the voucher package to prevent their being resubmitted to support another disbursement. Checks in excess of a certain amount, such as $5,000 to $10,000, should require two signatures (control 21.7), thereby providing yet another independent review of the expenditure. Finally, someone who did not participate in processing either cash collections or disbursements should reconcile all bank accounts (control 21.8). This control provides an independent check on accuracy and prevents someone from misappropriating cash and then concealing the theft by adjusting the bank statement.

Access to the approved supplier list should be restricted (control 21.9), and any changes to that list should be carefully reviewed and approved. It is especially important to restrict the ability to create one-time suppliers (control 21.10) and process invoices so that the same employee cannot both create a new supplier and issue a check to that supplier.

When possible, expenditures should be made by check or EFT. Nevertheless, it is often more convenient to pay for minor purchases, such as coffee or pencils, in cash. A petty cash fund (control 21.11), managed by an employee who has no other cash-handling or accounting responsibilities, should be established to handle such expenditures. The petty cash fund should be set up as an imprest fund. An **imprest fund** has two characteristics: it is set at a fixed amount, such as $100, and it requires vouchers for every disbursement. At all times, the sum of cash plus vouchers

should equal the preset fund balance. When the fund balance gets low, the vouchers are presented to accounts payable for replenishment. After accounts payable authorizes this transaction, the cashier then writes a check to restore the petty cash fund to its designated level. As with the supporting documents used for regular purchases, the vouchers used to support replenishment of the petty cash fund should be canceled at the time the fund is restored to its preset level.

The operation of an imprest petty cash fund technically violates the principle of segregation of duties, because the same person who has custody of the cash also authorizes disbursements from the fund and maintains a record of the fund balance. The threat of misappropriation is more than offset, however, by the convenience of not having to process small miscellaneous purchases through the normal expenditure cycle. Moreover, the risk of misappropriation can be mitigated by having the internal auditor make periodic unannounced counts of the fund balance and vouchers and by holding the person in charge of the petty cash fund accountable for any shortages discovered during those surprise audits (control 21.12).

Theft can also occur through check alteration (threat 22). Check-protection machines (control 22.1) can reduce the risk of this threat by imprinting the amount in distinctive colors, typically a combination of red and blue ink. Using special inks that change colors if altered and printing checks on special papers (control 22.2) that contain watermarks can further reduce the probability of alteration. Many banks also provide special services to help protect companies against fraudulent checks. One such service, called Positive Pay (control 22.3), involves sending a daily list of all legitimate checks to the bank, which will then clear only checks appearing on that list. Finally, bank reconciliations are an important detective control for identifying

check fraud. If done in a timely manner, they facilitate recovery from banks. Indeed, many banks will cover bad-check losses only if a company notifies them promptly of any such checks it discovers.

Finally, it is important to plan and monitor expenditures in order to avoid cash flow problems (threat 23). A cash flow budget (control 23.1) is the best way to mitigate this threat.

Summary and Case Conclusion

The basic business activities performed in the expenditure cycle include ordering materials, supplies, and services; receiving materials, supplies, and services; approving supplier invoices for payment; and paying for goods and services.

The efficiency and effectiveness of these activities can significantly affect a company's overall performance. For example, deficiencies in requesting and ordering necessary inventory and supplies can create production bottlenecks and result in lost sales due to stockouts of popular items. Problems in the procedures related to receiving and storing inventory can result in a company's paying for items it never received, accepting delivery and incurring storage costs for unordered items, and experiencing a theft of inventory. Problems in approving supplier invoices for payment can result in overpaying suppliers or failing to take available discounts for prompt payment. Weaknesses in the cash disbursement process can result in the misappropriation of cash.

IT can help improve the efficiency and effectiveness with which expenditure cycle activities are performed. In particular, EDI, bar-coding, RFID, and EFT can significantly reduce the time and costs associated with ordering, receiving, and paying for goods. Proper control procedures, especially segregation of duties, are needed to mitigate various threats such

as errors in performing expenditure cycle activities and the theft of inventory or cash.

At the next executive meeting, Ann Brandt and Elizabeth Venko presented to Linda Spurgeon their recommendations for improving AOE's expenditure cycle business activities. Ann indicates that LeRoy Williams's plan to conduct more frequent physical counts of key raw materials components will increase the accuracy of the database and reduce the likelihood of future stockouts at the Wichita plant. She also designed a query to produce a daily supplier performance report that will highlight any negative trends before they become the types of problems that disrupted production at the Dayton plant. Ann also indicated that it would be possible to link AOE's inventory and production planning systems with major suppliers to better manage AOE's inventory levels.

Elizabeth Venko stated that she was working to increase the number of suppliers who either bar-code or RFID tag their shipments. This would improve both the efficiency and accuracy of the receiving process and also the accuracy of AOE's inventory records, thereby providing possible additional reductions in inventory carrying costs. In addition, Elizabeth wants to encourage more suppliers to either send invoices via EDI or agree to ERS, which should improve the efficiency and accuracy of processing invoices and reduce the costs associated with handling and storing paper invoices. Concurrently, Elizabeth plans to increase EFT as much as possible to further streamline the cash disbursements process and reduce the costs associated with processing payments by check.

As the meeting draws to a close, LeRoy Williams asks if Elizabeth and Ann can meet with him to explore additional ways to improve how AOE's new system tracks manufacturing activities.

Exercises

1. Which of the following inventory control methods is most likely to be used for a product for which sales can be reliably forecast?

a. JIT

b. EOQ

c. MRP

d. ABC

2. Which of the following matches is performed in evaluated receipt settlement (ERS)?

a. the vendor invoice with the receiving report

b. the purchase order with the receiving report

c. the vendor invoice with the purchase order

d. the vendor invoice, the receiving report, and the purchase order

3. Which of the following is true?

a. It is easier to verify the accuracy of invoices for purchases of services than invoices for purchases of raw materials.

b. Setting up petty cash as an imprest fund violates segregation of duties.

c. The EOQ formula is used to identify when to reorder inventory.

d. A voucher package usually includes a debit memo.

4. Which document is used to establish a contract for the purchase of goods or services from a supplier?

a. vendor invoice

b. purchase requisition

c. purchase order

d. disbursement voucher

5. Which method would provide the greatest efficiency improvements for the purchase of noninventory items such as miscellaneous office supplies?

a. bar-coding

b. EDI

c. procurement cards

d. EFT

6. Which of the following expenditure cycle activities can be eliminated through the use of IT or reengineering?

a. ordering goods

b. approving vendor invoices

c. receiving goods

d. cash disbursements

7. What is the best control procedure to prevent paying the same invoice twice?

a. Segregate check-preparation and check-signing functions.

b. Prepare checks only for invoices that have been matched to receiving reports and purchase orders.

c. Require two signatures on all checks above a certain limit.

d. Cancel all supporting documents when the check is signed.

8. For good internal control, who should sign checks?

a. cashier

b. accounts payable

c. purchasing agent

d. controller

9. Which of the following procedures is designed to prevent the purchasing agent from receiving kickbacks?

a. maintaining a list of approved suppliers and requiring all purchases to be made from suppliers on that list

b. requiring purchasing agents to disclose any financial investments in potential suppliers

c. requiring approval of all purchase orders

d. prenumbering and periodically accounting for all purchase orders

10. Which document is used to record adjustments to accounts payable based on the return of unacceptable inventory to the supplier?

a. receiving report

b. credit memo

c. debit memo

d. purchase order

Discussion Questions

1. In this chapter and in Chapter 3, the controller of AOE played a major role in evaluating and recommending ways to use IT to improve efficiency and effectiveness. Should the company's chief information officer make these decisions instead? Should the controller be involved in making these types of decisions? Why or why not?

2. Companies such as Walmart have moved beyond JIT to vendor-managed inventory (VMI) systems. Discuss the potential advantages and disadvantages of this arrangement. What special controls, if any, should be developed to monitor VMI systems?

3. Procurement cards are designed to improve the efficiency of small noninventory purchases. What controls should be placed on their use? Why?

4. In what ways can you apply the control procedures discussed in this chapter to paying personal debts (e.g., credit card bills)?

5. Should every company switch from the traditional three-way matching process (purchase orders, receiving reports, and supplier invoices) to the two-way match (purchase orders and receiving reports) used in evaluated receipt settlement (ERS)? Why or why not?

6. Should companies allow purchasing agents to start their own businesses that produce goods the company frequently purchases? Why? Would you change your answer if the purchasing agent's company were rated by an independent service, such as *Consumer Reports*, as providing the best value for price? Why?

Problems

1. Which internal control procedure would be most cost-effective in dealing with the following expenditure cycle threats?

a. A purchasing agent orders materials from a supplier that he partially owns.

b. Receiving-dock personnel steal inventory and then claim the inventory was sent to the warehouse.

c. An unordered supply of laser printer paper delivered to the office is accepted and paid for because the "price is right." After all of the laser printers are jammed, however, it becomes obvious that the "bargain" paper is of inferior quality.

d. The company fails to take advantage of a 1% discount for promptly paying a vendor invoice.

e. A company is late in paying a particular invoice. Consequently, a second invoice is sent, which crosses the first invoice's payment in the mail. The second invoice is submitted for processing and also paid.

f. Inventory records show that an adequate supply of copy paper should be in stock, but none is available on the supply shelf.

g. The inventory records are incorrectly updated when a receiving-dock employee enters the wrong product number at the terminal.

h. A clerical employee obtains a blank check and writes a large amount payable to a fictitious company. The employee then cashes the check.

i. A fictitious invoice is received and a check is issued to pay for goods that were never ordered or delivered.

j. The petty cash custodian confesses to having "borrowed" $12,000 over the last five years.

k. A purchasing agent adds a new record to the supplier master file. The company does not exist. Subsequently, the purchasing agent submits invoices from the fake company for various cleaning services. The invoices are paid.

l. A clerk affixes a price tag intended for a low-end flat-panel TV to a top-of-the-line model. The clerk's friend then purchases that item, which the clerk scans at the checkout counter.

2. Match the terms in the left column with their appropriate definition in the right column.

Terms

1. Economic order quantity (EOQ)
2. Materials requirements planning (MRP)
3. Just-in-time (JIT) inventory System
4. Purchase requisition

5. Imprest fund
6. Purchase order
7. Kickbacks
8. Procurement card
9. Blanket purchase order
10. Evaluated receipts settlement (ERS)
11. Disbursement voucher
12. Receiving report
13. Debit memo
14. Vendor-managed inventory
15. Voucher package
16. Nonvoucher system
17. Voucher system

Definitions

a. A document that creates a legal obligation to buy and pay for goods or services

b. The method used to maintain the cash balance in petty cash account

c. The time to reorder inventory triggered when the quantity on hand falls to a predetermined level

d. A document used to authorize a reduction in accounts payable because merchandise has been returned to a supplier

e. An inventory control system that triggers production based upon actual sales

f. An inventory control system that triggers production based on forecasted sales

g. A document used only internally to initiate the purchase of materials, supplies, or services

h. A process for approving supplier invoices based on a two-way match of the receiving report and purchase order

i. A process for approving supplier invoices based on a three-way match of the purchase order, receiving report, and supplier invoice

j. A method of maintaining accounts payable in which each supplier invoice is tracked and paid for separately

k. A method of maintaining accounts payable that generates one check to pay for a set of invoices from the same supplier

l. Combination of a purchase order, receiving report, and supplier invoice that all relate to the same transaction

m. A document used to list each invoice being paid by a check

n. An inventory control system that seeks to minimize the sum of ordering, carrying, and stockout costs

o. A system whereby suppliers are granted access to point-of-sale (POS) and inventory data in order to automatically replenish inventory levels

p. An agreement to purchase set quantities at specified intervals from a specific supplier

q. A document used to record the quantities and condition of items delivered by a supplier

r. A special-purpose credit card used to purchase supplies

s. A fraud in which a supplier pays a buyer or purchasing agent in order to sell its products or services

3. Match the threats in the left column to appropriate control procedures in the right column. More than one control may be applicable.

Threat

1. Failing to take available purchase discounts for prompt payment

2. Recording and posting errors in accounts payable
3. Paying for items not received
4. Kickbacks
5. Theft of inventory
6. Paying the same invoice Twice
7. Stockouts
8. Purchasing items at inflated prices
9. Misappropriation of cash
10. Purchasing goods of inferior quality
11. Wasted time and cost of returning unordered Merchandise to suppliers
12. Accidental loss of purchasing data
13. Disclosure of sensitive supplier information (e.g., banking data)

Control Procedure

a. Accept only deliveries for which an approved purchase order exists.
b. Document all transfers of inventory.
c. Restrict physical access to inventory.
d. File invoices by due date.
e. Maintain a cash budget.
f. Conduct an automated comparison of total change in cash to total changes in accounts payable.
g. Adopt a perpetual inventory system.
h. Require purchasing agents to disclose financial or personal interests in suppliers.
i. Require purchases to be made only from approved suppliers.
j. Restrict access to the supplier master data.
k. Restrict access to blank checks.

l. Issue checks only for complete voucher packages (receiving report, supplier invoice, and purchase order).

m. Cancel or mark “Paid” supporting documents in voucher package when check is issued.

n. Carry out a regular backup of expenditure cycle database.

o. Train employees in how to properly respond to gifts or incentives offered by suppliers.

p. Hold purchasing managers responsible for costs of scrap and rework.

q. Ensure that someone other than the cashier reconciles bank accounts.

4. Use Table 4-2 to create a questionnaire checklist that can be used to evaluate controls for each of the basic activities in the expenditure cycle (ordering goods, receiving, approving supplier invoices, and cash disbursements).

Required

a. For each control issue, write a Yes/No question such that a “No” answer represents a control weakness. For example, one question might be “Are supporting documents, such as purchase orders and receiving reports, marked ‘paid’ when a check is issued to the vendor?”

b. For each Yes/No question, write a brief explanation of why a “No” answer represents a control weakness.

