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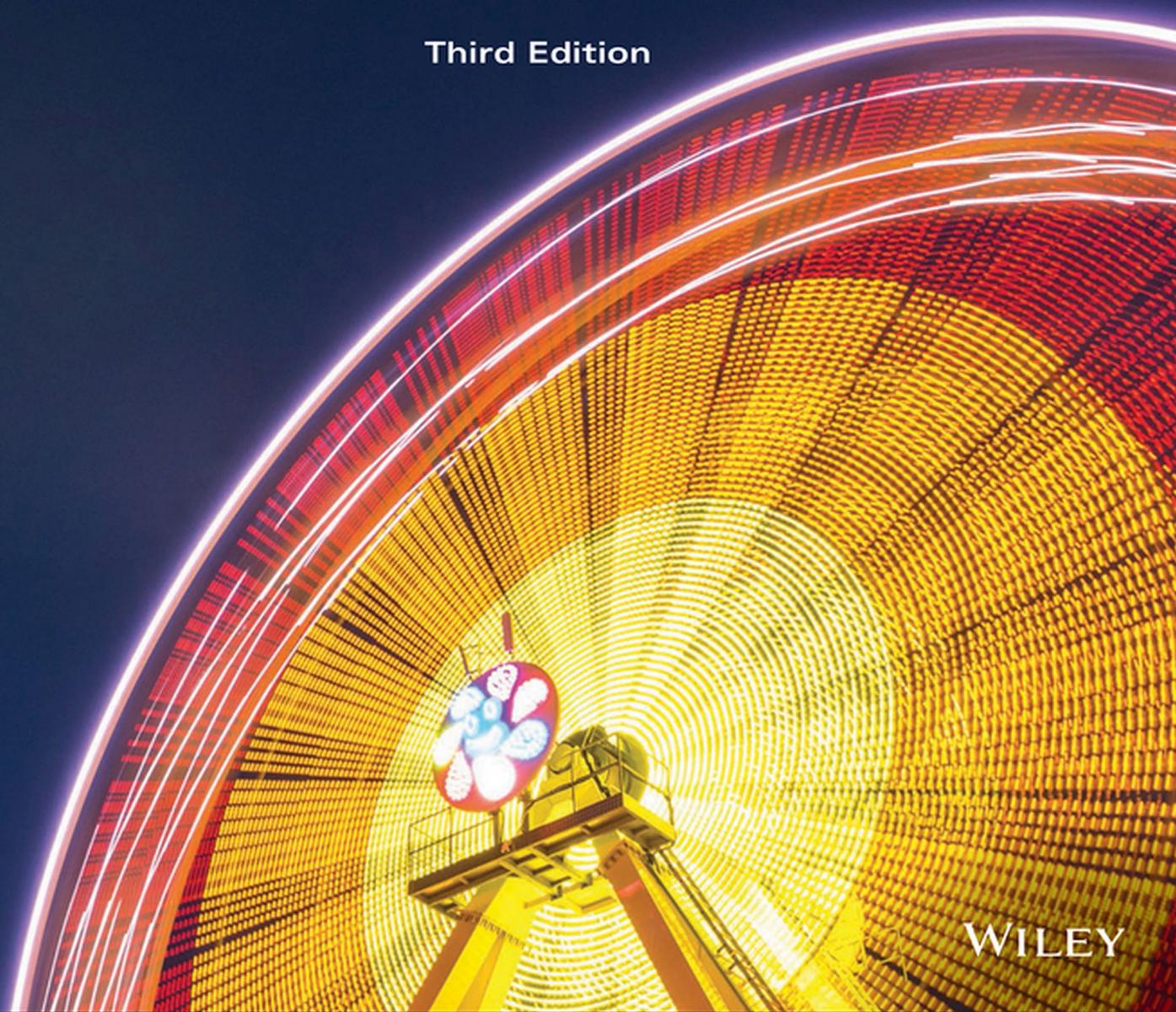
LESLIE TURNER | ANDREA WEICKGENANTT | MARY KAY COPELAND

# ACCOUNTING INFORMATION SYSTEMS

Controls and Processes

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Third Edition



WILEY

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# Accounting Information Systems

CONTROLS AND PROCESSES

Third Edition

**Leslie Turner**

**Andrea Weickgenannt**

**Mary Kay Copeland**

**WILEY**

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**Leslie Turner**

*To my parents and the many students who have inspired and motivated my work.*

**Andrea Weickgenannt**

*To my sons, Karl and Erik, for their encouragement, wit, and tolerance.*

**Mary Kay Copeland**

*To Bob and Barb Schiesser (my parents), Steve (my husband)  
and Tim and Chris (my sons) for their continued support.*

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## ABOUT THE AUTHORS

**Leslie D. Turner** is Dean and a professor of accounting at Palm Beach Atlantic University. He previously taught at Northern Kentucky University and the University of North Carolina at Greensboro. He earned a DBA in accounting from the University of Kentucky, an MBA from Wheeling Jesuit University, and a BBA in accounting from Ohio University. Dr. Turner is a Certified Management Accountant (CMA) and a Certified Financial Manager (CFM).

Professor Turner's research interests are in internal controls and Sarbanes-Oxley compliance, educational pedagogy, and ethics. His research has been published in *The Accounting Educators' Journal Management Accounting Quarterly*, *Accounting Horizons*, *Journal of Accounting and Public Policy*, *Journal of Internet Commerce*, *Journal of Information Systems*, *Management Accounting*, *The Review of Accounting Information Systems*, *The Journal of Management Accounting Research*, *Strategic Finance*, *The CPCU Journal*, *National Accounting Journal*, *The Oil and Gas Tax Quarterly*, *Accounting Systems Journal*, and *The Journal of Accounting Case Research*.

Professor Turner is a member of the American Accounting Association, the Institute of Management Accountants, and the Information Systems Audit and Control Association.

**Andrea B. Weickgenannt** is an assistant professor in the Department of Accountancy at Xavier University. She is a DBA candidate at Kennesaw State University, and also holds an MBA from the University of Maryland and a BBA from the University of Cincinnati. She is a Certified Public Accountant (CPA) and has over 13 years of experience with Ernst & Young LLP (Cincinnati and Baltimore).

Professor Weickgenannt's research interests are in the areas of accounting information systems, financial accounting, auditing, and corporate governance. Her research has been published in *The Journal of Business Cases and Applications*, *Issues in Accounting Education*, *Advances in Accounting Education*, *The National Accounting Journal*, *Journal of Accounting Case Research*, *Critical Perspectives on Accounting*, and *The Journal of College Teaching & Learning*.

Professor Weickgenannt is a member of the American Accounting Association, the American Institute of Certified Public Accountants, the Institute of Internal Auditors, the Institute of Management Accountants, and the Ohio Society of Certified Public Accountants.

### **Mary Kay Copeland, PhD, MBA, CPA**

Mary Kay Copeland is an assistant professor, teaching accounting and accounting information systems at St. John Fisher College in Rochester, NY. She previously taught at the University of Buffalo and Bowling Green State University. She earned a BS/MBA in Accounting from the University of Buffalo and a PhD from Regent University. Dr. Copeland is a Certified Public Accountant and has over 30 years of professional experience including 5 years with KPMG and 20 years in consulting and CFO positions.

Professor Copeland's research interests include accounting information systems, financial and managerial accounting, ethics, and values-based leadership. Her research has been published in *The CPA Journal*, *Research on Professional Responsibility and Ethics in Accounting*, *International Journal of Leadership Studies and Business Education Forum*. Dr. Copeland also has had numerous conference proceeding publications with the American Accounting Association. Dr. Copeland has also co-published a Microsoft Dynamics GP® text with Armond Dalton Publishers and authored hands on Microsoft Dynamics coursework for Microsoft Dynamics AX and Microsoft Dynamics GP ERP systems.

Professor Copeland is a member of the American Accounting Association, the American Institute of Certified Public Accountants, and the Microsoft Dynamics National Academic Advisory Board.

## PREFACE

### Instructor

**Overview** Each of us who teaches Accounting Information Systems (AIS) faces the problem of providing students a comprehensive, but interesting knowledge base of AIS. However, we all know that it is difficult to find the right balance of coverage of technical concepts and student comprehension. When addressing this issue of balance, we began to see clearly that a better, more comprehensible approach was needed. With this book, we have achieved a good balance of covering technical concepts while still making the text easy to read and understand. Our textbook also reinforces AIS concepts with relevant, real-world examples and reasonable end-of-chapter materials.

This text incorporates the important content found in a typical AIS course, but has five distinguishing characteristics. Five characteristics we focus on throughout the text are simplicity and understandability of the writing, business processes, accounting and IT controls, examples from Microsoft Dynamics GP (an ERP/AIS system), and ethics as it relates to accounting systems.

We place extra emphasis on the students' understanding. We explain AIS in the context of business processes and incorporate many real-world examples. The richness of these examples improves the text, the discussion questions, and end-of-chapter exercises and cases. We explain IT controls by employing the framework in the AICPA Trust Services Principles. This is an encompassing, but easy to understand, framework of IT controls. We provide examples in the text of an AIS/ERP system, Microsoft Dynamics GP. Instructors are able to add a hands-on learning of Microsoft Dynamics GP that complements the theoretical concepts in the text. Finally, we believe that ethics continues to increase in importance as a topic to be included in accounting texts. We have included an ethics section in each chapter.

We think that including all these characteristics in a single text has resulted in an extremely user-friendly product: one that will help your students achieve a better foundation in AIS.

### Features

The book is designed to enhance student learning with a focus on ease of use, business processes and the related controls, and ethics and corporate governance as they relate to accounting information systems (AIS).

**Ease of Use** This AIS textbook will allow students to easily read and comprehend the material, understand the charts and graphs, and successfully answer questions and cases at the end of the chapters. To attain ease of use, we included several features, including the following:

- An approach to technical topics with a writing style that is easy to understand.

- **Process maps and document flowcharts that provide a picture of business processes and that are easy to understand.** While there are several approaches to charts that depict systems, we have used the types of charts that illustrate business processes in the simplest, yet complete manner. Especially in the chapters focused on business processes, we use matched process maps, document flowcharts, and data flow diagrams to illustrate the processes that occur, and the related flow of information and documents. These charts are easy to follow and they will enhance the understanding of the business processes.
- **AICPA Trust Services Principles framework for IT controls.** Controls within Information Technology can be a very difficult subject to comprehend because of the underlying complexity of the technology. While COBIT is the most comprehensive source of IT control information, it is not typically easy for students to understand. This is especially true for students who have not had the opportunity to gain work experience with IT systems and business processes. We use the simplest framework available for the explanation of IT controls: the AICPA Trust Services Principles. The Trust Services Principles categorize IT Controls into five areas: security, availability, processing integrity, online privacy, and confidentiality.
- **Control and risk tables that summarize internal controls and the related risks.** Internal controls are easier to understand when students can see the corresponding types of risks that the controls are intended to lessen. We use control/risk exhibits to present risks that are reduced when controls are used.
- **Real-world examples to illustrate important concepts.** Concepts are often easier to comprehend when presented in a real-world scenario. Each chapter includes examples of issues faced by actual business organizations that help illustrate the nature and importance of concepts in the chapter. Real-world discussions are boxed in a feature titled “The Real World.”
- **Microsoft Dynamics GP screen shots to present topics in the context of a real computer system.** New concepts are often easier for students to understand while presented within a real-life application. We use screen shots from Microsoft Dynamics GP software to show how various aspects of business processes would appear in this computer system. In addition, in this version, we have added the ability for instructors to add hands-on learning of Microsoft Dynamics GP to the coursework. See the textbook website for details. This add-on tool provides access to a cloud-based version of Microsoft Dynamics minimizing the involvement of a university’s IT staff.
- **The IT technology that underlies AIS continually evolves and allows enhancements to those systems.** Several chapters integrate the concept of cloud computing and the increasing use of cloud computing. The effects of cloud computing on the risk benefits and auditing in AIS are also described.
- **End-of-chapter questions, problems, and cases that match well with the chapter content.** It is important to provide material at the end of each chapter that helps students reinforce the topics presented. It is equally important that this material be relevant and understandable. We have devoted our attention to providing a variety of end-of-chapter activities that are meaningful and manageable, including a concept check, discussion questions, brief exercises, Web exercises, problems, cases, and a continuing case. In addition, most chapters include activities adapted from professional (CPA, CMA, and CIA) examinations.

**Business Processes, Accounting Controls, and IT Controls** Business transactions are portrayed within the text in terms of business processes, which are widely recognized throughout the accounting profession. These business processes are described in a manner that is applicable to many different business environments.

We incorporate the COSO framework and integrate discussions of risks and controls in all business process chapters. These discussions are also carried out in as many of the other chapters as possible. The COSO framework, especially the control procedure component, is used as a framework to describe accounting controls. This continued use of the framework across several chapters is intended to increase student understanding and retention of risk and control concepts.

In addition, we place a strong emphasis on IT controls. We accomplish this by using the guidance provided by the AICPA in the revised (2009) Trust Services Principles for WebTrust® and SysTrust® assurance engagements. The Trust Services Principles are the AICPA's guidance that is closely related to COBIT.

The Trust Services Principles risk and control procedures are incorporated into the chapters covering business processes and controls. These controls are also discussed in chapters on databases, ERP systems, auditing IT systems, and the system development life cycle.

**Ethics and Corporate Governance** It is indisputable within the business world that honest, consistent reporting and management of information has never been more important. Considering the increased responsibility on corporate managers for the overall financial reporting of the company, the study and use of accounting information systems is critical. Accordingly, business ethics and corporate governance continue to increase in focus and we made them a focus of this textbook. An ethics discussion is also found at the end of each chapter and an ethics icon highlights applicable end-of-chapter material.

In order to place emphasis on business ethics in many chapters, it is important to establish a foundation of ethics to build upon. Chapter 3 includes a significant section on ethics in the current environment and the relation of ethical problems to the need for internal controls and ethics codes. We establish Chapter 3 as the foundation for the chapters that follow. The ethics and control concepts in Chapter 3 are reinforced as themes throughout the text. We also include ethics-related questions or cases in the end-of-chapter materials.

In addition to business ethics, corporate governance is a related topic that has received much attention in the business world without a corresponding increase in focus by AIS texts. In addition, each process chapter in Module 3 discusses corporate governance in its application to the various business processes. Sarbanes–Oxley discussions are highlighted in the textbook margins with the letters “SOX.”

## Supplements

A solutions manual, test bank, computerized test bank, instructor outlines, and PowerPoint presentations accompany this textbook. They are available on the instructor companion site available with this textbook. The third edition of the text also provides instructors the option of adding hands-on learning of an ERP/AIS system, Microsoft Dynamics GP, to their coursework. This additional supplement provides instructional materials and cloud access to Microsoft Dynamics GP at a nominal cost. Details are provided in the textbook website. The authors would like to thank Patricia Fedje, Minot State University; Yvonne Phang, Borough of Manhattan Community College; and Coby Harmon, University of California–Santa Barbara for their help in developing the test bank and PowerPoint presentations.



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## TO THE STUDENTS

Businesses, and the products and services they provide, are unquestionably a critically important part of our society. We would not have food, shelter, cars, computers, iPhones, or the other things we need and use daily without smoothly functioning businesses to provide those goods and services. Likewise, individual businesses could not operate at a level to sustain our society without accounting information. Accounting information is the lifeblood of business. Without the regular flow of accurate accounting information to managers and investors, businesses would collapse. Operating a business or investing in businesses without accounting information would be as difficult as driving with a covered windshield. You would have no feedback information about where you are going and what corrections you must make to get there. Just as your view through the windshield tells you when to make steering, braking, and accelerating corrections, accounting information allows managers and investors to determine how to make corrections that will allow them to achieve business objectives.

Accountants generate, evaluate, summarize, report, and confirm the information that managers and investors need to make good choices in their operations or objectives. The system that allows accountants to accomplish this is the accounting information system.

The study of AIS provides a very important set of concepts to prepare you for an accounting and business career. We hope the features of this book make your study of AIS a little more pleasant, interesting, and understandable. Now, go forward and learn more about AIS and its role in providing critical information to managers and investors!



# A LIST OF REAL-WORLD EXAMPLES IN THIS TEXTBOOK

<b>Chapter</b>	<b>Company Example</b>	<b>Subject</b>
1	McDonald's remote order taking at drive-throughs	Business processes
1	McDonald's and a dedicated supplier of buns, East Balt	Supply chain
1	Ford and its reengineered vendor payment system	Business processes reengineering
1	American Institute of CPAS Top Technology Initiatives survey	IT priorities
1	BP and Deep Water Horizon oil spill	Risks
1	Anonymous company that inflated revenues	Ethics
2	Au Bon Pain and South Gate Restaurant updated ordering systems	Business processes
2	Bowen implementing a new system	Legacy systems
2	Thomas Kemper Soda Company's updated systems	Cloud computing
2	Cole Haan, a subsidiary of Nike and system integration	Legacy systems
2	Hawaii Commercial Real Estate, LLC's data sharing	Business processes
3	Phar-Mor fraud	Top management ethics
3	Johnson & Johnson fraud	Top management ethics
3	Association of Certified Fraud Examiners and fraud statistics	Fraud
3	Enron and its demise	Fraud
3	Xerox GAAP violations	Fraud
3	Koss Corporation embezzlement scheme	Fraud
3	Dow Chemical's warning signs of fraud	Fraud
3	Data Processors International and access to its database	Hackers
3	Denial of service attacks at Yahoo, eBay, Amazon.com	Hackers
3	Survey results: Ethical conduct in corporations	Financial pressures
4	Network break-ins at Stratfor and Target computers	Hackers
4	2003 North American power blackout	Disaster recovery
4	Internet company SurveyMonkey	Business continuity
4	Microsoft Windows operating system	Hackers
4	Boeing's automated shop floor	Wireless networking
4	Availability risks at SalesForce.com and Coghead	Cloud computing
4	Public and private cloud applications at Starbucks	Cloud computing
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5	Information and technology strategy committee at UPS	IT governance