5. The following list identifies several important control features. For each control, (1) describe its purpose, and (2) explain how it could be best implemented in an integrated ERP system.

a. Cancellation of the voucher package by the cashier after signing the check

b. Separation of duties of approving invoices for payment and signing checks

c. Prenumbering and periodically accounting for all purchase orders

d. Periodic physical count of inventory

e. Requiring two signatures on checks for large amounts

f. Requiring that a copy of the receiving report be routed through the inventory stores department prior to going to accounts payable

g. Requiring a regular reconciliation of the bank account by someone other than the person responsible for writing checks

h. Maintaining an approved supplier list and checking that all purchase orders are issued only to suppliers on that list

6. For good internal control, which of the following duties can be performed by the same individual?

1. Approve purchase orders
2. Negotiate terms with suppliers
3. Reconcile the organization's bank account
4. Approve supplier invoices for payment
5. Cancel supporting documents in the voucher package
6. Sign checks
7. Mail checks
8. Request inventory to be purchased
9. Inspect quantity and quality of inventory received

7. Last year the Diamond Manufacturing Company purchased over $10 million worth of office equipment under its "special ordering" system, with individual orders ranging from $5,000 to $30,000. Special orders are for low-volume items that have been included in a department manager's budget. The budget, which limits the types and dollar amounts of office equipment a

department head can requisition, is approved at the beginning of the year by the board of directors. The special ordering system functions as follows.

Purchasing A purchase requisition form is prepared and sent to the purchasing department. Upon receiving a purchase requisition, one of the five purchasing agents (buyers) verifies that the requester is indeed a department head. The buyer next selects the appropriate supplier by searching the various catalogs on file. The buyer then phones the supplier, requests a price quote, and places a verbal order. A prenumbered purchase order is processed, with the original sent to the supplier and copies to the department head, receiving, and accounts payable. One copy is also filed in the open requisition file. When the receiving department verbally informs the buyer that the item has been received, the purchase order is transferred from the open to the filled file. Once a month, the buyer reviews the unfilled file to follow up on open orders.

Receiving The receiving department gets a copy of each purchase order. When equipment is received, that copy of the purchase order is stamped with the date, and, if applicable, any differences between the quantity ordered and the quantity received are noted in red ink. The receiving clerk then forwards the stamped purchase order and equipment to the requisitioning department head and verbally notifies the purchasing department that the goods were received.

Accounts Payable Upon receipt of a purchase order, the accounts payable clerk files it in the open purchase order file. When a vendor invoice is received, it is matched with the applicable purchase order, and a payable is created by debiting the requisitioning department's equipment account. Unpaid invoices are filed by due date. On the due date, a check is prepared

and forwarded to the treasurer for signature. The invoice and purchase order are then filed by purchase order number in the paid-invoice file.

Treasurer Checks received daily from the accounts payable department are sorted into two groups: those over and those under $10,000. Checks for less than $10,000 are machine signed. The cashier maintains the check signature machine's key and signature plate and monitors its use. Both the cashier and the treasurer sign all checks over $10,000.

Required

a. Describe the weaknesses relating to purchases and payments of "special orders" by the Diamond Manufacturing Company.

b. Recommend control procedures that must be added to overcome weaknesses identified in part a.

c. Describe how the control procedures you recommended in part b should be modified if Diamond reengineered its expenditure cycle activities to make maximum use of current IT (e.g., EDI, EFT, bar-code scanning, and electronic forms in place of paper documents). *(CPA Examination, adapted)*

d. Draw a BPMN diagram that depicts Diamond's reengineered expenditure cycle.

8. The ABC Company performs its expenditure cycle activities using its integrated ERP system as follows:

• Employees in any department can enter purchase requests for items they note as either out of stock or in small quantity.

• The company maintains a perpetual inventory system.

• Each day, employees in the purchasing department process all purchase requests from the prior day. To the extent possible, requests for items available from the same supplier are combined into one larger purchase

order to obtain volume discounts. Purchasing agents use the Internet to compare prices in order to select suppliers. If an Internet search discovers a potential new supplier, the purchasing agent enters the relevant information in the system, thereby adding the supplier to the approved supplier list. Purchase orders above $10,000 must be approved by the purchasing department manager. EDI is used to transmit purchase orders to most suppliers, but paper purchase orders are printed and mailed to suppliers who are not EDI capable.

• Receiving department employees have read-only access to outstanding purchase orders. Usually, they check the system to verify existence of a purchase order prior to accepting delivery, but sometimes during rush periods they unload trucks and place the items in a corner of the warehouse where they sit until there is time to use the system to retrieve the relevant purchase order. In such cases, if no purchase order is found, the receiving employee contacts the supplier to arrange for the goods to be returned.

• Receiving department employees compare the quantity delivered to the quantity indicated on the purchase order. Whenever a discrepancy is greater than 5%, the receiving employee sends an e-mail to the purchasing department manager. The receiving employee uses an online terminal to enter the quantity received before moving the material to the inventory stores department.

• Inventory is stored in a locked room. During normal business hours, an inventory employee allows any employee wearing an identification badge to enter the storeroom and remove needed items. The inventory storeroom employee counts the quantity removed and enters that information in an online terminal located in the storeroom.

• Occasionally, special items are ordered that are not regularly kept as part of inventory, from a specialty supplier who will not be used for any regular purchases. In these cases, an accounts payable clerk creates a one-time supplier record.

• All supplier invoices (both regular and one-time) are routed to accounts payable for review and approval. The system is configured to perform an automatic three-way match of the supplier invoice with the corresponding purchase order and receiving report.

• Each Friday, approved supplier invoices that are due within the next week are routed to the treasurer's department for payment. The cashier and treasurer are the only employees authorized to disburse funds, either by EFT or by printing a check. Checks are printed on dedicated printer located in the treasurer's department, using special stock paper that is stored in a locked cabinet accessible only to the treasurer and cashier. The paper checks are sent to accounts payable to be mailed to suppliers.

• Monthly, the treasurer reconciles the bank statements and investigates any discrepancies with recorded cash balances.

Required

a. Identify weaknesses in ABC's existing expenditure cycle procedures, explain the problem, and suggest a solution. Present your answer in a three-column table with these headings: Weakness, Problem, Solution.

b. Draw a BPMN diagram that depicts ABC's expenditure cycle process redesigned to incorporate your answer to step a.

9. Figure 4-11 depicts the basic activities performed in Lexsteel's expenditure cycle. The following additional information supplements that figure:

• Because of cash flow problems, Lexsteel always pays suppliers on the last possible day before incurring a penalty for late payment. Supplier invoices are processed and paid weekly. Every Friday, the accounts payable clerk reviews and approves all invoices with a due date the following week.

• The purchasing manager reviews and approves all purchases prior to e-mailing them to suppliers.

• After counting and inspecting incoming deliveries, the receiving clerk enters the following information into the system:

    • Quantities received for each inventory item

    • Date and time received

    • Supplier number

• After entering that information, the receiving clerk takes the inventory to the inventory control department for storage.

• Access to the inventory control department is restricted.

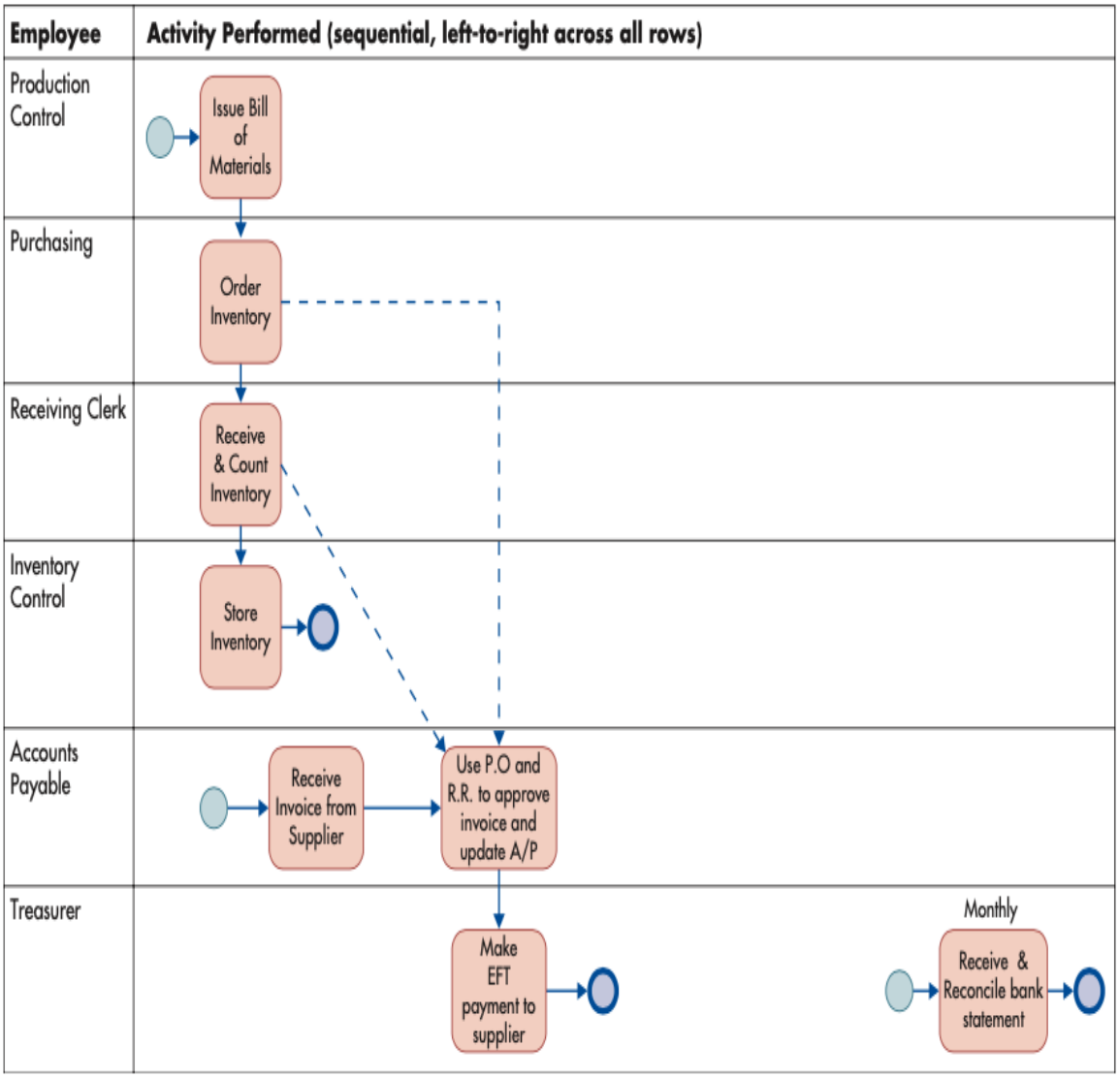
• Inventory is only released to production when properly authorized request is received. When the inventory is released, the inventory control clerk updates the perpetual inventory system.

• Physical counts of inventory are taken every three months. Discrepancies between the counts and recorded quantities on hand are investigated. Upon resolution of the investigation, the plant manager authorizes adjustments to the perpetual inventory records to change them to the amount actually on hand.

Required

Identify at least three control weaknesses in Lexsteel's expenditure cycle. For each weakness, explain the threat and suggest how to change the procedures to mitigate that threat.

Figure 4-11


Employee
Activity Performed (sequential, left-to-right across all rows)
Production Control
Issue Bill of Materials
Purchasing
Order Inventory
Receiving Clerk
Receive & Count Inventory
Inventory Control
Store Inventory
Accounts Payable
Receive Invoice from Supplier
Use P.O and R.R. to approve invoice and update A/P
Treasurer
Make EFT payment to supplier
Monthly
Receive & Reconcile bank statement

CHAPTER 5: E-Commerce and E-Business

INTRODUCTION TO E-COMMERCE AND E-BUSINESS

The Real world

A few years ago, Walmart effected a huge change in the EDI (Electronic Data Interchange) approach to business-to-business transactions. Although EDI had been around for many years, the technology had advanced to allow it to be conducted for free over the Internet. Yet many were concerned about the lack of secure transmission over the Internet. By 2002, Walmart felt the new security standards, called AS2, were adequate. It announced to its 10,000 small and mid-size suppliers that the suppliers had one year to begin using Internet EDI (EDIINT AS2). This was a tremendous change from its traditional EDI and value-added networks, and it had a dramatic impact not only on Walmart's suppliers but on many other large companies and their suppliers worldwide. Some call Walmart the market maker for Internet EDI. Its change to EDIINT led to a revolution of adoption of Internet EDI around the world. Since the buyer and seller have to use the same EDIINT AS2 protocol, Walmart forced a huge number of companies to switch to EDIINT, and in turn, those suppliers used EDIINT with other business customers.

Organizations use information technology to improve efficiency and effectiveness of their operations. Walmart transitioned to Internet EDI to save costs and to take advantage of the new EDI technology. In many cases this IT enablement causes major changes for not only that organization, but also for its trading partners, the entire business world, and other aspects of the economy. The Walmart decision caused 10,000 Walmart suppliers to invest in new IT systems and resulted in major changes in the demand for EDIINT.

The Walmart transition is an example of e-business. **E-business** is the use of electronic means to enhance business processes. E-business

encompasses all forms of on-line electronic trading, consumer-based e-commerce, and business-to-business electronic trading and process integration, as well as the internal use of IT and related technologies for process integration inside organizations.

“E-business” is a term used widely in business and in the mass media. However, there are sometimes misunderstandings about e-business and e-commerce, and any differences between the two. In addition, the sheer number of acronyms in use in e-business and the technological nature of some of the acronyms can make it difficult to understand e-business. The first purpose of this chapter is to define and clarify many of the terms and concepts related to e-business and ecommerce. In addition, this chapter describes the advantages, disadvantages, security issues, and controls related to e-business.

There is some overlap between e-commerce and e-business, and this leads some to confuse the two concepts. **E-commerce** is electronically enabled transactions between a business and its customers. E-business is a broader concept that includes not only electronic trade with customers, but also servicing customers and vendors, trading information with customers and vendors, and electronic recording and control of internal processes. These internal processes include electronic internal employee services such as access to personnel records, access to fringe benefit information, travel and expense reporting, and purchase of items such as office supplies. Figure 5-1 shows the differences and the overlap between the two concepts.