<b>Chapter</b>	<b>Company Example</b>	<b>Subject</b>
5	Prioritizing IT projects at Allstate	IT governance
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6	SkullCandy's growth and ERP system	Cloud computing
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6	Failed ERP implementation at the city of Tacoma, Washington and in Marin County, California	ERP implementation
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7	JCPenney's vendor audit of Aurafin	IT audit benefits
7	Ford Motor Company's focus on financial processes and controls	Internal audit
7	Use of CAATs at EY	IT audit
7	Audit mistakes at Phar-Mor	Auditor independence
7	Koss Corporation's lack of controls	Audit failure
7	Crazy Eddie's fraud	Auditor independence
7	Enron, WorldCom, and Xerox and the need to test balances	Substantive testing
8	Sales processes performance measures at Staples	Sales processes
8	Internet sales processes at Staples	Sales processes
8	Internet EDI at Nortel	Internet EDI
8	Advantages of a POS system at Pizza Hut	POS systems
8	Fraud at MiniScribe	Fraud
8	Sales misstatements at Coca-Cola and McAfee	Ethics
8	Sales misstatements at HealthSouth	Fraud
9	General Electric's electronic invoice presentation system	IT enablement of purchasing
9	City Harvest doubles deliveries without increasing costs	Purchasing and procurement process
9	Frymaster's automated invoice matching system	IT enablement of purchasing
9	Federal government of the United States as strong advocate of e-invoicing	IT enablement of purchasing
9	Evaluated receipt settlement system at an anonymous company	IT enablement of purchasing
9	General Electric's procurement card use	Business process reengineering
9	Special checking account used at Phar-Mor	Fraud
9	Multiple instances of fraud by Paul Pigeon	Fraud
9	Walmart's ethics guidelines for employees in purchasing	Ethics
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10	Automated payroll system at Scott Paper Company	IT enablement of payroll

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11	Walmart's sophisticated database	IT enablement of logistics
11	Fraud in conversion processes at F&C Flavors	Fraud
12	Typical timing of month-end closing processes	Administrative processes
12	Fast closing process at Alcoa	Administrative processes
12	Fraud in administrative processes at echapman.com	Fraud
12	Automated authorization at Walmart	Administrative processes
12	Interconnected systems at Walmart and Procter & Gamble	Administrative processes
12	Automatic triggering in ERP systems	Administrative processes
12	Misleading data for investors at Krispy Kreme	Ethics
13	Large database at Walmart	Databases
13	High-impact processes at Anheuser-Busch and Hewlett Packard	High-impact processes
13	Failed ERP and IT projects	Data mining
13	Data mining at Anheuser-Busch	Data mining
13	Procter & Gamble (P&G) as a multinational consumer products manufacturer	Cloud computing
13	Data mining activities in Walmart	Data mining
13	Control breakdown at Netflix	Ethics
13	Distributed databases at McDonald's	Distributed data
13	Theft of data at Bloodstock	Ethics
14	Walmart's change to Internet EDI	Internet EDI
14	E-business at General Electric	E-business
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# CHAPTER 1

## Introduction to AIS

### STUDY OBJECTIVES

This chapter will help you gain an understanding of the following concepts:

1. An overview of business processes
2. An overview of an accounting information system
3. The business process linkage throughout the supply chain
4. The IT enablement of business processes
5. Basic computer and IT concepts
6. Examples of IT enablement
7. The internal control structure of organizations
8. The importance of accounting information systems to accountants
9. The relation of ethics to accounting information systems

### Overview of Business Processes (Study Objective 1)

The Real World example on the next page will help you understand the context of many concepts in this chapter. Please read that Real World example to begin effective reading and studying of this chapter. You might wonder how the Real World example relates to accounting information systems (AIS). An accounting information system must capture, record, and process all financial transactions. Prior to McDonald's implementation of the experimental drive-through order systems, all in-store and drive-through orders were processed through the cash registers at each location. When the new, experimental systems were implemented, consider their effects on the system that recorded sales. The new technology had to be configured in such a way that

1. Order details were taken accurately
2. Those details were forwarded to the correct McDonald's location so that the order could be handed to the customer at the drive-through
3. The order data had to be included with McDonald's sales and cash received for the day
4. The correct McDonald's location had to be properly credited with the sale so that the franchise and managers would be given credit for sales they generated

The point of this example is that there are many different ways that sales transactions can be conducted. No matter the form of those business transactions, the accounting information system must identify the transactions to record, capture all the important details of the transaction, properly process the transaction details into the correct accounts, and provide reports externally and internally. Many types of transactions that result from business processes must be captured, recorded, and reported.

A **business process** is a prescribed sequence of work steps performed in order to produce a desired result for the organization. A business process is initiated by a particular kind of event and has a well-defined beginning and end. In the McDonald's example, the business process is the taking and filling of a drive-through order.

## The Real World



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A few years ago, the fast food restaurant industry experimented with remote order-taking at the drive-through. Fastfood chains such as Hardee's, Wendy's, Jack in the Box, and McDonald's each experimented with remote order-taking at some of their drive-through windows. In the case of McDonald's, an experimental order-taking center takes drive-through orders for several

different McDonald's locations. In addition, some McDonald's locations use off-site order-takers such as stay-at-home moms. Order-takers under both arrangements use voice over Internet protocol, or VoIP technology, a T1 phone line, and instant photographs to process the orders. A car pulling up to the menu board trips a magnetic loop that alerts the order-taker, who takes and confirms the order, enters the details on a computer screen, and transmits it instantly to the restaurant. In-store employees focus on taking the cash and delivering the food. Using photos of diners allows stores to install multiple drive-through lanes, which can boost car counts. While the industry appears to have gotten away from this trend, this example illustrates how companies are always searching for new ways to conduct business more efficiently. Often, changes such as these affect the accounting system.

Organizations have many different business processes, such as completing a sale, purchasing raw materials, paying employees, and paying vendors. Each business process has either a direct or an indirect effect on the financial status of the organization. For example, completing a sale directly increases cash or other assets, while paying employees directly reduces cash or increases liabilities. Purchasing new, efficient equipment also directly affects assets and/or liability accounts; yet this transaction is also expected to indirectly increase sales and assets, as it provides for increased productivity and an expanded customer base. Therefore, we can see why, as business processes occur, the accounting information system must capture and record the related accounting information.

All of the possible business processes would be too numerous to list. However, the four general types of business processes typical in organizations (which will be described in later chapters of this book) are as follows:

1. Revenue processes (Chapter 8)
  - a. Sales processes
  - b. Sales return processes
  - c. Cash collection processes
2. Expenditure processes (Chapters 9 and 10)
  - a. Purchasing processes
  - b. Purchase return processes
  - c. Cash disbursement processes
  - d. Payroll processes
  - e. Fixed asset processes
3. Conversion processes (Chapter 11)
  - a. Planning processes
  - b. Resource management processes
  - c. Logistics processes

4. Administrative processes (Chapter 12)
  - a. Capital processes
  - b. Investment processes
  - c. General ledger processes

In the example on the previous page, the remote drive-through processing is part of the revenue processes. The order-taking combines the sales process and the cash collection process. For a fast food franchise such as McDonald's, these processes are the most visible and obvious to customers. However, there are many other business processes that occur that may not be as apparent to customers.

In addition to revenue processes to sell food to customers and collect the cash, McDonald's must implement some or all of the remaining processes in the preceding list. That is, to sell a Big Mac Extra Value Meal to a customer, McDonald's must first engage in purchase processes to buy meat, vegetables, buns, soft drinks, and other food items, as well as operating supplies. In addition, it must have payroll processes to pay employees, and fixed asset processes to buy and maintain equipment and other fixed assets. McDonald's must have conversion processes to convert the raw meat, vegetables, and buns into customer products that can be sold.

McDonald's must have capital processes that raise funds to buy capital assets, and investment processes to manage and invest any extra cash flow. Finally, McDonald's needs general ledger processes to ensure that all transactions are recorded into the appropriate general ledger accounts and that financial information is reported to external and internal users. For example, each sale to a customer must be recorded as a sale, and the results of the sale must eventually be posted to the general ledger accounts of cash and sales.

The purpose here of reviewing these processes is not to cover the entire set of details, but to emphasize that there must be prescribed work steps in every area. Employees, work steps, and transaction recording systems must be established in any organization to ensure that business processes occur and that any accounting effects of those processes are captured and recorded. For example, employees who work the cash register must be trained to apply company policies for customer payment (such as cash and credit cards accepted, but no personal checks). As these employees perform their work steps, the system in place should be capturing the relevant accounting information. In the case of McDonald's, the cash register captures the in-store sales data, including the items sold, price paid, sales tax, and date of sale. The cash registers are connected to a computer system that feeds the sales and cash data to corporate headquarters so that management reports can be created and external financial statements can be prepared at the end of the period.

In addition, organizations implement internal control processes into their work steps to prevent errors and fraud. **Internal controls** are the set of procedures and policies adopted within an organization to safeguard its assets, check the accuracy and reliability of its data, promote operational efficiency, and encourage adherence to prescribed managerial practices. For example, McDonald's probably requires that at the end of every day, a manager close each cash register and reconcile the cash in the register to the recorded total sold at that register. This is an internal control process to prevent and detect errors in cash amounts and to discourage employees from stealing cash. Reconciliation of cash to cash register records is a business process designed to control other processes. Thus, we begin to see that the accounting information system has many components, as explained further in the next section.

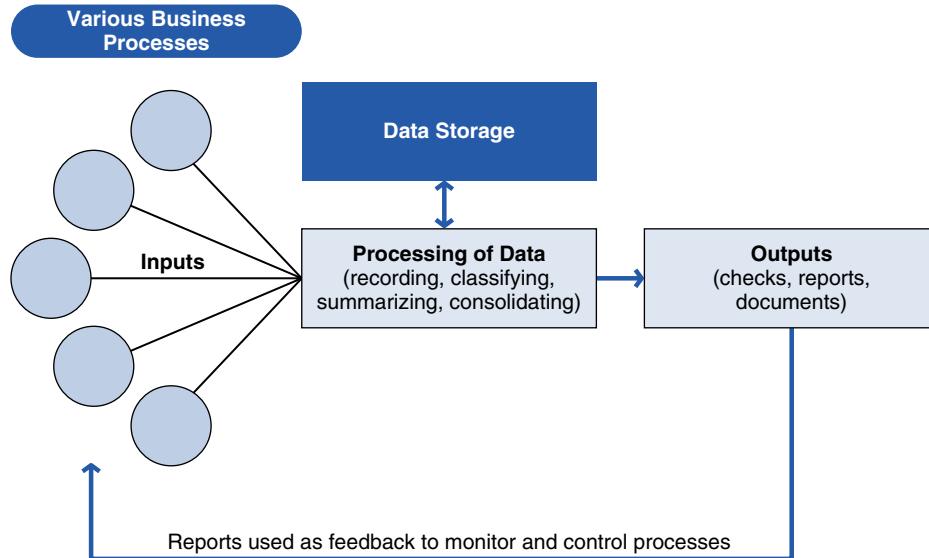
## Overview of an Accounting Information System (Study Objective 2)

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The **accounting information system** comprises the processes, procedures, and systems that capture accounting data from business processes; record the accounting data in the appropriate records; process the detailed accounting data by classifying, summarizing, and consolidating; and report the summarized accounting data to internal and external users. Many years ago, accounting information systems were paper-based journals and ledgers that were recorded manually by employees. Today, nearly every organization uses computer systems for maintaining records in its accounting information system. The accounting information system has several important components, listed next. An example from McDonald's is used to describe each component.

1. *Work steps within a business process capture accounting data* as that business process occurs. When McDonald's employees greet a customer at the cash register, they perform several work steps to complete a sale, some of which are accounting related and some of which are not. Greeting the customer with a smile may be an important step, but it has no impact on accounting records. However, using the touch screen at the cash register to conduct the sale does have an accounting effect: sales amounts in the sales records should be increased and cash amounts in cash records should be increased.
2. *Manual or computer-based records record the accounting data* from business processes. As is true of most companies, McDonald's has a system of computers and computer processes to record the appropriate data from the sale process. These systems usually involve both manual and computerized steps. For McDonald's, the manual process is that a person must operate the cash register. The remainder of the McDonald's system is computer-based, and the computer records the sale and all related data.
3. *Work steps serve as internal controls* within the business process to safeguard assets and ensure accuracy and completeness of the data. As mentioned before, requiring a manager to close and reconcile the cash register at the end of the day is an example of an internal control within the sales processes.
4. *Work steps are used to process, classify, summarize, and consolidate the raw accounting data.* For example, sales at each McDonald's franchise must be summarized and consolidated into a single total of sales revenue to be reported on the income statement. At McDonald's, these steps are accomplished by the computer system and the accounting software. In some companies, there may be manual or handwritten accounting records, although currently most organizations use information technology (IT) systems to conduct some or all of the accounting recording and summarizing processes.
5. *Work steps generate both internal and external reports.* McDonald's needs many types of internal reports to monitor the performance of individual franchise locations and regions. In addition, year-end external financial statements such as the income statement, balance sheet, and statement of cash flows must be prepared for external users.

These five components are part of any accounting information system but are likely to be applied differently in different business organizations. Exhibit 1-1 shows an overview of an accounting information system. The circles represent the many business processes that occur in the organization—revenue, expenditure, conversion,



**EXHIBIT 1-1** Overview of an Accounting Information System

and administrative processes. As those processes occur, data is captured and becomes input into the accounting information system. The accounting information system classifies, summarizes, and consolidates the data. As input and processing occur, data must be added to or retrieved from data storage. From this stored data and processing, several types of output are prepared. Some of the outputs would be documents such as purchase orders, invoices, and customer statements; other output would be checks to vendors and employees. The output reports are feedback that managers within the organization use to monitor and control the business processes. The number of computerized versus manual work steps may vary across organizations, but every organization should have each of these component pieces. In some organizations, the processes may be manual steps performed by employees, and the accounting records may be paper journals and ledgers. At the other extreme are companies where many or all of these work steps are performed by computers, and the accounting records are in computer files. In most cases, there is a combination of manual and computerized work steps.

The accounting system internal controls are not pictured in Exhibit 1-1, but there should be internal controls throughout the accounting information system. As defined earlier, internal controls are the set of procedures and policies adopted within an organization to safeguard its assets, check the accuracy and reliability of its data, promote operational efficiency, and encourage adherence to prescribed managerial practices. Internal controls are described later in this chapter and covered in detail in the Control Environment section (Chapters 3–7) of this book.

## Business Process Linkage Throughout the Supply Chain (Study Objective 3)

The accounting information system and the reports generated by the system are intended to help management monitor and control the organization. However, any organization operates in an environment in which it has many interactive relationships

with other organizations. For example, McDonald's could not operate without its relationships with the many suppliers that provide the ingredients for its menu selections. There is an entire set of activities (business processes) that culminate when McDonald's sells a Big Mac® to a customer. Consider the road that leads to this culminating sale—it stretches far back into many other organizations. To illustrate these activities, let's trace just a small part of that Big Mac sale back as far as we can reasonably go. In order to sell a Big Mac, McDonald's had to purchase and keep an inventory of hamburger meat. McDonald's would have purchased this meat from a meat supplier called a vendor. A **vendor** provides materials or operating supplies to an organization. The terms "vendor" and "supplier" are usually used interchangeably.

For the McDonald's meat vendor to supply meat, that vendor had to buy cattle to process into raw meat. Therefore, McDonald's meat supplier must have relationships with vendors that sell cattle. The cattle seller can be called a secondary supplier to McDonald's. To trace back one step farther, we could say that the cattle seller had to buy cattle from a rancher who raised cattle.

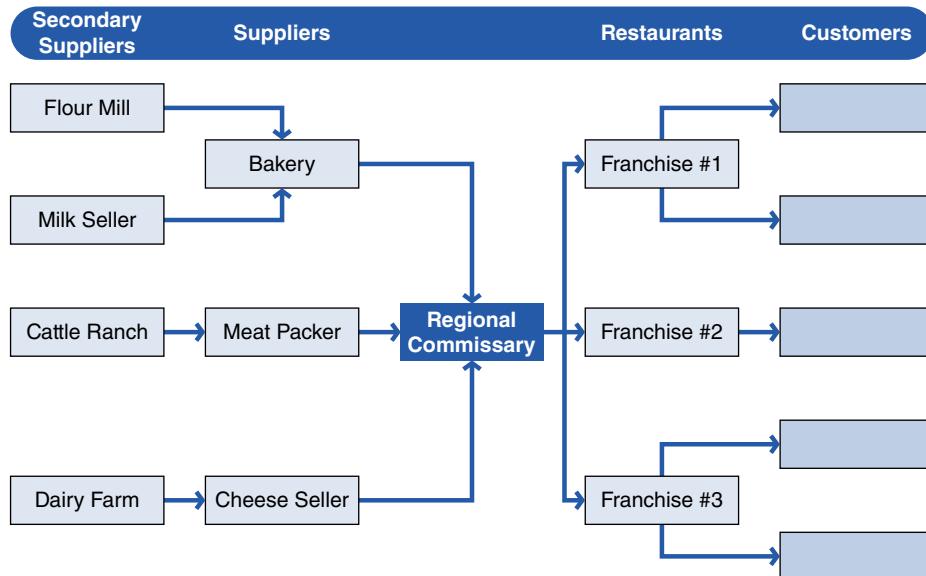
Likewise, the bun on the Big Mac can be traced back to a bakery, which had to purchase flour from another company, and that flour producer needed wheat to produce flour. Tracing back one step farther, we find that the wheat was sold by a wheat farmer. You might wonder what the purpose is of tracing a Big Mac back to the rancher who raised cattle and the farmer who grew wheat. The point is that for McDonald's to operate efficiently, each of these interactive relationships between buyer and seller must operate efficiently. For example, a labor union strike at a bakery could interrupt the supply of buns for McDonald's. Therefore, the top management at McDonald's must ensure that it properly manages, monitors, and controls the internal processes, as well as those processes that are linked to outside parties such as vendors. McDonald's may not be able to directly control all of these interrelated activities stretching back through the many suppliers, but McDonald's may be able to influence those activities by the suppliers they choose and the expectations they place on those suppliers in terms of price, quality, and delivery timing. This set of linked activities is called the supply chain. The **supply chain** is the entities, processes, and information flows that involve the movement of materials, funds, and related information through the full logistics process, from the acquisition of raw materials to the delivery of finished products to the end user. The supply chain includes all vendors, service providers, customers, and intermediaries.

## The Real World

An organization such as McDonald's must have many different suppliers of the same product because of the need for fresh ingredients. For example, the regional bakery in the next exhibit provides buns for McDonald's in a five-state area.