E-commerce is the sale of goods or services from a business to an end-user consumer. Since E-commerce involves selling to consumers, the usual sale will be a relatively small dollar amount when only a few items are sold. The company making the sale will strive for high-volume sales to many

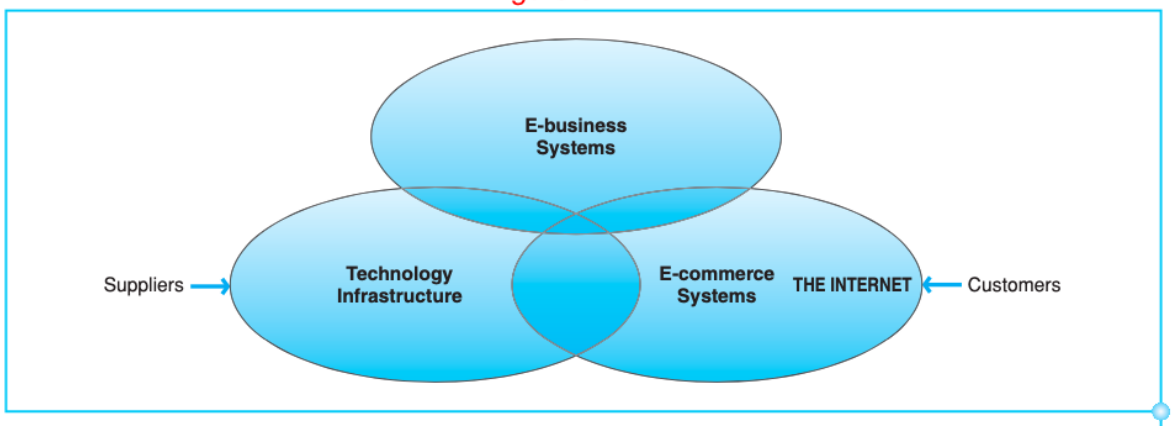
consumers to generate a profit. Its customers will use a user-friendly interface, such as a Web browser, to place the order and pay with a credit card. Amazon.com, Inc., is a well-known example of an e-commerce enterprise. The sales between Amazon.com and its customers are sales between a company and end-user customers.

On the other hand, e-business is a broader concept that encompasses many business processes, using IT systems to enhance or streamline these processes. A part of e-business includes company-to-company sales. E-business includes the sale of goods, services, or raw materials between companies in a supply chain, as well as internal processes like product design and production. An example of a supply chain sale is a manufacturer that buys raw materials from a vendor, using
the Internet as the electronic network. These e-business sales tend to be much larger in dollar value, and there are likely to be many items on each order. The buyer and seller will use common business documents such as purchase orders and invoices, but in electronic form. The software interface between buyer and seller will usually involve more than just a Web browser. The vendor’s and buyer’s computer systems may be linked, and the vendor may actually be able to access and monitor the buyer’s inventory systems.

For a large majority of e-business–enabled companies, the infrastructure that supports e-business and e-commerce includes software systems such as ERP, CRM, and SCM.

The most common method of conducting e-commerce and e-business is to use the Internet to electronically exchange data. The next section presents the historical development of the Internet, which provides insight into its current widespread application in the business world.

Figure 5-1



THE HISTORY OF THE INTERNET

Much of the technology foundation upon which the Internet is based was developed by university and military researchers nearly 50 years ago. To understand the current status of the Internet, it is useful to briefly review the historical development of the Internet and the underlying technology. In 1965, a researcher at MIT connected a computer in Massachusetts to a computer in California, using dial-up telephone lines. During this time, the U.S. military needed a method of sharing data and research among universities that were working on defense research projects. In 1969, the large computers at four major universities were connected via leased telephone lines. This network, used by the United States Defense Advanced Research Project Agency, grew into a network called ARPANET. The purpose of the network was to share military research data among UCLA, UC Santa Barbara, Stanford, and the University of Utah. Over the next few months, many other universities, NASA, and the Rand Corporation were connected to this network.

Two of the technologies developed for ARPANET form the basic foundation of the Internet of today. Packet switching and routers are

necessary to send data over the network. **Packet switching** is the method used to send data over a computer network. Computer data are divided into packets (small packages of data). Each packet is sent individually over the network, with each packet possibly transmitted via a different route. When the packets arrive at the destination, they are reassembled into the correct order to recreate the original data. When data are sent packet switched, small parts of the data are transmitted, they are verified for correctness, and then more information is sent toward the destination.

A **router** is an electronic hardware device that is located at the gateway between two or more networks. The router forwards the packets of data along the best route so that the data reach their destination. The ARPANET used both of these technologies, which have continued to be used in the Internet of today.

The ARPANET was developed during the height of the Cold War and nuclear weapon proliferation. Thus, the network was designed so that if some of the sites were destroyed by a nuclear attack, the other sites could still function and share the military research data. Therefore, routers were designed to route the network traffic via many possible alternative routes.

E-mail, which is simply another form of data that can be transmitted over a network, was adapted to ARPANET in 1972. Ray Tomlinson of BBN Technologies developed the idea of using the @ symbol to separate the username from the address. BBN Technologies has been involved in much of the development of the Internet. BBN Technologies also developed a communication protocol for ARPANET that is still used today. Since there were several different brands, or types, of computers in the network ARPANET, a common communication protocol was necessary to allow different types of computers to communicate. A **protocol** is a standard data

communication format that allows computers to exchange data. Computers must have a common communication method to be linked together in a network. As an analogy, think about what would happen if a foreign exchange student from Japan met a foreign exchange
student from Spain in the hallway of the business building at your college. They would be completely unable to communicate in their native languages. However, if both were accompanied by an English translator, their native languages could be translated into English, communicated between the translators (the network), and then translated into the language of either student. Likewise, a common and standard communication protocol allows computers with different operating systems to communicate on a network. Thus, a UNIX® computer, or Digital Equipment Company's (DEC) OpenVMS can communicate with a
Windows or Apple computer.

In the 1970s, BBN Technologies helped develop the TCP/IP protocol that continues in use in the Internet today. **TCP/IP** is an abbreviation for transmission control protocol/Internet protocol.

Through the 1970s and 1980s, the ARPANET continued to add universities, research organizations, and libraries to its network. However, other than universities, libraries, and research organizations, there were no other users of ARPANET. In 1986, the National Science Foundation (NSF) funded and began to develop a backbone set of servers, gateways, and networks that eventually became what we now call the Internet. The NSF also set rules for the use of the Internet by government, university, and research users. Throughout its history of development, and until the early 1990s, the Internet was not user friendly and was not used by the general public. The **Internet** is the global computer network, or "information super-

highway.” The term “Internet” comes from the concept of *inter*connected *net*works. Thus, the Internet evolved from a variety of university- and government-sponsored computer networks built largely for research. That network became the Internet and is now made up of millions upon millions of computers and subnetworks throughout the world. The Internet serves as the backbone for the World Wide Web (WWW).

In 1993, Marc Andreessen developed the first graphical user interface (GUI) browser, which he named Mosaic. Using the ideas and concepts in the Mosaic browser, Andreessen developed the Netscape® Navigator Web browser. Netscape became a phenomenon and fueled the use of the Internet by the general public. A GUI browser made the use of the Internet user friendly so that the Internet could be used by the general public. During this period, more commercial enterprises became involved in adding to the network backbone of servers, routers, and gateways. In 1992, commercial enterprises such as Delphi Corporation and America Online (AOL) began offering Internet access to subscribers. This was the first time that the general public could access the Internet by buying a monthly subscription account with an Internet service provider. In 1994, the first business transaction occurred on the Internet.

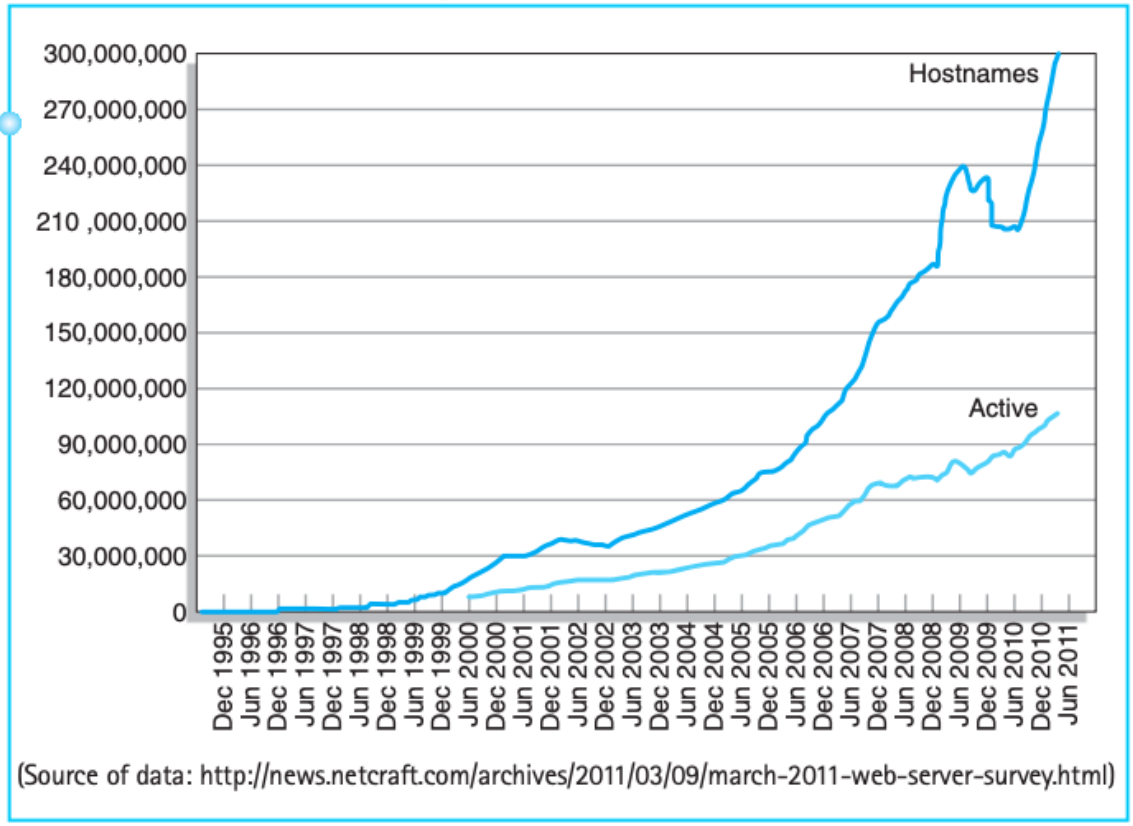
In 1995, the NSF relinquished control of the Internet backbone to commercial enterprises, and the NSF funded backbone was separated from the Internet and returned to a research network. Since that time, all Internet traffic has been routed through commercial networks. The latter half of the decade of the 1990s saw the explosive growth of the Internet. Retailers and other corporations began to conduct business via the Internet, and many new Internet-based companies were formed. Companies such as Amazon.com, eBay, Webvan, and Pets.com were started during this time.

These are only a few examples of the so-called dot-com firms of the 1990s, some of which did not survive beyond the beginning of the next decade.

As the Internet grew, the backbone was continually updated and improved to build in additional servers, routers, and networks that transmit data much faster. The speed and the amount of network traffic grew very rapidly as the technology allowed improvements. The exponential growth of the Internet throughout its life can be seen in figure 5-2.

As you will note by looking at figure 5-2, there have been a few periods of decline in the number of Web servers, such as during economic downturns in 2002 and 2009. However, the overall trend shows exponential growth since the Internet was commercialized.

Figure 5-2



THE PHYSICAL STRUCTURE AND STANDARDS OF THE INTERNET

THE NETWORK

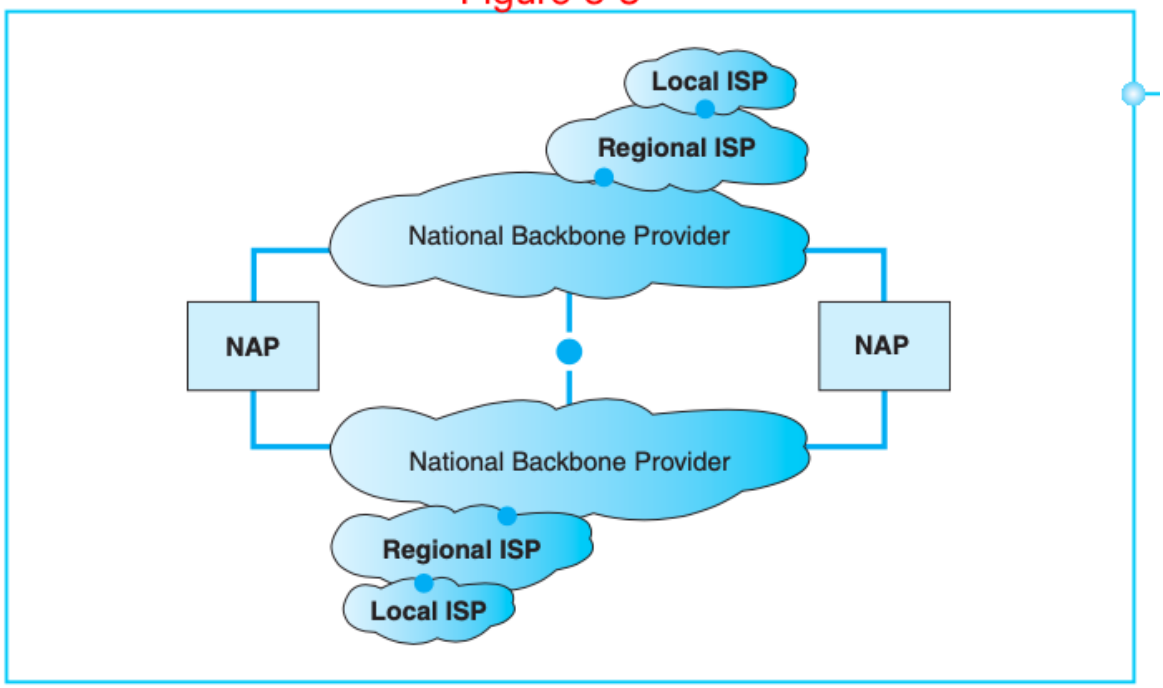
Figure 5-3 shows the types of organizations that make up the interconnected networks of the Internet. The Internet includes backbone providers, network access points, regional Internet service providers (ISPs), local ISPs, and Internet subscribers. The Internet is a hierarchical arrangement: There are a few large backbone providers, many more regional and local ISPs, and millions of Internet subscribers. Internet subscribers are the individual users of the Internet.