As you have traveled, you may have noticed that your Big Mac is always the same, no matter where you go. Even the buns are exactly the same in each town and city. McDonald's plans for this uniformity in buns and must have many suppliers throughout the world that can make and deliver a consistent quality bun.

East Balt, Inc. is one of the large bakeries that supplies McDonald's with buns. East Balt bakeries make these buns according to strict standards of size, shape, color, height, and seed coverage. To maintain freshness, the buns have to be baked in regional locations. It would be much too difficult to have one central location bake all buns for McDonald's. Therefore, McDonald's must have many different suppliers of buns throughout the world.



**EXHIBIT 1-2** A Simplified Supply Chain for McDonald's

The concept of monitoring and controlling the linked set of activities in the supply chain is called supply chain management. **Supply chain management** is the organization and control of all materials, funds, and related information in the logistics process, from the acquisition of raw materials to the delivery of finished products to the end user (customer). A simplified view of a supply chain for McDonald's is shown in Exhibit 1-2.

The management at McDonald's would find it in the best interest of its company to closely manage, monitor, and control the processes within the supply chain as much as possible. For example, a large organization such as McDonald's can demand certain levels of quality from the bakery that supplies buns. In addition, McDonald's can apply pressure to make sure that the bakery has reliable suppliers of high-quality flour. To the extent that McDonald's can influence primary and secondary suppliers to maintain quality of supplies and efficiency of operations, the business processes within McDonald's will operate more smoothly. As an example, McDonald's bun purchasing process will operate more efficiently when the bakery's bun selling processes run efficiently. This connection between the purchasing processes used by McDonald's and the supplier's selling processes represents a supply chain linkage. In order to increase the efficiency and effectiveness of these supply chain linkages, many organizations employ IT systems. Using IT systems to enhance efficiency and effectiveness of internal or supply chain processes is called **IT enablement**.

## IT Enablement of Business Processes (Study Objective 4)

Generally, information technology (IT) comprises all types of technology used to create, store, exchange, and utilize information in its various forms, including business data, conversations, still images, motion pictures, and multimedia presentations. For the purposes of this book, **information technology** is defined as the

computers, ancillary equipment, software, services, and related resources as applied to support business processes. IT usage to support business processes accomplishes one or more of the following objectives:

1. Increased efficiency of business processes
2. Reduced cost of business processes
3. Increased accuracy of the data related to business processes

Any processes within an organization, including the linkages within its supply chain, may benefit by IT enablement. The touch-screen cash register at McDonald's is an example of IT enablement that increases the efficiency of the sales process. Another popular example of IT enablement is e-commerce sales such those in place at Amazon.com, Inc. Amazon.com uses complex IT systems to present a sales model that allows customers to place orders on its website.

These two examples only scratch the surface of the types of processes that can be IT-enabled. Any business process has the potential to be improved by IT enablement. In many cases, using IT to enable processes leads to a completely different approach to those processes. For example, the remote order-taking system described at the beginning of this chapter is a completely different order-taking process from the usual drive-through system. Using more complex IT such as voice over IP and digital photos, McDonald's is experimenting with improving the efficiency of drive-through order taking. Applying IT to business processes is an opportunity to "think outside the box" and consider new and different methods for business processes. This concept of revising processes as IT enabling occurs is called business process reengineering.

**Business process reengineering** (BPR) is the purposeful and organized changing of business processes to make them more efficient. BPR not only aligns business

## The Real World

An example of business process reengineering with IT enablement occurred at Ford Motor Company several years ago. Ford used a purchasing process that required a three-part purchase order. One copy was sent to the vendor, one was kept by the purchasing department, and one was forwarded to the accounts payable department. When purchased parts were received, the receiving department prepared a two-part receiving report. The receiving department kept a copy, and the other copy was forwarded to accounts payable. The vendor mailed an invoice to Ford's accounts payable department. Matching purchase orders, receiving reports, and invoices required more than 500 people. These employees spent a great deal of time investigating mismatched documents. For example, the quantity on the purchase order might not have agreed with the quantity on the invoice. These time-consuming steps of document matching and reconciling

mismatches led to late payments to vendors and, therefore, unhappy vendors.

Using IT and business process reengineering, Ford changed its purchasing and payment processes. After a BPR, an online database replaced the manual matching of documents. No document copies were prepared or circulated internally. When parts were received, the receiving employee verified that the goods matched to an outstanding purchase order in the ERP system. The computer system verified the matching of the part number, unit of measure, and supplier code between the purchase order and receiving report. When they agree, the computer system prepared a check to pay the vendor. This reengineered process allowed Ford to reduce the number of employees in accounts payable by 75 percent. Today, automated matching of documents such as a purchase order, receiving report, and vendor invoice have become the normal process in many companies.

processes with the IT systems used to record processes, it also improves efficiency and effectiveness of these processes. Thus, the use of these sophisticated IT systems usually leads to two kinds of efficiency improvements. First, the underlying processes are reengineered to be conducted more efficiently. Second, the IT systems improve the efficiency of the underlying processes. Through rethinking and redesigning a process, the organization may be able to improve, and thereby enhance, the process. This rethinking and redesign is especially aided by the use of IT. When technology or computers are introduced into processes, the processes can be radically redesigned to take advantage of the speed and efficiency of computers to improve processing efficiency. IT and BPR have a mutually enhancing relationship. IT capabilities should support the business processes, and any business process should be designed to match the capabilities that the IT system can provide. BPR should leverage the capabilities of IT to improve the efficiency of processes. This is exactly what McDonald's has done in the remote drive-through example; it has taken advantage of the capabilities offered by technology to improve the process and match it to the capability of the IT system.

PO Number	Site ID	Item	Description	Qty Shipped	Unit Cost	Extended Cost
PO1002		PHON-GTE-5043		2	\$81.25	\$162.50
Each	WAREHOUSE			0		\$162.50
Cordless-Grand S5043				10		10
				0.00		\$0.00
				0.00		\$0.00
				0.00		0.00
1099 Amount						\$162.50
Payment Terms						\$0.00
Landed Cost Func. Total						\$0.00
Tax Schedule ID						\$0.00
						Total
						\$162.50

**EXHIBIT 1-3** Microsoft Dynamics GP Receivings Transaction Entry Screen Used to Complete Automated Matching of a Purchase Order and Product Receipt

Exhibit 1-3 is a screen from Microsoft Dynamics GP®, an ERP system that this text will use to illustrate details in an accounting information system. The screen provided is the Receivings Transaction Entry window. The screen illustrates the concept of automated matching in an ERP system. This screen would be completed by a receiving clerk or someone responsible for entering inventory items received that had previously been ordered on a purchase order. When a receiving transaction is entered, the user can view all purchase orders placed with the vendor and all inventory items ordered. When the correct purchase order is selected, the items ordered by the company populate the Receivings Transaction Entry screen. The user can

then identify how many items were received. If there is a discrepancy between what was ordered and what was received, the system will note the discrepancy and only receive the actual amount received. Later when the vendor invoice is received the received purchase order is retrieved again and a matching of the receiving report and vendor invoice is also completed electronically in the system. At that point the purchase order, receiving report, and vendor invoice would be electronically matched and the invoice would be able to be paid. As noted in the Ford example, automated matching of documents such as a purchase order, receiving report, and vendor invoice significantly increases the efficiency of a company's transaction processing.

Each of the business process categories (revenue, expenditure, conversion, and administrative) described in the early part of this chapter has been affected by business process reengineering and IT enablement. In this book, the chapters in the section "Business Processes" provide more detail about those categories of common business processes. Parts of those chapters also provide details of IT enablement that allowed BPR to occur in organizations. The next sections of this chapter briefly describe basic IT concepts and IT enabling systems.

## Basic Computer and IT Concepts (Study Objective 5)

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Nearly all accounting information systems rely on computer hardware and software to track business processes and to record accounting data. Therefore, it is important to have some understanding of basic computer terminology and concepts. Many details about IT systems are described in later chapters of this book, but some of the basic concepts are included in this chapter.

### Basic Computer Data Structures

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Accounting data is stored in computer files, and an accountant should have some understanding of data structures in IT systems. Data is organized in a data hierarchy in computer systems, as follows:

1. Bit, or binary digit
2. Byte
3. Field
4. Record
5. File
6. Database

A bit is a shortened reference to **binary digit**. The **bit** is the smallest unit of information in a computer system. A bit can have only one of two values: zero or one. All data in a computer system is reduced to a set of bits, or zeros and ones. A **byte** is a unit of storage that represents one character. In most computer systems, a byte is made up of eight bits. For example, the character "A" would be represented in a computer system by a set of eight bits. Every character, including letters, numbers, and symbols, are represented by a byte.

A **field** is one item within a record. For example, *last name* is a field in a payroll record, and *description* is a field in an inventory record. A **record** is a set of related fields for the same entity. All fields for a given employee form a payroll record. Such fields would be employee number, last name, first name, Social Security number,

pay rate, and year-to-date gross pay. The entire set of related records forms a **file**. The set of all employee records forms a payroll file.

Thus, the data structure hierarchy is as follows: Eight bits are a byte, a collection of related bytes is a field, a set of related fields is a record, and a set of related records is a file. The entire collection of files is called a database. A **database** is a collection of data stored on the computer in a form that allows the data to be easily accessed, retrieved, manipulated, and stored. The term database usually implies a shared database within the organization. Rather than each computer application having its own files, a database implies a single set of files that is shared by each application that uses the data. A **relational database** stores data in several small two-dimensional tables that can be joined together in many varying ways to represent many different kinds of relationships among the data. An example of a relationship in data is a single customer having more than one order. A relational database is intended to allow flexibility in queries. This means that managers or users can query the database for information or reports as needed.

The computer files of traditional accounting software systems use master files and transaction files. The **master files** are the relatively permanent files that maintain the detailed data for each major process. For example, a payroll master file contains a record of each employee's relatively permanent information necessary to process payroll transactions such as name, address, pay rate, and year-to-date amounts. Thus, the master file is much like a subsidiary ledger. The **transaction file** is the set of relatively temporary records that will be processed to update the master file. A payroll transaction file would contain the set of hours worked by each employee for a particular pay period. The transaction file is processed against the master file, and employee year-to-date balances are updated in the master file.

Not all modern IT systems and accounting software use master files and transaction files. Some systems use a database approach to processing and storing accounting data, whereby the many details of financial transactions are stored in huge databases. These systems do not necessarily maintain computerized ledgers and journals. Because all transaction data is stored in databases, the transactions can be organized or summarized by the important dimension requested. For example, the sales transactions that meet certain criteria can be extracted from the database when needed—it is not necessary to construct or review a sales ledger.

## File Access and Processing Modes

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In computer systems, files are organized in one of two ways which determine the type of access provided. **Sequential access** files store records in sequence, with one record stored immediately after another. The sequence is usually based on a key field such as employee number or customer number. Sequential files are read and written in sequence. This means that for the user to access record number 500, the previous 499 records must first be read by the computer. Sequential access is faster when the records are always accessed and used in sequential order.

**Random access** files (sometimes called direct access files) are not written or read in sequential order; rather, their records are stored in random order on a disk media. Since records are distributed randomly on the disk surface, an underlying system enables the computer to find a record among the random records, using either a formula or a hashing scheme to assign a specific address to each record. When a record is requested, the formula can be recalculated to find the address of

the requested record. If records are to be accessed randomly, then random access is a more efficient access method than sequential access.

There are situations where the same files may sometimes be accessed either way, sequentially or randomly. In cases where both access methods are necessary, some systems use the **indexed sequential access method** (ISAM). ISAM files are stored sequentially, but can also be accessed randomly because an index allows random access to specific records.

There are also two modes of processing transactions in accounting systems: batch processing and online processing. **Batch processing** requires that all similar transactions be grouped together for a specified time; then this group of transactions is processed as a batch. Batch processing is best suited to applications having large volumes of similar transactions that can be processed at regular intervals. Payroll processing is a good example of a system well suited for batch processing. All time cards can be grouped together for a two-week pay period, and all payroll processing takes place on the entire set of time cards.

**Online processing** is the opposite of batch processing. Transactions are not grouped into batches, but each transaction is entered and processed one at a time. Some online processing systems are also **real-time processing** systems, meaning that the transaction is processed immediately, and in real time, so that the output is available immediately. Online processing is best suited to applications in which there is a large volume of records, but only a few records are needed to process any individual transaction.

Batch processing is best suited to sequential access files, and online processing is best suited to random access files. If transactions are to be processed online and in real time, then the computer must access a single record immediately. An online, real-time system requires direct access files. As an example, think about placing a telephone call to reserve an airline ticket. The airline employee must be able to access the specific flight that you request. If flight records were stored sequentially, the computer system would need to read all records in sequence until it reached the requested record. This system would be too inefficient. If the flight records are stored randomly, a hashing index exists to locate any single record quickly.

Online processing usually requires random access files, but batch processing can use either random or sequential access files. In many cases, ISAM files are used, since they offer both random and sequential access. For example, payroll processing requires access to employee records in sequence. This operation would be most efficient as a batch processing system that accesses and processes records sequentially. However, the human resources department would occasionally need to access an individual employee records. For example, when an employee receives a raise, the employee record must be accessed to update the *pay rate* field. Random access would allow the system to quickly locate that single employee record.

## Data Warehouse and Data Mining

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A **data warehouse** is an integrated collection of enterprise-wide data that generally includes several years of nonvolatile data, used to support management in decision making and planning. The function of a data warehouse can be better understood by comparing it with an operational database. An **operational database** contains the data that is continually updated as transactions are processed. Usually, the operational database includes data for the current fiscal year and supports day-to-day operations and record keeping for the transaction processing systems. Each time a new transaction is completed, parts of the operational database must be updated.

For example, recording a sale means that sales, inventory, and receivables balances must be updated. This type of update does not occur in a data warehouse.

The data in the data warehouse is said to be enterprise-wide because the data is pulled from each of the operational databases and maintained in the data warehouse for many fiscal periods—ideally, 5–10 years. The data in the data warehouse is retrieved from sales order processing, inventory systems, receivables, and many other transaction-processing systems within the organization. The data in a data warehouse is called nonvolatile because it does not change rapidly in the same way that operational data changes. Periodically, new data is uploaded to the data warehouse from the operational data; but other than this updating process, the data in the data warehouse does not change.

The data warehouse is used by management to complete data mining. **Data mining** is the process of searching data within the data warehouse for identifiable patterns that can be used to predict future behavior. Although there are many reasons a company might want to know future behavior, the most popular use of data mining is to predict the future buying behavior of customers. If businesses are able to more accurately predict customer buying trends, they can plan appropriately to produce, distribute, and sell the right products to customers at the right time. For example, by examining customer buying patterns from the past few periods of sales, a grocery chain might be able to more accurately predict which products sell better during hot weather periods. The company might find that ice cream sales increase by a large percentage when the temperature exceeds 80 degrees, and therefore it would be able to better plan the amount of ice cream to buy as the weather changes.

## **Structured, Unstructured, and Big Data**

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Data collected from transactions is in the form of structured data. **Structured data** easily fits into rows and columns. These columns usually are fields of fixed length. An example would be 10 digits for a phone number. Customer name, credit card number, and total dollar amount of sales are other examples of data that easily fits into rows and columns. Companies also collect unstructured data. **Unstructured data** does not easily fit into rows and columns of fixed length. An example of unstructured data would be the free-form text of a customer's online review of a product. It might include Facebook posts, tweets, video, and other free-form types of data. Since most accounting data is structured data, the remainder of this chapter describes the typical storage and processing techniques used in organizations to manage their structured data.

Organizations accumulate a mountain of structured accounting data resulting from their numerous business transactions. This includes account numbers, dollar amounts, and other financial data from business transactions. Sometimes, the volume of data may seem overwhelming; but as long as it is structured data, it can be easily stored and organized by most accounting systems. However, accountants are evolving toward using more unstructured data. As companies collect more data from more sources, Big Data becomes a critically important resource that accountants must use. **Big Data** is known as high-volume, high-speed information that may be so large and diverse that it demands innovative forms of IT processing. It is generally considered too large in size and scope to be analyzed with traditional database tools. Yet it is important to understand Big Data so it can be used to provide key insights to enhance decision-making. Later chapters will explore potential areas for accountants to use Big Data.

## Networks and the Internet

A computer **network** is two or more computers linked together to share information and/or resources. There are several types of computer networks, but the types most important to the topic of accounting information systems are local area network (LAN), the Internet, extranet, and intranet. A **LAN** is a computer network that spans a relatively small area. Most LANs are confined to a single building or group of buildings and are intended to connect computers within an organization. However, one LAN can be connected to other LANs over any distance via other network connections. A system of LANs connected in this way is called a **WAN**, or wide area network.

The **Internet** is the global computer network, or “information super-highway.” The Internet developed from a variety of university- and government-sponsored computer networks that have evolved and are now made up of millions upon millions of computers and subnetworks throughout the world. The Internet is the network that serves as the backbone for the World Wide Web (WWW).

An **intranet** is a company’s private network accessible only to the employees of that company. The intranet uses the common standards and protocols of 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.

An **extranet** is similar to an intranet except that it offers access to selected outsiders, such as buyers, suppliers, distributors, and wholesalers in the supply chain. Extranets allow business partners to exchange information. These business partners may be given limited access to company servers and access only to the data necessary to conduct supply chain exchanges with the company. For example, suppliers may need access to data pertaining to raw material inventory levels of their customers, but they would not need access to customers’ finished product inventory levels. Conversely, a wholesaler within the supply chain may need access to the manufacturer’s finished product inventory, but it would not need access to raw material inventory levels.

### The Real World

The American Institute of Certified Public Accountants recently released the results of the 25th year of its Top Technology Initiatives Survey. The survey asked respondents to rank their organization’s top IT goals for the coming year. The top five responses were:

1. Securing the IT environment
2. Managing and retaining data
3. Managing risks and compliance
4. Ensuring privacy
5. Enabling decision support and analytics

These findings clearly indicate that the ability to access key information is a top priority for accountants. However, changing technologies tend to cause accountants to rethink the way they work. The more that can be learned about the capabilities of emerging technologies, the more likely it is that they will be appropriately integrated into the IT environment to produce an improved result.

The survey respondents included both accountants who work for accounting firms as well as many who work in business and industry. Complete survey results are available at [aicpa.org/toptech](http://aicpa.org/toptech).