A **backbone provider** is an organization which supplies access to high-speed transmission lines that make up the main network lines of the Internet. Much like the way that your spinal bones, or backbone, support all the skeletal systems of your body, the Internet **backbone** is the main trunk line of the Internet. The backbone has extremely high capacity and high-speed network lines. The actual speed and capacity of the backbone lines continually increase as the technology is upgraded, and the speed of the U.S. backbone is 1 trillion bytes per second. This means that one trillion bits of data could be transmitted over the network lines in one second. The backbone providers connect to each other either directly through private lines or through network access points (NAPs). Major backbone providers in the United States are companies such as Sprint,AT&T, and UUNET.

Regional ISPs connect to the backbone through lines that have less speed and capacity than the backbone. The network lines used to connect regional ISPs to the backbone are usually T3 lines. A T3 line carries data at 44.476 megabits per second (44 million bits per second). Local ISPs connect to regional ISPs by either T3 or T1 lines. A T1 line carries data at a speed of 1.544 megabits per second (Mbps). Regional and local ISPs usually use

several T3 or T1 lines simultaneously. You might envision how this works by thinking about water hoses. If you squirt one water hose at a house fire, only a small volume of water reaches the fire.The use of four water hoses, all aimed at the same fire, will send four times the volume of water. Examples of local ISPs are local telephone companies and local cable companies.

Figure 5-3



Local ISPs connect individual users to the Internet. These Internet subscribers are connected to local ISPs using either dial-up modems, digital subscriber lines (DSL), or cable TV lines. Dial-up modem speeds are typically 56 kilobytes per second, while DSL speed is usually approximately 5 mbps and cable broadband speeds are approximately 5 to 10 mbps.

At each of these organizations and gateways, there are computers that function as Web servers. A **Web server** is a computer and hard drive space that stores Web pages and data. These Web servers respond to requests

for Web pages or data and transmit the Web pages or data over the network. Through these interconnected networks and Web servers, any computer connected to the Internet can communicate with any other computer on the Internet. This system enables e-business, e-commerce, and e-mail to function as we know it today.

THE COMMON STANDARDS OF THE INTERNET

Since any computer can theoretically link to any other computer on the Internet, there must be common and standard methods to display and communicate the data transmitted via the Internet. Each computer on the Internet uses the TCP/IP protocol to communicate with the network. While every computer connected to the Internet could possibly be part of the World Wide Web, every such computer is not necessarily part of the Web. The World Wide Web is an information-sharing network that uses the Internet as the network to share data.

Web pages that are part of the World Wide Web are available to anyone using a Web browser. However, a common way to present and read the data on a Web page is also necessary. The language invented to present data on websites is **HTML,** a hypertext markup language. Nearly all websites use HTML to format the words, data, and pictures that you see on a Web page. Figure 5-4 shows a very simple Web page and the HTML source code that formats and presents the words and the arrow symbol on this Web page. There are many users of the Internet throughout the world, using different types of computers with different operating systems. The common formatting language HTML for Web pages allows any computer to display the Web page the way it was intended to be displayed. HTML has evolved over the years to increase functionality and security. The current standard, HTML 5, allows much richer use of video and audio, as well as better security than

the previous versions. These enhancements make the Internet user-friendly for browsing, and also increase its usefulness for e-commerce or e-business.

In addition to a standard communication protocol and a standard formatting language for Web pages, there must also be a common addressing method to store and locate Web pages. The addresses of websites and Web pages use a uniform resource locater (URL) address. A **URL** is the address you type in to reach a website. For example, the URL address of the Google search engine is http://www.google.com. The “http” in a URL address stands for “hypertext transmission protocol.” When you type in a URL, your Web browser actually sends an http command to a Web server, directing the server to find and transmit the Web page you requested.

In a URL address such as http://www.google.com, the google.com part is called the **domain name**—the unique name that identifies the Internet site. Organizations must register a domain name to own its exclusive use. For example, The Coca-Cola Company has registered, and pays a monthly fee to own and use, the domain name coke.com. Domains have a suffix that indicates the type of organization owning the rights to that domain name. In the United States, some of the common suffix portions of domain names are as follows:

Suffix	**Organization Type**
.com	commercial business
.edu	educational institution
.org	nonprofit organization
.gov	governmental organization or unit
.mil	military organization
.net	network or commercial business

For domains outside the United States, the suffix indicates the country. For example, .ca is Canada and .au is Australia.

The URL addressing system actually uses IP addresses rather than domain names that are spelled out. An IP address is an Internet protocol address. A given domain name is associated with a single IP address. In the same way that your postal address allows your mail carrier to locate your exact home, an IP address is the unique information that allows a specific website or server to be located.

There are specialized servers on the Internet called domain name servers (DNS), which function to store, index, and provide the IP address for each domain name. When a domain name such as coke.com is typed into a Web browser, a request is sent to a DNS to find the IP address of the domain, and the website is located on the basis of the IP address.

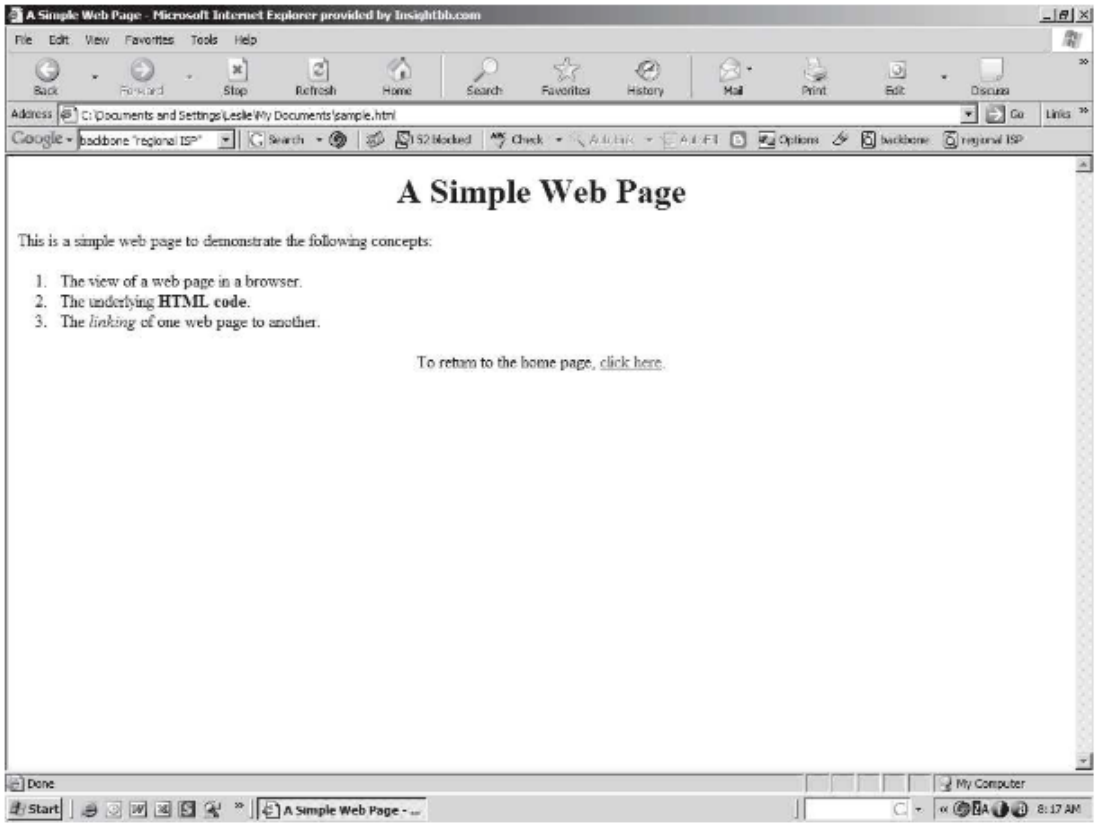
Since the Internet is an open network system that anyone can access, there are those who misuse the Internet for illegal and fraudulent activity. Examples of such risks are hackers, identity thieves, password sniffers, and denial of service attacks. Without an extra layer of protection, any data exchange between a user and a Web server is open for anyone to read. This means if you enter your credit card number on an e-commerce website, your credit card number and other data can possibly be intercepted. Therefore, the majority of e-commerce sites use common forms of encryption and data protection.

The standard form of encryption embedded in e-commerce sites and in Web browser software is **secure sockets layering** (**SSL**), an encryption system in which the Web server and the user's browser exchange data in encrypted form. The Web server uses a public encryption key, and only the browser interacting with that Web server can decode the data. Web browsers

in use today use 128-bit encryption. Persons using a Web browser will know they are connected to a secure encrypted site that uses SSL by seeing two things in their Web browser. First, a website using SSL will have a URL address that begins with https://. The extra “s” at the end of the http denotes a secure site. Also, most browsers show a picture of a locked padlock in the lower bar of the Web browser. SSL and encryption allow the general public to conduct e-commerce over websites with less fear of exposure regarding credit card or other private information.

The Internet network, the World Wide Web, and the common standards used allow the general public to browse the Web, share data, send e-mail, and conduct e-commerce. The next section describes e-commerce.

Figure 5-4




```
<html>
<head>
<title>A Simple Web Page</title>
</head>
<body>
<h1><center>A Simple Web Page</center></h1>
This is a simple Web page to demonstrate the following concepts:
        <ol>
        <li>The view of a Web page in a browser.</li>
        <li>The underlying <b>HTML code</b>.</li>
        <li>The <i>linking</i> of one Web page to another.</li>
        </ol>
<center>To return to the home page, <a href="www.simplesite.com/index.htm">click
here</a>.</center>
</body>
</html>
```

E-COMMERCE AND ITS BENEFITS

There has never been complete agreement on an exact definition of e-commerce. However, most would agree that e-commerce is a transaction between a business and customer, in which the transaction information is

exchanged electronically. Under such a broad definition, there are many forms of exchange that could be called e-commerce. The use of a credit card at a department store, ATM transactions with a bank, EDI transactions between vendor and buyer, and Web-based transactions all fit into this definition of e-commerce. With the explosive growth of "Web-based" commerce in the last decade, ecommerce has widely come to be thought of as Web-based. That is, the average person thinks that e-commerce is Web-based commerce. Since Web-based commerce is the most common form of e-commerce, this section will focus on the Web-based form of e-commerce.

Hereafter, the references to e-commerce will be to Web-based e-commerce. Also, e-commerce will refer to business-to-consumer sales. The common term for business-to-consumer e-commerce is **B2C**. Conversely, the term e-business will include business-to-business electronic transactions. The common term for business-to-business electronic sales is **B2B**.

B2C sales are transactions between a business and a consumer, which usually involve a retail or service company whose customers are end-user consumers. While there are literally thousands of different types of B2C transactions, some examples are as follows:

1. Buying a book on Amazon.com

2. Downloading a song purchased from Apple's iStore

3. Buying an airline ticket on Expedia.com

4. Buying a computer at Dell.com

The common aspect in these transactions in that the consumer interacts with the business via the business's website.

There are many advantages of B2C sales to the business and to the customer. Both parties benefit from the increased access to the market, the speed and convenience of e-commerce, and the ability to share information.

BENEFITS AND DISADVANTAGES OF E-COMMERCE FOR THE CUSTOMER

The major benefits to the customer of buying products or services relate to the increased access, speed, convenience, and information sharing mentioned previously. More specifically, the benefits to the customer are the following:

1. E-commerce provides access to a much broader market for goods and services. By using e-commerce, the customer is not constrained by geography or geographic boundaries. If a customer wishes to buy a shirt, he can access any number of websites selling shirts, some of which may be in other states or countries. The customer need not physically visit a store to buy.

2. E-commerce also provides more convenient times for shopping. Orders can be placed 24 hours a day, 7 days a week. As mentioned in item 1, the customer does not need to go to a store to buy the product or service and is not limited by location or hours of operation of the website, as he would be when shopping at a store.

3. The wider access to the marketplace also provides more choices to the customer. This may enable the customer to more easily find the same product at a less expensive price. In addition, the wider market access may allow the customer to find a product with better features at a more competitive price.

4. E-commerce is likely to provide lower prices, for many reasons. Businesses that sell via e-commerce can reduce many costs, and these cost

savings can be passed on to the customer. The details of the cost savings will be discussed later in the section on the benefits to businesses of e-commerce. In addition, the customer may not be required to pay sales taxes for e-commerce purchases. However, in many cases, the tax savings may be offset by shipping or delivery costs.

5. The information-sharing aspect of the Internet and World Wide Web allows the customer to exchange information with businesses before, during, and after the purchase. Some e-commerce websites have live chat sessions with product or service specialists to answer questions.

6. E-commerce can allow quicker delivery of the product, enabled by the faster processing time of e-commerce. To fill an order, the business does not have to undertake steps such as entering order information into the computer system. As soon as the customer enters the order via the website, order processing can begin.

7. Customers can receive targeted marketing from businesses that they frequently purchase from. For example, Amazon.com analyzes customer buying patterns and can recommend specific books that may be of interest to the customer.