A cloud computing environment is a contemporary type of computer infrastructure used by a growing number of companies. Cloud computing involves the use of shared services, software and/or data stored on servers at a remote location. These resources are accessible over a network such as the Internet.

These networks are an important part of the infrastructure that allows organizations to effectively use IT systems. The networks allow the IT enablement of business processes. For example, the remote order-taking system described at the beginning of this chapter employs voice-over Internet protocol (VoIP) technology. VoIP uses the Internet to transmit voice telephone data. The IT enabling technologies described in the next section utilize some or all of these types of networks.

## Examples of IT Enablement (Study Objective 6)

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As described earlier, computers and IT can be used to enable business processes, and applying IT to business processes offers companies the opportunity to do business process reengineering. The manner in which companies complete their processes can be changed to take advantage of the efficiency, effectiveness, or cost savings inherent in IT systems. The examples that follow are systems applied by companies today that use IT-enabled business processes.

### E-Business

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**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 and business-to-business transactions, as well as the use of IT for process integration inside organizations. E-business is therefore a very broad concept that includes not only electronic trading with customers, but also servicing customers and vendors, swapping information with customers and vendors, and electronic recording and control of internal processes. IT systems, Internet and websites, as well as wireless networks, are the common means of enabling e-business to occur. E-commerce is the type of e-business that we are familiar with as consumers. Buying a book at Amazon.com and clothes at Patagonia.com are examples of engaging in e-commerce. E-business has so many other forms that it is difficult to explain its entire breadth. Chapter 14 describes e-business in more detail.

### Electronic Data Interchange

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**Electronic data interchange** (EDI) is the intercompany, computer-to-computer transfer of business documents in a standard business format. Three parts of this definition highlight the important characteristics of EDI: (1) “Intercompany” refers to two or more companies conducting business electronically. For example, a buyer of parts may use EDI to purchase parts from its supplier. (2) The computer-to-computer aspect of the definition indicates that each company’s computers are connected via a network. (3) A standard business format is necessary so that various companies, vendors, and sellers can interact and trade electronically by means of EDI software. EDI is used to transmit purchase orders, invoices, and payments electronically between trading partners.

## Point of Sale System

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A **point of sale system** (POS) is a system of hardware and software that captures retail sales transactions by standard bar coding. Nearly all large retail and grocery stores use POS systems that are integrated into the cash register. As a customer checks out through the cash register, the bar codes are scanned on the items purchased, prices are determined by access to inventory and price list data, sales revenue is recorded, and inventory values are updated. All of these processes occur in real time, and through POS-captured data the store can provide to its managers or home office daily summaries of sales by cash register or by product. Many companies adopt POS systems because they enhance customer satisfaction by enabling faster and more accurate sales processing.

## Automated Matching

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**Automated matching** is a system in which the software matches an invoice to its related purchase order and receiving report. Exhibit 1-3 provided an example of automated matching in Microsoft Dynamics GP. Traditional systems rely on a person to do this matching, whereas an automated matching system does not. To institute an automated matching system, all of the relevant files must be online and constantly ready for processing; the purchase order and receiving files and records must be in online files or databases. When an invoice is received from a vendor, an employee enters the details into the accounting system by completing the fields in the invoice entry screen, including the purchase order number that usually appears on the invoice. The system can then access the online purchase order and receiving files and verify that the items, quantities, and prices match. The system will not approve an invoice for payment unless the items and quantities match with the packing slip and the prices match the purchase order prices. This ensures that the vendor has billed for the correct items, quantities, and prices. Automated matching reduces the time and cost of processing vendor payments. The real-world example of Ford Motor Company described earlier illustrated an automated matching system.

## Evaluated Receipt Settlement

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**Evaluated receipt settlement** (ERS) is an invoice-less system in which computer hardware and software complete an invoice-less match comparing the purchase order with the goods received. If the online purchase order matches the goods, payment is made to the vendor. This eliminates the need for the vendor to send an invoice, since payment is approved as soon as goods are received (when they match a purchase order). The name ERS signifies that the receipt of goods is carefully evaluated and, if it matches the purchase order, settlement of the obligation occurs through this system. This IT-enabled system reduces the time and cost of processing vendor payments.

## E-Payables and Electronic Invoice Presentment and Payment

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**E-payables** and **electronic invoice presentment and payment** (EIPP) are both terms that refer to Web-enabled receipt and payment of vendor invoices. EIPP enables a vendor to present an invoice to its trading partner via the Internet, eliminating the paper, printing, and postage costs of traditional paper invoicing.

## Enterprise Resource Planning Systems

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**Enterprise resource planning** (ERP) is a multi-module software system designed to manage all aspects of an enterprise. ERP systems are usually broken down into modules such as financials, sales, purchasing, inventory management, manufacturing, and human resources. The modules are designed to work seamlessly with the rest of the system and to provide a consistent user interface between modules. These systems usually have extensive set-up options that allow some flexibility in the customizing of functionality to specific business needs. ERP systems are based on a relational database system.

An ERP software system is much more comprehensive and encompassing than traditional accounting software. ERP systems include modules to handle accounting functions, but, as previously mentioned, they also incorporate modules for manufacturing, marketing, logistics, and human resources. Before ERP, these types of modules usually were in separate software systems and were not well integrated with accounting software. This caused the need for some data requests to be answered by accessing data or reports from several different systems. If a customer asked whether a particular product was in stock, the accounting system could be accessed to answer that request. If it was not in stock, the customer might ask when it is scheduled to be manufactured. To answer that request, a completely separate software system, the production planning and control system, would need to be accessed. Under this kind of operation, with separate and nonintegrated software systems, a single employee usually did not have access to the separate systems to answer such requests. Customers might have been bounced from department to department to get answers to questions that should be answered by one person. The integration of all modules and business processes into a single ERP system is intended to be a solution to these types of problems. (Chapter 6 provides more details about ERP systems.)

## The Internal Control Structure of Organizations (Study Objective 7)

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All organizations face risks in both day-to-day operations and long-term management. Some risks may be beyond the control of management. For example, management would be unable to reduce the risk of an earthquake, which could interrupt operations or destroy buildings and equipment. However, managers can take steps to lessen the negative impact of an earthquake. For example, they can ensure that buildings are designed to be resistant to earthquake damage. In fact, management has the ability and responsibility to take action to reduce risks or to lessen the impact of nearly all risks that the organization faces. These processes are called controls.

Accountants have a long history of being the professionals within the organization who help design and implement controls to lessen risks that have an impact on the financial standing of the organization. Accountants are usually experts in controls that can reduce risks in the following broad categories:

1. The risk that assets will be stolen or misused
2. The risk of errors in accounting data or information
3. The risk of fraudulent activity by employees, managers, customers, or vendors
4. The risks inherent in IT systems, such as
  - a. Erroneous input of data
  - b. Erroneous processing of data
  - c. Computer fraud
  - d. Computer security breaches

- e. Hardware or software failure
- f. Natural disasters that can interrupt computer system operations

Although management has the ultimate responsibility to establish a control environment to mitigate these risks to the extent to which it can reasonably do so, accountants are heavily involved in assisting management in the creation, implementation, and ongoing monitoring of the control environment. Management should ensure that the following types of controls exist:

1. Enterprise risk management (summarized in the next subsection)
2. Code of ethics (Chapter 3)
3. COSO accounting internal control structure (Chapter 3)
4. IT system control structure (Chapter 4)
5. Corporate governance structure (Chapters 3 and 4)
6. IT governance structure (Chapter 5)

## Enterprise Risk Management

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In 2004, the Committee of Sponsoring Organizations (COSO)<sup>1</sup> of the Treadway Commission issued a comprehensive report on enterprise risk management that is still widely used in today's business environment. The purpose of the report, and the many related thought papers that have been issued, is to assist managers in meeting the challenge of managing risk in their organizations. A proper response to risk that all organizations face is to establish formal processes and procedures to manage risk. **Enterprise risk management (ERM)** is defined as

... a process, effected by an entity's board of directors, management and other personnel, applied in strategy setting and across the enterprise, designed to identify potential events that may affect the entity, and manage risk to be within its risk appetite, to provide reasonable assurance regarding the achievement of entity objectives.<sup>2</sup>

This definition has several critical components. First, notice that ERM is put into place by top management and the board of directors. This emphasizes that ERM is the responsibility of management. Second, ERM is an ongoing *process*. Therefore, it is not something that occurs once and is forgotten—it is the continuous assessment of risks, determination of acceptable levels of risk, and management of risks to that acceptable level. Finally, ERM must involve not only management, but also personnel across the enterprise.

ERM requires that management set policies and procedures related to:<sup>3</sup>

- *Internal Environment*—The internal environment encompasses the tone of an organization that sets the basis for how risk is viewed and addressed by an entity's people, including risk management philosophy and risk appetite, integrity and ethical values, and the operational environment.

<sup>1</sup> COSO is a voluntary, private-sector organization that was originally formed in 1985 to sponsor the National Commission on Fraudulent Financial Reporting. COSO is jointly sponsored by five major professional associations in the United States: the American Accounting Association, the American Institute of Certified Public Accountants, Financial Executives International, the Institute of Internal Auditors, and the Institute of Management Accountants. It sponsors and disseminates frameworks and guidance based on in-depth research, analysis, and best practices in the areas of enterprise risk management, internal controls, and fraud deterrence. The Treadway Commission was named for James C. Treadway, the National Commission's first chairman and former Commissioner of the Securities and Exchange Commission ([www.coso.org](http://www.coso.org)).