While there are significant advantages to e-commerce to the customer, there are also disadvantages. The free and open nature the World Wide Web allows the opportunity for fraud, theft of assets, or theft of data. Customers have concerns about the privacy and security of personal information shared with businesses during e-commerce transactions. Hackers and identity thefts can potentially steal credit card information, banking information, and private data. Because such concerns may prevent some customers from purchasing via e-commerce, businesses must respond by trying to ensure the security

and privacy of customer data. The details of privacy principles are covered later in this chapter.

The other disadvantage for the customer is the inability to handle or try out the product. Compared with a store shopping experience, the customer does not have the same ability to see and handle the product.

BENEFITS AND DISADVANTAGES OF E-COMMERCE FOR THE BUSINESS

Advantages to the business are as follows:

1. E-commerce provides access to a much broader market, including the potential of a global market for even small businesses. Traditional geographic boundaries are no longer a constraint if the business uses e-commerce.

2. Dramatically reduced marketing costs are a typical result of the expanded market. While a business may still spend for advertising, such as for Web based ads, the cost per customer reached is usually substantially less than that for traditional forms of marketing. For example, suppose that an electronics store can place a local television advertisement at a cost $10,000 to reach 10,000 customers. That same amount spent on a Web-based ad has the potential to reach millions of potential customers.

3. E-commerce provides the potential for much richer marketing concepts that include video, audio, product comparisons, and product testimonials or product tests. On its website, the business can provide links to these marketing tools.

4. The company can quickly react to changes in market conditions. For example, if market changes require price drops, the business can quickly change prices on the website, and all customers will see the new price immediately. If a company uses mail-order catalogs instead of e-commerce,

price changes can occur only when a new catalog is printed. If a chain store such as Walmart wished to change prices in all of its stores in a specific region or state, it would be somewhat time-consuming to update the signs and systems in order to institute the price changes.

5. The business using e-commerce is likely to experience reduced order processing and distribution costs. Order-processing costs are reduced because e-commerce automates all or most of the order processing. Rather than business employees taking sales orders by phone or mail and keying them into the IT system, the customer enters all order information. Distribution costs are reduced simply because e-commerce uses a much different model than traditional retail businesses. Many e-commerce businesses do not maintain stocks of inventory in stores or warehouses. The business may instead order only when the customer orders and have the product drop-shipped directly from the supplier to the customer.

6. The customer convenience aspect of e-commerce means that the business is likely to experience higher sales.

7. Higher sales coupled with reduced marketing, order processing, and distribution costs can lead to much higher profits.

There are also some disadvantages to e-commerce, for businesses. The IT systems necessary to conduct e-commerce are usually much more complex and costly. The e-commerce software and systems must also be implemented in a way that integrates the existing general ledger, inventory, and payment IT systems. In addition, the free and open nature of the World Wide Web opens a business to greater chances for fraud, hackers, and compromised customer privacy.

THE COMBINATION OF E-COMMERCE AND TRADITIONAL COMMERCE

Much of the preceding discussion focused on the comparison of e-commerce with traditional forms of commerce, namely, catalog and store commerce. However, in the retail environment of today, most retailers or service businesses use a combination of traditional commerce and e-commerce. For example, Walmart, Target, and Kmart are traditional store-based retailers that now also offer to customers Web-based shopping. Local, regional, and national banks all used to depend on customers' walking, riding, or driving to a bank branch office. Today, banks also offer Web-based banking. So, traditional forms of commerce have changed to incorporate e-commerce. However, the converse is true also. Many e-commerce retailers that began purely as e-commerce forms of business

have found that they must add the traditional customer interaction in the form of stores or offices. For example, E*TRADE Financial Corp., a Web-based brokerage firm, found that to better service customers, it needed some physical office locations. E*TRADE opened offices around the country and placed a link on its website, called "Physical Locations." The Web page that customers access by clicking on that link presents the addresses of regional offices of E*TRADE in large cities.

This merging and melding of forms of commerce has led to new terminology in the world of commerce. Companies that work from purely traditional stores, are called **bricks and mortar** retailers in e-commerce. At one point in the evolution of e-commerce, businesses that were purely Web-based were called **e-tailers**. As businesses merged the two, the resulting combined forms are referred to as **clicks and mortar** businesses. Alternatively, some call this form of business **bricks and clicks**.

PRIVACY EXPECTATIONS IN E-COMMERCE

The fourth risk area of IT systems described in the AICPA Trust Services Principles is “online privacy.” Regarding this risk area, the Trust Services Principles states that the “online privacy principle focuses on protecting the personal information an organization may collect from its customers, employees, and other individuals” through its e-commerce systems. This personal information consists of many different kinds of data. The Trust Services Principles provide the following partial list of personal information to be protected:

- Name, address, Social Security number, or other government ID numbers
- Employment history
- Personal or family health conditions
- Personal or family financial information
- History of purchases or other transactions
- Credit records

In the course of conducting business with customers, an organization may have legitimate reasons to collect and keep these customer data. However, to conduct e-commerce, the organization must provide to customers a level of confidence in the privacy and security of this kind of personal information shared. To engender such confidence, the organization must demonstrate to customers that it has taken appropriate steps to ensure privacy. The Trust Services Principles explain ten privacy practices that an organization should follow to ensure adequate customer confidence regarding privacy of information, as follows:

1. Management. The organization should assign a specific person or persons, the responsibility of privacy practices for the organization. That responsible person should insure that the organization has defined and documented its privacy practices. That person should also insure that privacy practices have been communicated to both employees and customers. Management would also include the responsibility to insure that privacy practices are followed by employees.

2. Notice. The organization should have policies and practices to maintain privacy of customer data. Notice implies that the company provides the privacy practices to customers in some form. At the time that data is to be collected, a notice should be available to the customer that describes the privacy policies and practices. Many e-commerce organizations accomplish this by providing a link on their website to privacy policies. Notice should include information regarding the purpose of collecting the information, and how that information will be used.

3. Choice and consent. The organization should provide choice to its customers regarding the collection of data, and also should ask for consent to collect, retain, and use the data. The customer should be informed of any choices that the customer may have to opt out of providing information. The customer should have access to descriptions about the choices available. The customer should also be able to read policies about how the data will be used. As in “notice” above, these descriptions usually are in the form of a link to privacy policies.

4. Collection. The organization should collect only the data that is necessary for the purpose of conducting the transaction. In addition, the customer should have provided implicit or explicit consent before data is collected. Explicit consent might be in the form of placing a check mark by a

box indicating consent. Implicit consent occurs when the customer provides data that is clearly marked as voluntary, or when the customer has provided data and has not clearly stated that it cannot be used.

5. Use and retention. The organization uses customers' personal data only in the manner described in "notice" from part a. on page 590. The use of this data occurs only after the customer has given implicit or explicit consent to use the data. Such personal data is retained only as long as necessary.

6. Access. Every customer should have access to the data provided so that the customer can view, change, delete, or block further use of the data provided.

7. Disclosure to third parties. In some cases, e-commerce organizations forward customer information to third parties. Before this forwarding of data occurs, the organization should receive explicit or implicit consent of the customer. Personal data should only be forwarded to third parties that have equivalent privacy protections.

8. Security for privacy. The organization has necessary protections to try to insure that customer data is not lost, destroyed, altered, or subject to unauthorized access. The organization should put internal controls in place that prevent hackers and unauthorized employees from accessing customer data.

9. Quality. The organization should institute procedures to insure that all customer data collected retains quality. Data quality means that the data remains "accurate, complete, current, relevant, and reliable."

10. Monitoring and enforcement. The organization should continually monitor to insure that its privacy practices are followed. The

organization should have procedures to address privacy related inquiries or disputes.

In summary, these practices require that a company establish, enforce, monitor, and update policies and practices that protect the privacy and security of customer information. The company should consider not only its own privacy practices and policies, but also the practices and policies of any third parties who will share information. Companies that fail to establish good policies or that fail to enforce policies have violated the ethical standards that customers expect when conducting e-commerce. The ethics-related aspects of privacy are addressed at the end of this chapter.

E-BUSINESS AND IT ENABLEMENT

As discussed previously, e-business is a very broad, encompassing term for the electronic enabling of business processes. The business processes enabled by IT systems can be internal and external. Examples of internal processes are the movement of raw materials within a company, the timekeeping and labor management of workers, the dissemination of employee information such as health and retirement benefits, and the sharing of data files among workers. These types of internal processes can be streamlined and enhanced by incorporating electronic forms of these processes through the use of IT systems. Likewise, there are many external business processes that can be streamlined and enhanced through the use of IT systems. For example, the processes that involve suppliers and distributors can be streamlined, enhanced, and improved by the use of IT systems.

The **supply chain** is the set of linked processes that take place from the acquisition and delivery of raw materials, through the manufacturing, distribution, wholesale, and delivery of the product to the customer. The

supply chain includes vendors; manufacturing facilities; logistics providers; internal distribution centers such as warehouses, distributors, and wholesalers; and any other entities that are involved, up to the final customer. In some cases, the supply is larger at both ends because it can include secondary suppliers to the company's suppliers and the customers of the company's immediate customers. Figure 5-5 illustrates the entities in a sample supply chain for a manufacturer and the relationships between those entities. Service firms have a less complex supply chain.

To gain an understanding of the supply chain, it may be helpful to begin in the middle of the exhibit. A manufacturer makes products. Upon completion of the manufacturing, the finished products are sent to and stored in warehouses. As those products are needed, they are shipped to distributors or wholesalers. The distributors or wholesalers eventually ship the products to retail companies, and the retail companies sell the products to end-user consumers.

However, before a manufacturing company can produce products, it must buy the raw materials that are the ingredients of the products. For example, a wine maker must buy grapes. In some instances, a manufacturing company's supply chain may include secondary suppliers. For example, a company that manufactures personal computers (PCs) may buy components such as graphics cards from a supplier. The supplier, however, makes the graphics cards after buying chips and circuit boards from secondary suppliers. While there may not be direct exchanges between the manufacturer (maker of the PC) and the secondary supplier's (the chip maker), the secondary supplier's performance and product quality have a dramatic effect on the manufacturer. For example, if the chip maker runs out of chips, the graphics card maker is prevented from making graphics cards

on time, which thereby makes the PC maker unable to make and ship PCs. Similarly, poor quality chip production by the chip maker affects the quality of the graphics board, and therefore the quality of the PC.

This interdependency of entities in the supply chain means that companies should be interested in enhancing and streamlining the processes and exchanges that occur throughout the supply chain. Poor quality, slow performance, or a process bottleneck anywhere in the supply chain affects other parts of the supply chain. There is an old saying that a chain is only as strong as the weakest link. Similarly, a supply chain is only as efficient as its weakest, or most inefficient, link.

Many interactions between entities and many business processes must occur to complete the steps that result in raw materials being converted into products and eventually sold to the customer. Any of these processes or linkages between entities can be enabled or enhanced by the use of IT systems. Any that are enabled by IT become a part of e-business. This view of the supply chain shows how broad the scope of e-business is in comparison with e-commerce. E-commerce, or B2C sales, includes only the extreme right-hand part of the diagram in figure 5-5, when the sale is between a company and the end-user customer. E-business includes the entire supply chain, and there is overlap between e-business and e-commerce. E-commerce is a subset of e-business.

Some companies may choose to be involved in many parts of their supply chain. For example, a vertically integrated company may have its own related subsidiaries so that each of the interactions within the supply chain is owned or controlled by the larger corporate entity. Vertical integration occurs when a single company owns all of the entities that make up the

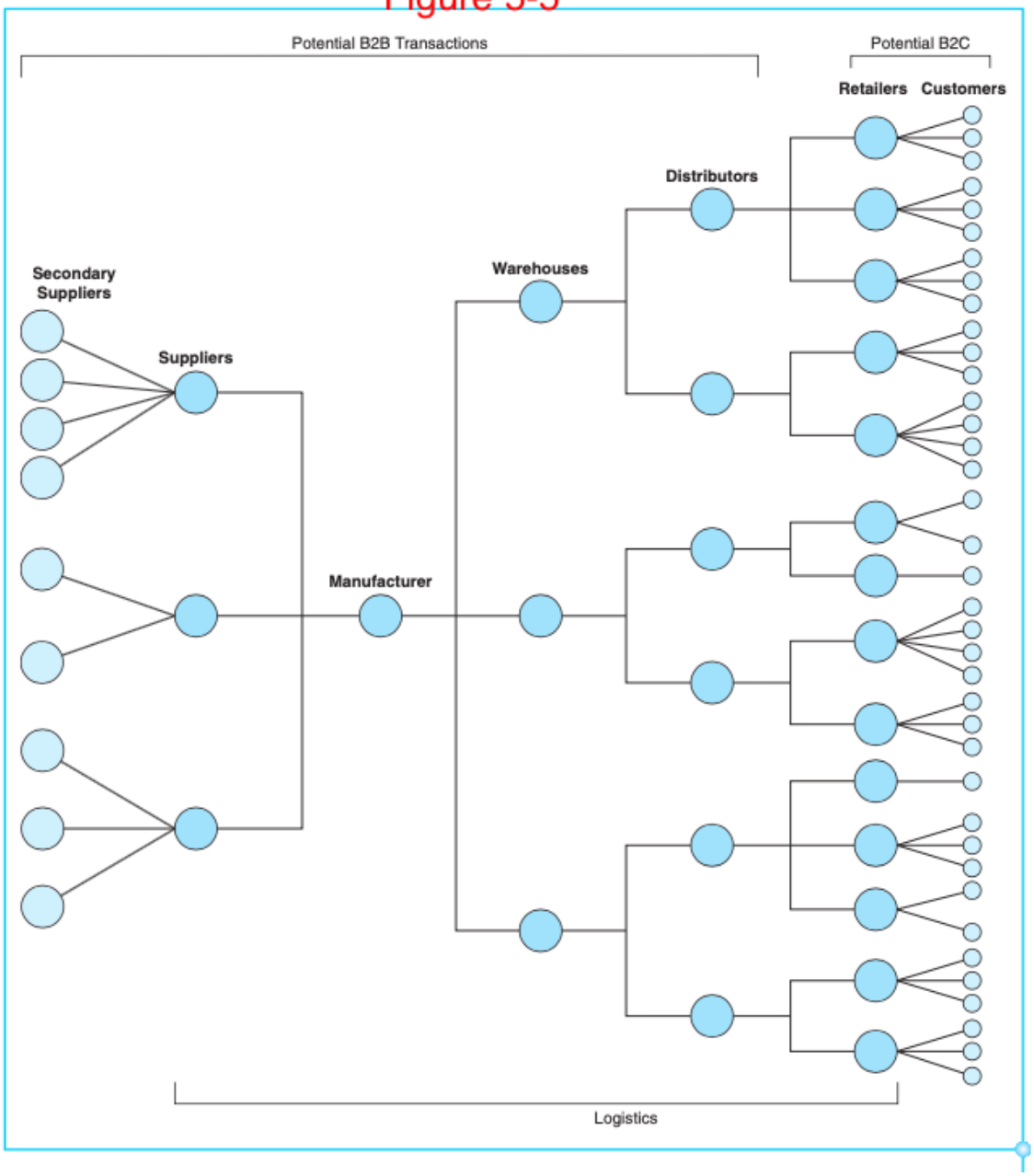
supply chain, from the movement of raw materials to the delivery of the finished product to the customer.

Other companies may choose to focus on only a small part of the supply chain. For example, a company could choose to do only the manufacturing portion of the supply chain; all other entities within the supply chain, such as suppliers, distributors, wholesalers, and retailers, are separate companies. These differing levels of integration within the supply chain mean that the processes which occur within a supply chain may be internal to a company or may involve exchanges with external companies. In either case, internal or external, those processes and exchanges can be streamlined or enhanced through e-business.

The “Logistics” label in figure 5-5 illustrates that there are entities within the supply chain whose function is to provide the physical support that moves materials and goods between parts of the supply chain. For example, a manufacturer must have a means of moving raw materials from the supplier to the plant and of moving finished goods from the plant to the warehouse and distributor. Logistics are the types of services provided by entities such as trucking companies, air and rail freight companies, and freight expediting companies.

Any of the interactions between the entities within the supply chain can be a point at which e-business can be applied to streamline or reduce costs. The next section describes a smaller subset of e-business interactions within the supply chain: B2B, or business-to-business electronic transactions.

Figure 5-5



B2B: A PART OF E-BUSINESS

B2B is the sale of products or services between a business buyer and a business seller that is electronically enabled by the Internet. In B2B sales, neither buyer nor seller is an end-user consumer. Although there are many ways to conduct business electronically between businesses, this chapter

focuses on Internet based e-business. As in the case of e-commerce, both parties benefit from the increased access to the market, the speed and convenience of e-business, and ability to share information. There are also many differences between B2C and B2B transactions, as illustrated in figure 5-6. When comparing B2B with B2C, B2B has the following differing characteristics:

- The transaction or exchange is between businesses.
- The order would have many line items, and the dollar amount of each sale is usually large.
- While a B2C sale might be a single book purchased from Amazon, a B2B sale might be tons of raw materials, as in the case of grapes to make wine.
- The B2B sale will have specific shipping details such as type of carrier used, delivery dates, and locations of delivery to different plants within the company.
- The B2B transaction can involve electronic forms of standard business documents such as purchase order and invoice.
- The B2C transaction is between the company and any potential customer on the Internet. There need not be any preexisting relationship. The B2B transaction is between buyer and supplier, and the parties usually have a preexisting relationship. The buyer knows which suppliers it will use, and the supplier knows that the buyer will be buying raw materials or services. The buyer and supplier would have already negotiated many of the details of the transaction, such as prices, discounts, payment terms, credit limits, delivery dates, and locations of delivery.

Figure 5-6

Differences between E-Commerce and E-Business

E-COMMERCE, or B2C	E-BUSINESS, or B2B
• Business-to-consumer	• Business-to-business
• Few line items per order	• Many line items per order
• Large order volume	• Very specific shipping data
• Geared to consumer's ease of use	• User-selected information content and interaction tools, deeper functionality
• Use of credit card purchasing	• Use of purchase orders • Sophisticated transaction protocols
• No necessity of a preexisting relationship between buyer and seller	• Buyer and seller usually have a pre-existing relationship and negotiated prices and delivery details

When conducted via the Internet, B2B transactions between supplier and buyer offer many advantages to both parties. Many of the advantages are similar to those described in the e-commerce section of this chapter. Internet-based transactions offer a wider potential market, reduced transaction cost, and higher profits. B2B will also result in faster cycle times for the purchases from suppliers. The cycle time is the time from the placement of an order for goods to the receipt of, and payment for, the goods. The faster cycle time results from the increased efficiency

of processing transactions via the Internet. In B2B transactions between suppliers and buyers, the two IT systems exchange data through the Internet network. The Internet allows companies to reduce or eliminate manually keying the order into the computer system, mailing documents to initiate the order, entering receipt of goods, and keying in documents to initiate payment. The fact that the two IT systems communicate eliminates data errors, since data may no longer be manually keyed into the system.

E-BUSINESS ENABLEMENT EXAMPLES

There is much more to e-business than just B2B transactions. The Internet can be used in many different ways to streamline business processes, reduce operational costs, and enhance efficiency that it is difficult to describe the entire range of e-business possibilities. The summaries that follow are real business examples of the ways in which businesses adopt e-business strategies.

These examples illustrate the broad nature of e-business, even though they do not encompass all the ways that e-business is used to streamline processes, reduce costs, and improve relationships with suppliers, distributors, wholesalers, retailers, and customers. To gain the advantages available in e-business, organizations must utilize various levels of networks within and attached to the Internet. Companies must use the Internet network to interact electronically with the entities in the supply chain. The levels of the Internet network structure that enable e-business are the Internet, extranets, and intranets. These levels of the network serve as the platform to connect parties throughout the supply chain.

The Real World

General Electric Company (GE)

On April 26, 2000, Jack Welch, the well-known CEO of General Electric Company, spoke at the GE annual meeting of shareholders and described how e-business affects four aspects of business at GE. He called these four areas "buy, make, sell, and strategic." Regarding these four areas, he said the following:

On our "buy" side, we now measure the number of auctions on line, the percentage of the total buy on line and the dollars saved.

On the "make" portion, the Internet is all about getting information from its source to the user without intermediaries. The new measurement is how fast information gets from its origin to users and how much unproductive data gathering,

expediting, tracking orders and the like can be eliminated. This tedious work in a typical

big company is the last bastion—the Alamo—of functionalism and bureaucracy. Taking it out improves both productivity and employee morale.

On the "sell" side, the new measurements are number of visitors, sales on line, percentage of sales on line, new customers, share, span and the like.

Strategically, the breadth of our business portfolio exposes us to a very wide range of emerging companies, many of them Internet based. This intimate knowledge

has enabled us to make successful strategic investments in over 250 companies.

Mr. Welch was indicating that GE uses e-business to improve how it buys, makes, sells, and strategically positions the company. The buy and sell concepts of e-business are somewhat evident and have been described here. However, notice that Mr. Welch indicates that e-business can be used within the company in internal processes such as manufacturing. GE uses Internet communication within the company to expedite and track orders, reducing manual processes.

General Motors Corporation (GM)

Ecommerce indicated the following about a new GM e-business initiative called eGM.

eGM has been charged with the task of transitioning GM's traditional automotive operations into a global e-business enterprise. Under the plan, GM expects to improve upon customer service, efficiency and slash costs via eGM's integration of business development, strategic e-marketing, e-sales, e-product management and technology and operations units to one central unit.

Again, notice that GM's e-business strategy included much more than sales. GM expected to apply Internet and IT systems to reduce costs through e-business based marketing and e-business management of products and parts. Mark Hogan, the division president in charge of eGM, expected that this e-business initiative would reduce internal costs by 10 percent.6 To achieve this goal, GM planned to "webify"7 the design, engineering, and manufacture of vehicles. The internal processes of tracking parts and the manufacture of cars was to be enhanced by the

use of internal websites to reduce or eliminate the manual processes and paper processing the company previously used to track and order parts, to move those parts between warehouses to plants, and to more efficiently track the manufacturing process. In addition, GM intended to use e-business to reduce the cost and improve the effectiveness of marketing efforts. Two examples of this were e-mail newsletters sent to customers and Web-based advertisements that potential buyers could click on as they surfed the Internet.

Komatsu LTD.

Komatsu is one of the world's largest manufacturers of construction, mining, and utility

equipment such as dump trucks, bulldozers, skid loaders, and backhoe loaders. Komatsu sells this equipment through distributors. To assist distributors, Komatsu uses an e-business application that allows distributors online access to price quotations for warranties. This enables distributors to quickly answer customer inquiries.

Kenworth Truck Company

Kenworth Truck Company is a leading manufacturer of heavy- and medium-duty trucks. Kenworth has established an e-business application, which they named PremierCare® Connect, that allows Kenworth dealers to provide better service to customers who buy Kenworth trucks. This Internet link between the customer, dealer, and Kenworth enables the customer to generate part inventory orders automatically when the parts need to be reordered.

3M

In addition to enhancing existing business, e-business can help build entirely new product or service lines. Using advanced software and cloud computing, 3M developed a revenue generating service called Visual Attention Service (VAS). 3M allows it customers to scientifically analyze how humans react to visual designs such as banner ads, print ads, signage, and retail space. The customer uploads to a cloud-based storage a visual design, such as a print ad for a magazine. 3M's VAS scientifically analyzes the visual design to determine the likely eye path when a

human sees the ad and highlights the areas that will most likely draw attention. This allows 3M customers to design more effective visual advertising or retail space.

INTRANETS AND EXTRANETS TO ENABLE E-BUSINESS

In many cases, interaction between entities within the supply chain occurs between entities that are part of the same company. As an example, in the eGM vignette, GM was using e-business to enhance the engineering and manufacturing of vehicles. Therefore, engineers and plant personnel have interaction electronically. This interaction within the same company would use an intranet. Figure 5-7 depicts the three levels of network platforms—intranets, extranets, and the Internet—that are used in e-business.

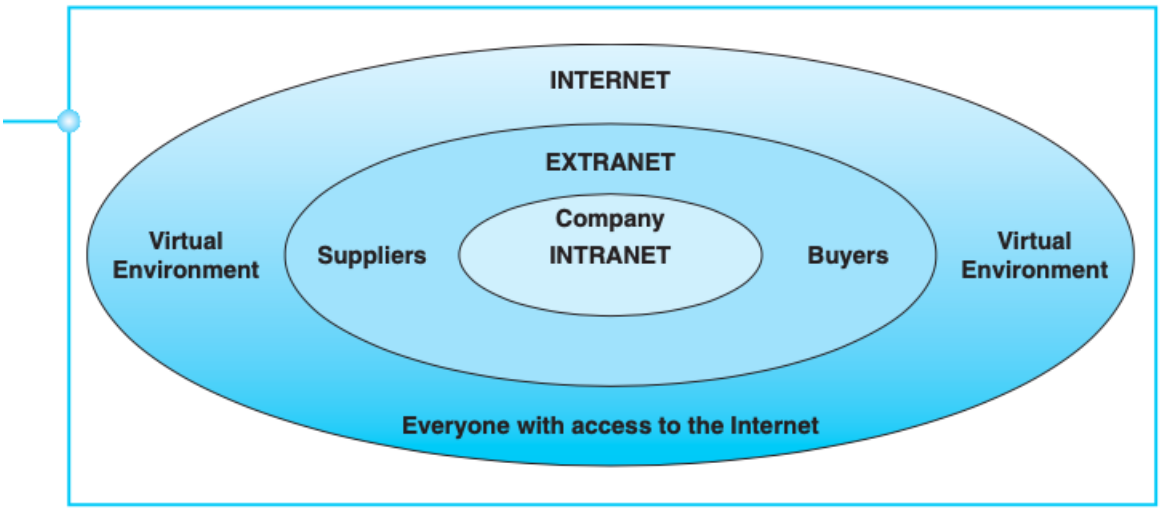
An **intranet** is a private network accessible only to the employees of a company. The intranet uses the same common standards and protocols of the Internet. An intranet uses TCP/IP protocol and the same type of HTML Web pages as the Internet. However, the computer servers of the intranet are accessible only from internal computers within the company. The purposes of an intranet are to distribute data or information to employees, to make shared data or files available, and to manage projects within the company. For example, GM engineers located in several different offices across the United States may collaborate on the design of a new car. Those engineers can share project files and information by the use of the internal network, the intranet.

To engage in B2C e-commerce, a company must access the Internet, since it is the network platform that gives a wide range of customers access to B2C sales. For example, Amazon.com could not exist as it currently does if it were not able to reach customers anywhere and anytime over the

Internet. However, when an organization engages in B2B e-business and e-business throughout the supply chain, it is not interested in reaching the general public. Instead, e-business activities require network access to entities such as suppliers, distributors, logistics providers, and wholesalers. When communicating with these entities, the company in fact needs to exclude access by the general public. For example, if Dell, Inc., is buying computer hard drives from a supplier, Western Digital Corporation, it would be more appropriate for these two businesses to use a network that does not allow the general public to have access. Rather than using the Internet, this type of exchange may use an extranet.

An **extranet** is similar to an intranet except that it offers access to selected outsiders—buyers, suppliers, distributors, or wholesalers in the supply chain. Extranets are the networks that allow business partners to exchange information through limited access to company servers and data. The external parties have access only to the data necessary to conduct supply chain exchanges with the company. For example, suppliers would need access to raw material inventory levels of the company they sell to, but they would not need access to finished product inventory levels. Conversely, a wholesaler within the value chain may need access to the manufacturer's finished product inventory, but would not need access to raw material inventory levels.

Figure 5-7



The Real World

An Extranet Example of B2B

Staples, Inc., the office supply company, provides a good example of an organization using an extranet to link to large companies to facilitate purchases of office supplies. Staples Advantage (www.staplesadvantage.com) is the extranet available only to established customers of Staples who have 50 or more employees. With a proper company ID, user ID, and password, an employee of a company can log into Staples Advantage to purchase office supplies. This e-business arrangement offers advantages to both the company buying supplies and to Staples. The company will have negotiated prices, acceptable products that employees can order, and payment

terms. These agreements give company employees convenience and control over their office supply purchases, yet at the same time allow the company to restrict the type and amount of office supplies purchased. Employees of a company using Staples Advantage can order supplies online at any time and at a pricing structure that is advantageous to the Staples Advantage customer. The Staples Advantage customer can also block its employees from purchasing certain items. For example, a company may block the purchase of furniture, printers, or fax machines.

Through such an agreement, Staples has assured itself of an ongoing customer as long as it continues to satisfy the agreement terms. Therefore, Staples increases its volume of sales but accepting a slightly smaller profit margin on each sale. The extranet provides benefits to both Staples and the companies that use Staples Advantage.

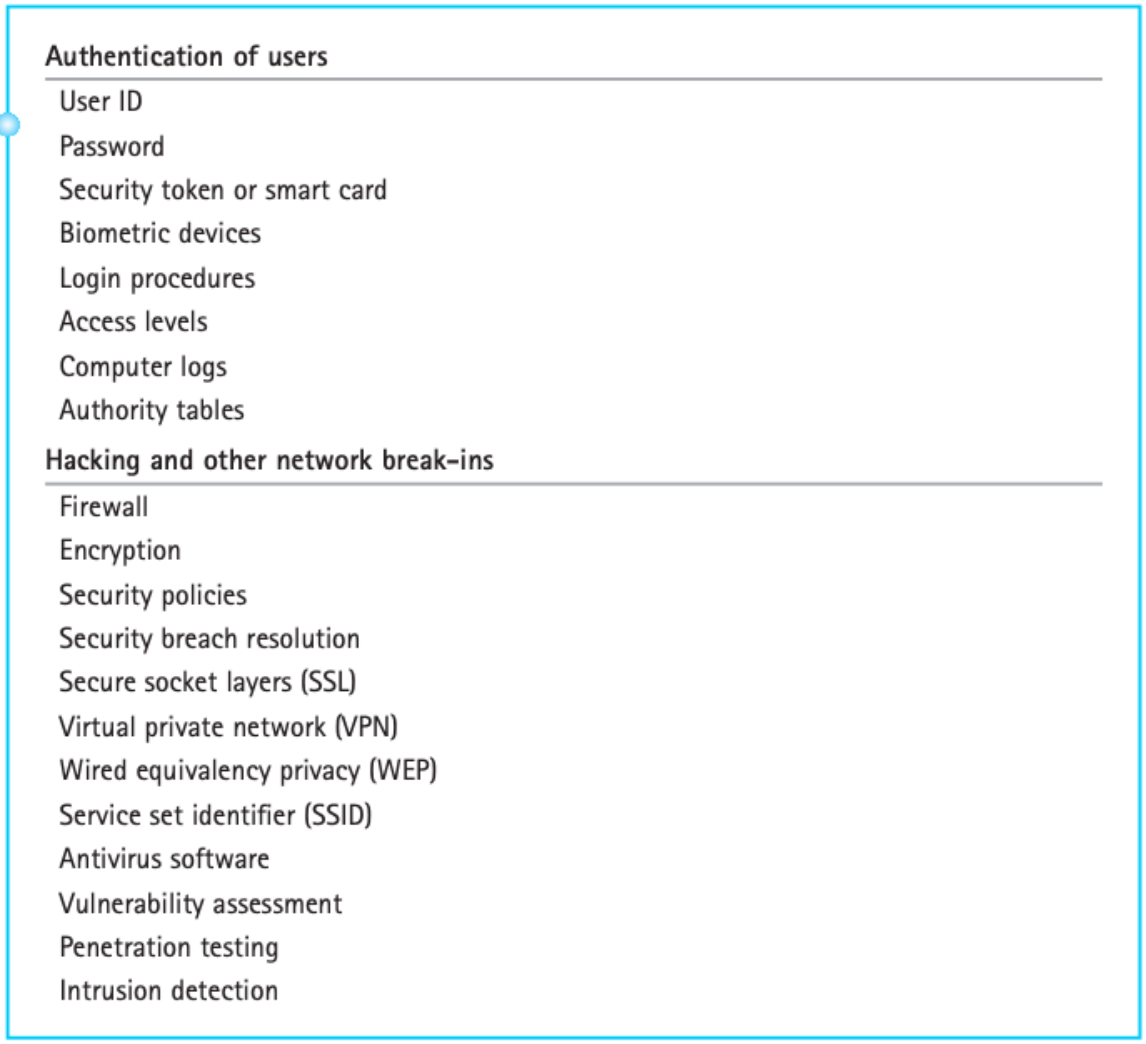
INTERNAL CONTROLS FOR THE INTERNET, INTRANETS, AND EXTRANETS

The Internet, intranets, and extranets are all networks that are intended for the sharing of information and the conducting of transactions. In all three networks, controls must be in place to limit access and prevent hackers and other network break-ins. As illustrated in figure 5-7, extranets must have more limited access than the Internet, and intranets must limit access to those inside the company. For all three network levels, a company must establish the correct level of controlled access. In the case of intranets, only internal employees are given access to the network and information. Extranet access should be limited to those parties in the supply chain who will be sharing information or engaging in exchanges with the company. The general public must be prevented from gaining access to these intranet and extranet networks. The Internet connections of a company must also be controlled. When a company uses the Internet for exchanges such as B2C transactions, it must by default give access to all potential customers. However, controls must still exist to limit those customers' access. For example, a potential customer of Amazon.com would need to know whether a particular book was in stock and available for immediate shipment but would not need to know the number of units in stock of that book. On the other hand, a supplier in the supply chain of Amazon.com would probably

need access to inventory levels by virtue of being a part of the extranet of Amazon.com. The point of this illustration is that a company must establish and maintain controls that limit access to the appropriate level for related parties. Customers, suppliers, and employees need different levels of access, as well as access to different types of data. Therefore, a company must carefully implement and maintain proper controls over Internet, extranet, and intranet network connections.

Access is limited by establishing appropriate internal controls such as firewalls and user authentication. The establishment and use of user authentication is intended to prevent log-in to the intranet or extranet by unauthorized users. Firewalls prevent external users from accessing the network and data on the extranet or intranet. Two of the categories of risks and controls that can limit access to intranets and extranets are reproduced in figure 5-8.

Figure 5-8



XML AND XBRL AS TOOLS TO ENABLE E-BUSINESS

Within the environment of the Internet, intranets, and extranets, two languages have emerged as important tools to enable e-business: XML and XBRL. Both languages have important uses.

XML, short for eXtensible Markup Language, is designed specifically for Web documents. Using XML, designers create customized tags for data that enable the definition, transmission, validation, and interpretation of data between applications and between organizations. XML is a rich language that facilitates the exchange of data between organizations via Web pages.

XBRL, short for eXtensible Business Reporting Language, is an XML-based markup language developed for financial reporting. XBRL provides a standards-based method to prepare, publish, reliably extract, and automatically exchange financial statements. In XBRL, dynamic financial statements can be published and manipulated on websites. The next sections explain the uses of XML and XBRL.

XML IN INTERNET EDI

EDI (electronic data interchange) is described as a method to conduct purchase transactions electronically. Traditional EDI is a technology that companies began to implement in the late 1960s. EDI was especially popular in industries such as rail and road transportation, auto manufacturing, and health care. Over the years, EDI came to be the form of conducting electronic business for large companies. However, two limiting factors have made it difficult for small to medium-size businesses to implement EDI. First, traditional EDI requires establishing very expensive networks such as private leased lines or value-added networks (VANs), and small and medium-sized companies in many cases could not justify the cost. Usually, small to medium-sized businesses adopted EDI only when forced to by a large company that they dealt with. For example, if a small company were a supplier to Ford Motor Company, it would have no choice but to implement an EDI system, since Ford conducts purchases only via EDI. The second limiting factor is that traditional EDI in the United States is based on an old document standard (ANSI X.12) that limits the kind of data that can be exchanged via EDI. The ANSI X.12 standard for EDI defines standards for common business documents such as purchase orders and invoices. However, the standard was never intended to cover the more extensive and complex exchange of information, such as shared files or databases, that

occurs when two companies collaborate on a project. Given these two limitations, traditional EDI was never widely adopted by small to medium-sized businesses.

The growth of the Internet over the last two decades has provided a powerful and inexpensive alternative to traditional EDI. **Internet EDI** uses the Internet to transmit business information between companies. Internet EDI is also referred to as EDIINT. There are several advantages to using the Internet or extranets to transmit EDI, compared with private leased lines or VANs. By far the biggest advantage is that the Internet or extranets allow cost-free exchange of data. The companies using the Internet or extranets avoid the cost of leasing private lines and paying fees to VANs. This allows any business, including small and medium-sized businesses, to employ EDI at a relatively low cost.

The Internet EDI method of transmission is a relatively new development, but some companies have implemented it throughout their supply chain. A partial list of companies using Internet EDI extensively includes General Electric, Procter & Gamble, Walmart, Kohl's, and Meijer. figure 5-9 summarizes the advantages of Internet EDI in comparison with traditional EDI employing value added networks.

A value-added network is expensive because a company must pay monthly fees or transaction fees to use the VAN. Internet EDI is much less costly because the Internet network can be used without fees. In addition, the hardware and IT systems necessary to support traditional EDI via a VAN are very complex and expensive. Much computer hardware and software must be dedicated to providing traditional EDI. Internet EDI is much less complex and requires only minimal computer hardware and software. Internet EDI can be operated with only a PC or network of PCs that are

Internet connected. This allows the easy adoption of Internet EDI by small and medium-sized businesses.

Traditional EDI is a batch-oriented system that processes transactions in batches. This means there is some delay while transactions are batched, temporarily stored, and then finally transmitted when the batch is complete. Internet EDI operates in a real-time environment, just as B2C commerce is in real time. Because of these problems with EDI, traditional EDI is limited to larger organizations and to the type of data included in standard business documents. The low cost and communication capabilities of the Internet remove those limitations for Internet EDI. All companies in the supply chain are more likely to be able to afford Internet EDI, and they will be able to transmit more types of

data than simply standard business documents. The Walmart example at the beginning of this chapter is an example of a company changing from traditional EDI to Internet EDI.

The network of computers connected to the Internet does allow for more types of data to be communicated between business partners. However, the traditional EDI data format of ANSI X.12 would not accommodate more rich data types such as graphics or spreadsheets. Therefore, Internet EDI can be more flexible if a different data format is used to transmit data. The format used in Internet EDI is eXtensible Markup Language, or XML.

Figure 5-9

VAN	Internet EDI
Expensive	Low-cost
Transaction fees	Zero transaction fees
Complicated	Easy to use
Heavy infrastructure	Minimal infrastructure
Proprietary	Industry standard
Batch-related store and forward	Real-time
Limited usage	Entire supply chain
Limited data transport	All data transport
Limited access	Web browser

Traditional EDI is capable of transmitting many standard business documents between companies, such as purchase orders, invoices, and even payments by electronic funds transfer (EFT). However, given the capabilities of the Internet and extranets for sharing information, this traditional EDI data format is too limited. In addition to business documents, companies may need to transmit or share product descriptions, pictures of products, or even databases of information. Traditional EDI cannot accomplish such sharing of data. Internet EDI does provide the capability of sharing much richer forms of data through the use of XML. XML is a metalanguage, which means that it is a computer language that defines a language. XML is a tagged data format in which each data piece is preceded by a tag that defines the data piece. The same tag then marks the end of that piece of data. Thus, a tag surrounds each piece of data. XML is the standard markup language utilized in Internet EDI.

XML allows businesses to exchange transaction data over the Internet in a rich format. As XML becomes the accepted standard in Internet EDI, it will enable companies to exchange more than standard business

documents. Spreadsheets, graphs, and databases could all be exchanged between businesses by the use of XML documents to tag the data and the manner in which the data should be presented. Those who predict the future of the IT environment predict that XML will revolutionize the way in which businesses share data with each other and with customers.

Although EDI through a value-added network or Internet EDI provide significant cost savings and efficiency, it has not led to every company using EDI. There are still businesses that use paper purchase orders or invoices. The number of companies using EDI is on the rise, yet some estimate that up to 35 percent of purchase orders processed in the United States are still paper based. In addition, some companies still use value-added-networks to facilitate EDI communication rather than Internet EDI.

XBRL FOR FINANCIAL STATEMENT REPORTING

A special variant of XML called eXtensible Business Reporting Language, or XBRL, is predicted to revolutionize business reporting to creditors, stockholders, and government agencies. In 2009, the Securities Exchange Commission (SEC) began requiring companies to provide annual reports and financial statements in XBRL format. The idea behind XBRL is that financial data are tagged in a computer readable format that allows the users to readily obtain, analyze, exchange, and display the information.

XBRL financial statements have two major advantages over paper-based financial statements. Financial statements that are coded in XBRL can easily be used in several formats. They can be printed in paper format, displayed as an HTML Web page, sent electronically to the SEC, and transmitted to banks or regulatory agencies as an XML file. When a financial statement is prepared in XBRL, a computer program such as a Web browser can extract pieces of information from the XBRL file. The underlying financial

data can be loaded into spreadsheets or other financial analysis software. This is not possible with an HTML file. For example, while a financial statement in HTML format can be viewed on a website, the computer cannot extract sales. However, a XBRL financial statement would tag the dollar amount of sales with the tag that names that number sales. The computer can then extract specific pieces of data.

This capability allows investors and creditors to more easily analyze financial statements, which should result in better investment and credit decisions.

For XBRL to be implemented widely, common standards regarding the tags that identify data must be developed and accounting software vendors must use these tags within the software.

ETHICAL ISSUES RELATED TO E-BUSINESS AND E-COMMERCE

Companies that engage in e-commerce, B2C sales with consumers have the same kind of obligations to conduct their business ethically as companies transacting business any other way. However, the lack of geographic boundaries and the potential anonymity of Web-based commerce suggest that B2C companies have an even greater necessity to act ethically. A customer who orders merchandise or services on a website may not be able to easily assess the ethics or trustworthiness of a company who sells online. For example, if you buy a defective or spoiled product from your local grocery store, you can simply return it quickly. Your grocery store has a local presence, and you buy there because you know the company is real and trustworthy. However, anyone can establish a website that looks like a bona fide company but may be just a false storefront used to defraud customers. In B2C e-commerce, customers do not have the same capability to visit and become familiar with the company as they do when they are buying from a local store.

In a previous section of this chapter, the “Online Privacy” section of the AICPA Trust Services Principles was described. For the most part, these types of practices are an ethical obligation, but not necessarily a legal requirement. For example, there is no legal requirement to disclose privacy policies on a company’s website. However, ethical obligations would suggest that customers should be so informed regarding customer privacy. The practices described in the Trust Services Principles are more than good business practices. The online privacy policies represent ethical obligations to customers. As a reminder, the privacy practices include the following concepts:

a. Management

b. Notice

c. Choice and consent

d. Collection

e. Use and retention

f. Access

g. Onward transfer and disclosure

h. Security

i. Quality

j. Monitoring and enforcement

These principles can be distilled into the ethical concept that management has an obligation to treat customer information with due care. Companies should honestly and fully disclose to customers the information they will collect and how they will protect it, use it, and share it. Management has an ethical obligation to create and enforce policies and practices which ensure that private customer data are not misused. Unfortunately, the profit

motive sometimes leads management to focus too much on potential revenue and not enough on customer privacy.

When a customer engages in e-commerce, she is sharing data such as name, address, e-mail address, credit card number, and buying habits. These data have potential value to many other companies and are sometimes sold to other companies. You may have even received a mail or e-mail solicitation and wondered how that company ever came to know your name and address. This might mean that your name and address have been sold to another company or shared with a related company or subsidiary. There are many, many examples of companies who have compromised customer privacy to earn revenue. Customer lists or other private data about customers are a valuable resource. Too often, companies are willing to sell or share customer lists or customer data. In some cases, companies have no policies about the privacy of customer data and are thus willing to sell or share the data. In other cases, companies with policies regarding the privacy of customer data have violated their own policies.

The Real World

Gateway Learning Corporation, the company behind Hooked on Phonics®, was charged by the Federal Trade Commission with deceptive and unfair practices. Starting in the year 2000, Gateway disclosed a privacy policy on its www.hop.com website stating that it would not share customers' personal information with any third parties without explicit consent from the customer.

In April 2003, Gateway allegedly began violating this policy by renting to telemarketers customer information such as name, address, phone number, age, and gender of children. A retroactive change was posted to the company's privacy statement on its website.

To settle this charge out of court, Gateway was required to pay a fine, was restricted from using deceptive claims regarding its privacy policy and cannot materially change its privacy policy without customers' consent.

While there is no requirement to disclose a privacy policy on a website, it is an ethical obligation to disclose and follow the policy. Moreover, when a policy is disclosed, the Federal Trade Commission holds companies to a legal standard of following their stated policy.

There are also regulations passed by the U.S. government regarding the privacy of medical information. The Health Insurance Portability and Accountability Act of 1996 (HIPAA) includes a section on the security of health care information. The Act requires health care providers, health plans, hospitals, health insurers, and health clearinghouses to follow regulations that protect the privacy of medical-related information.

As the issue of consumer privacy continues to become more important, there may be new regulations and requirements affecting companies. Even if there were no new regulations, ethical obligations would dictate that companies take adequate care to guard the security and privacy of data collected through e-commerce.

SUMMARY OF STUDY OBJECTIVES

An introduction to e-commerce and e-business**.** E-business is the use of electronic means to enhance business processes. E-business encompasses all forms of online electronic trading, consumer-based e-commerce, business-to-business electronic trading and process integration, as well as the internal use of IT and related technologies for process integration inside organizations. There is an overlap between e-commerce and e-business,

which leads some to confuse the two concepts. E-commerce is electronically enabled transactions between a business and its customers. E-business is a broader concept that includes e-commerce, as well as all forms of electronic means of servicing customers and vendors, trading information with customers and vendors, and recording and control of internal processes.

The history of the Internet**.** The Internet of today evolved from an early government research network called ARPANET. Many of the network standards were developed in the period of ARPANET. Routers, TCP/IP, and e-mail all came about during this time. ARPANET gradually evolved into a fully commercial network called the Internet. After the Internet became available for commercial transactions in 1994, it experienced tremendous and rapid growth.

The physical structure and standards of the Internet**.** Backbone providers, regional Internet service providers, and local Internet service providers make up the physical structure of the Internet that connects global users. The common standards that allow computers to communicate with each other over the Internet are TCP/IP, HTML, domain names, addresses based on uniform resource locater (URL), and SSL encryption.

E-commerce and its benefits**.** The most well-known form of e-commerce is business-to-consumer (B2C) transactions using the World Wide Web. B2C sales transactions offer many benefits to both the consumer and the business.

Privacy expectations in e-commerce**.** Businesses have an ethical obligation to establish systems and procedures to protect the privacy of customers. The AICPA Trust Services Principles establish nine privacy practices that companies should follow: notice, choice and consent, collection, use and

retention, access, onward transfer and disclosure, security, integrity, and management and enforcement.

E-business and IT enablement**.** E-business is the use of IT to enable processes within the supply chain. The supply chain is the set of linked processes that take place from the acquisition and delivery of raw materials through the manufacturing, distribution, wholesale, and delivery of the product to the customer. There are many benefits to the IT enablement of processes within the supply chain. E-business includes business-to-business (B2B) electronic transactions.

E-business enablement examples**.** There are many forms of e-business. This section provides examples of ways that businesses streamline business processes, reduce operational costs, and enhance efficiency through e-business.

Intranets and extranets to enable e-business**.** An intranet is a private network accessible only to the employees of that company. The intranet uses the same common standards and protocols of the Internet. An intranet uses TCP/IP protocol and the same type of HTML Web pages as the Internet. However, the computer servers of the intranet are accessible only from internal computers within the company. An extranet is similar to an intranet, except that it offers access to selected outsiders, such as buyers, suppliers, distributors, or wholesalers in the supply chain. Extranets are the networks that allow business partners to exchange information. These business partners will be given limited access to company servers and data.

Internal controls for the Internet, intranets, and extranets. The Internet, intranets, and extranets are all networks that are intended to share information and conduct transactions. In all three networks, controls must be in place to allow the intended users access, but also limit access to

unauthorized users. Therefore, proper user authentication and hacking controls must be implemented in these networks.

XML and XBRL as e-business tools**.** XML and XBRL are markup languages that allow designers to create customized tags for data that enable the definition, transmission, validation, and interpretation of data between applications and between organizations. XML is a rich language that facilitates the exchange of data between organizations via Web pages. XML is used in Internet EDI. XBRL is a business reporting language that allows businesses to provide dynamic financial statements to users over the World Wide Web.

Ethical issues related to e-business and e-commerce. The online privacy policies of the AICPA Trust Services Principles represent ethical obligations to customers. These are ethical, but not necessarily legal, obligations. However, if a company does choose to disclose privacy practices on its website, it is then legally obligated to follow those practices.

Exercises

1. Which of the following statements is true?

a. E-business is a subset of e-commerce.

b. E-commerce is a subset of e-business.

c. E-business and e-commerce are exactly the same thing.

d. E-business and e-commerce are not related.

2. An electronic hardware device that is located at the gateway between two or more networks is a

a. packet switch

b. URL

c. router
d. protocol

3. The type of organization that serves as the main trunk line of the Internet is called a
a. local ISP
b. regional ISP
c. global ISP
d. backbone provider

4. Which of the following is not a direct advantage for the consumer from e-commerce?
a. Access to a broader market
b. More shopping convenience
c. Reduced order-processing cost
d. Information sharing from the company

5. Each of the following represents a characteristic of B2B commerce except
a. electronic data interchange
b. electronic retailing
c. data exchanges
d. preexisting business relationships

6. Each of the following represents an application of B2C commerce except
a. software sales
b. electronic retailing
c. data exchanges

d. stock trading

7. Before forwarding customer data, an organization should receive explicit or implicit consent of the customer. This describes which of the AICPA Trust Services Principles online privacy practices?

a. Consent

b. Use and retention

c. Access

d. Onward transfer and disclosure

8. Which of the following processes within a supply chain can benefit from IT enablement?

a. All processes throughout the supply chain

b. Only internal processes within the supply chain

c. Only external processes within the supply chain

d. Exchange processes between a company and its suppliers

9. When a company has an e-business transaction with a supplier, it could be using

a. the Internet

b. an intranet

c. an extranet

d. either the Internet or an extranet

10. Intranets are used for each of the following except

a. communication and collaboration

b. business operations and managerial monitoring

c. Web publishing

d. customer self-service

11. When there is no necessity for a preexisting relationship between buyer and seller, that transaction is more likely to be classified as

a. B2B

b. B2C

c. B2E

d. either B2B or B2C

12. Which of the following IT controls would not be important in an extranet?

a. Encryption

b. Password

c. Antivirus software

d. Penetration testing

e. All of the above are important IT controls.

13. A company's computer network uses Web servers, HTML, and XML to serve various user groups. Which type of network best serves each of the following users?

Employees	*Suppliers*
a. Intranet	Extranet
b. Intranet	Internet
c. Internet	Extranet
d. Internet	Internet

14. An extensible markup language designed specifically for financial reporting is

a. Internet EDI

b. XML

c. XBRL

d. XFRL

DISCUSSION QUESTIONS

15. How do e-commerce and e-business differ?

16. What was the original purpose of the network of computers that eventually became the Internet?

17. Why was ARPANET designed with many different alternative routes for network traffic?

18. Why is a standard protocol necessary in computer networks?

19. How quickly did Internet usage by the public grow after the Internet was opened to business transactions in 1994?

20. Describe the relationship between national backbone providers, regional ISPs, and local ISPs.

21. What is the importance of a standard formatting language for Web pages and a standard addressing system?

22. Which types of costs can be reduced when a company decides to engage in B2C e-commerce on the Internet?

23. What are the differences between bricks-and-mortar retailers and clicks-and-mortar retailers?

24. According to the Online Privacy section of the AICPA Trust Services Principles, what types of personal information should be protected?

25. If you could condense the ten areas of Online Privacy in the AICPA Trust Services Principles, into a shorter list (three-, four-, or five-point list), how would you word that list?

26. What is meant by “monitoring and enforcement” regarding online privacy practices?

27. How is e-business a broader concept than e-commerce?

28. Describe the concept of a supply chain.

29. Why is it important to ensure an efficient flow of goods throughout the supply chain?

30. Which functions within the supply chain can be enhanced through the use of e-business?

31. How are activities in the supply chain interdependent?

32. In what ways are the characteristics of e-business different from those of e-commerce?

33. What are the three levels of network platforms that are utilized in e-business, and which groups use each level?

34. Which type of users should have access to an intranet?

35. Which type of users should have access to an extranet?

36. What types of controls should be used to properly limit access in intranets and extranets?

37. Why is the use of XML advantageous in Internet EDI?

38. In what ways are XBRL financial statements advantageous compared with traditional paper financial statements?

39. What are some of the ethical obligations of companies related to e-commerce?

40. Is there a difference between ethical obligations and legal obligations with regard to online privacy?

BRIEF EXERCISES

41. Much of the e-business and e-commerce conducted by companies uses the Internet as the form of electronic communication. Describe other electronic means to conduct e-business or e-commerce.

42. How does the use of HTML, URLs, domain names, and SSL contribute to an Internet that can be used worldwide?

43. Describe the benefits to the **consumer** of B2C sales.

44. Describe the benefits to the **company** of B2C sales.

45. Describe the benefits to a company that engages in B2B transactions via the Internet.

46. What are the ten areas of privacy practices described in the Online Privacy section of the AICPA Trust Services Principles?

47. Describe the activities that take place in the supply chain of a manufacturing firm.

48. Describe the differences between B2C and B2B.

49. Explain the importance of user authentication and network breakin controls in extranets.

50. What are the advantages of Internet EDI over traditional EDI?

PROBLEMS

51. Explain the hardware and technology standards that were developed during the ARPANET that were an important foundation for the Internet of today.

52. The Pizza Pie Pit is a local chain of pizza restaurants in Dallas,Texas. The chain has 30 locations throughout the city and its suburbs. The management is considering opening a website to conduct e-commerce with customers. Describe any benefits that might be derived from this move.

53. Using a search website, enter the term “privacy seal” and search. Answer the following questions:

a. What is the purpose of a Web privacy seal?

b. Which organizations provide Web privacy seals to Web-based companies?

c. What are the advantages to a company that maintains a Web privacy seal?

d. What are the benefits to a consumer of shopping from a website that has a privacy seal?

54. Visit the website www.cpawebtrust.org and answer the following questions:

a. What is a WebTrust seal?

b. Which organization sanctions the WebTrust seal?

c. What kind of professional can provide a WebTrust seal to a company?

d. What must this professional do before providing a WebTrust seal?

55. Enter the website of a popular retail company that sells a large volume of goods or services on the Internet. Search for the company’s “Privacy Policies” on that website. If you do not find any privacy policies, continue visiting other company websites until you do find privacy policies. Once you have found a company with privacy policies, describe how the company policies do or do not meet the privacy practices in the AICPA Trust Services Principles.

56. EDIPipeline is an Internet EDI solution for small to mid-size companies. View the Web page at http://www.edipipeline.com. Click on the link called “Trading Partners.” Examine two or three company names you recognize.

Describe how this EDI system might be advantageous for a small or mid-size company seeking to be a vendor to a large corporation such as Coca-Cola.

57. Read the article at http://xbrl.us/learn/documents/betterreporting.pdf. Briefly describe what this article says about how XBRL has transformed financial reporting.

58. List and describe the privacy practices recommended by the AICPA Trust Services Principles Privacy Framework. If you have ever made a purchase online, you have likely seen these practices in use. Provide any examples from your own personal experience.

59. Describe the ethical obligations of companies to their online customers.