<sup>2</sup> "Enterprise Risk Management—Integrated Framework," Committee of Sponsoring Organizations, September 2004 ([www.coso.org](http://www.coso.org)).

<sup>3</sup> *Ibid.*

- *Objective Setting*—Objectives must exist before management can identify potential events affecting their achievement. ERM ensures that management has in place a process to set objectives that support and align with the entity's mission and are consistent with its risk appetite.
- *Event Identification*—Internal and external events affecting achievement of an entity's objectives must be identified, with distinction made between risks and opportunities. Opportunities are channeled back to management's strategy or objective-setting processes.
- *Risk Assessment*—Risks are analyzed by likelihood and impact, as a basis for determining how they should be managed. Risks are assessed on both an inherent and a residual basis, meaning that the likelihood of errors is considered both before and after the application of controls.
- *Risk Response*—Management selects risk responses—avoiding, accepting, reducing, or sharing risk—by developing a set of actions to align risks with the entity's risk tolerances and risk appetite.
- *Control Activities*—Policies and procedures are established and implemented to help ensure that the risk responses are effectively carried out.
- *Information and Communication*—Relevant information is identified, captured, and communicated in a form and a time frame that enable people to carry out their responsibilities. Effective communication also occurs in a broader sense, flowing down, across, and up the entity.
- *Monitoring*—The entirety of ERM is monitored and modified as necessary. Monitoring is accomplished through ongoing management activities (including internal auditing), separate evaluations (such as those performed by external auditors), or both.

## The Real World

On April 20, 2010, an explosion aboard the Deep Water Horizon drilling platform forced millions of gallons of oil to spill into the Gulf of Mexico, wreaking havoc on marine life and upsetting the coastal economies. This event and the related problems have been disastrous for BP, the company most frequently blamed for this tragedy.

Although you may think this is an extreme example, it illustrates how critical it is for companies to manage risks. Risks lie in nearly every aspect of every business, and the task of identifying and mitigating them is a daily challenge. Certainly, any oil company would include an explosion, oil spill, or oil leak to be among its most serious risks, so how could it be that this risk was not prevented? In the case of BP and the other responsible companies, there were evidently breakdowns in the monitoring of controls surrounding this location.

You may also wonder how this is relevant to accounting information systems. Although many people are familiar with the BP oil spill, most have probably never considered the accounting implications of this disaster. Yet years after its occurrence, BP struggled to account for the damages owed for environmental clean-up and legal claims, and its audit firm consistently used cautionary language in the audit opinion accompanying BP's financial statements. Despite the anticipation of losses, the resulting outcomes were significant. In September 2014, the New York Times reported that a U.S. District Court judge ruled that due to BP's gross negligence and reckless conduct, they were primarily responsible for the oil spill. In July 2015, BP agreed to pay \$18.7 billion in fines, resulting in the largest corporate settlement in the U.S. history.

To achieve the objective of managing risk, management should establish control structures that include at least accounting internal controls, IT controls, corporate governance, and IT governance. These control structures are briefly sketched next and are described in more detail in later chapters.

## A Code of Ethics

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A company's developing and adhering to a code of ethics should reduce opportunities for managers or employees to conduct fraud. This will only be true, however, if top management emphasizes this code of ethics and disciplines or discharges those who violate it. Managers who emphasize and model ethical behavior are more likely to encourage ethical behavior in their employees.

## COSO Accounting Internal Control Structure

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In addition to its ERM guidance, COSO is well known for its “Internal Controls—Integrated Framework,” which explains what has become the standard accepted by the accounting and business community as the definition and description of internal control. According to this framework, there are five interrelated components of internal control: the control environment, risk assessment, control activities, information and communication, and monitoring. Notice that to achieve ERM, an organization must include these five components of internal control in its enterprise risk management processes. (These five components are described in detail in Chapter 3.)

## IT Controls

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Threats and risks that interrupt or stop computer operations can be severely damaging to the organization. Not only can they halt or disrupt normal operations, they can lead to incorrect or incomplete accounting information. In addition, computer processing of accounting data leads to the risks of erroneous accounting data due to flawed or incomplete input or processing of data, computer fraud, and computer security breaches. An organization must institute controls to limit these risks in IT systems.

IT controls can be divided into two categories: general controls and application controls. **General controls** apply overall to the IT accounting system; they are not restricted to any particular accounting application. An example of a general control is the use of passwords to allow only authorized users to log into an IT-based accounting system. Without regard to processing data in any specific application, passwords should be employed in the IT system. **Application controls** are used specifically in accounting applications to control inputs, processing, and output. Application controls are intended to ensure that inputs are accurate and complete, processing is accurate and complete, and outputs are properly distributed, controlled, and disposed of. (General and application controls in IT systems are described in Chapter 4.)

## Corporate Governance

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Corporate governance is a concept that has evolved over recent years. It is generally recognized as involving many diverse aspects of business; thus, many definitions of

corporate governance exist to cover each different aspect of interest. For instance, when economists define corporate governance, they recognize factors affecting the supply and demand of corporate leaders and tend to emphasize the importance of motivating leaders through the use of incentive programs. On the other hand, financiers tend to emphasize the role of corporate leaders to provide a good rate of return, while accountants focus on the responsibility of corporate leaders to provide effective internal controls and accurate records.

If forced to provide a single definition, accountants would characterize **corporate governance** as an elaborate system of checks and balances whereby a company's leadership is held accountable for building shareholder value and creating confidence in the financial reporting processes. This system of checks and balances includes several interrelated corporate functions within the corporate governance system, including management oversight, internal controls and compliance, financial stewardship, and ethical conduct.

Corporate governance has been tremendously affected by the Sarbanes–Oxley Act of 2002. The purpose of the Act was to improve financial reporting and reinforce the importance of corporate ethics. The legislation was enacted in an effort to curb the corruption and accounting blunders that had been discovered in connection with the bankruptcies of such corporate giants as Enron Corp. and WorldCom Inc. The Sarbanes–Oxley Act places a huge responsibility on top management to establish and maintain internal controls.

## IT Governance

The proper management, control, and use of IT systems are known as IT governance. The IT Governance Institute defines **IT governance** as

the leadership, organizational structure, and processes that ensure that the enterprise achieve(s) its goals by adding value while balancing risk versus return over IT and its processes. IT governance provides the structure that links IT processes, IT resources, and information to enterprise strategies and objectives.<sup>4</sup>

In summary, the board of directors and top-level, executive managers must take responsibility to ensure that the organization uses processes that align IT systems to the strategies and objectives of the organization. IT systems should be chosen and implemented to support the attainment of strategies and objectives. To fulfill the management obligations that are inherent in IT governance, management must focus on the following aspects:

- Aligning IT strategy with the business strategy
- Cascading strategy and goals down into the enterprise
- Providing organizational structures that facilitate the implementation of strategies and goals
- Insisting that an IT control framework be adopted and implemented

(IT governance is further described in Chapter 5.)

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<sup>4</sup> Control Objectives for IT (COBIT) 4.1, Executive Summary and Framework p. 5 ([www.isaca.org](http://www.isaca.org)).

## The Importance of Accounting Information Systems to Accountants (Study Objective 8)

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Anyone pursuing an accounting career must study and understand accounting information systems (AIS) and the related concepts. Any career path within accounting will in some manner involve the use of an accounting information system. Accountants have several possible roles related to accounting information systems: They may be users of the AIS, part of the design or implementation team of an AIS, and/or auditors of an AIS.

### **Users of the AIS**

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Accountants within any organization must use the accounting information system to accomplish the functions of accounting, generating and using accounting reports. For example, a controller in an organization must oversee a staff of accountants who record all accounting transactions, do the monthly closing of the accounting records, and generate the reports needed by management and external users. The accounting information system is the mechanism that allows the accounting staff to accomplish those functions. Accountants must therefore understand AIS concepts in order to perform these accounting jobs.

### **Design or Implementation Team**

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Accountants are usually part of a multiple-discipline team that designs and/or implements accounting information systems. When an organization considers a change to its AIS, accountants must be involved in decisions related to such matters as evaluating which software to purchase, how to design software or systems, and the implementation of software or systems.

### **Auditors of the AIS**

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Auditors conduct assurance services such as a financial audit. To conduct an audit, the auditor must collect evidence and make judgments regarding the completeness and accuracy of accounting information. The auditor cannot make informed decisions necessary to complete the audit without an understanding of the accounting information system. The auditor cannot judge the reliability of accounting data without understanding how the data is entered, processed, and reported in the accounting information system.

## The Relation of Ethics to Accounting Information Systems (Study Objective 9)

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Unfortunately, there are many opportunities for unethical or fraudulent behavior related to accounting information systems. Accounting information systems can be misused to assist in committing or concealing unethical acts. That is, the AIS is often the tool used to commit or cover up unethical behavior.

## The Real World

In an anonymous company that sold computer software, the following unethical behavior occurred:

Top management set very ambitious monthly targets in order to meet annual revenue goals. Sales could not be booked as revenue until the product was shipped to customers. As it got closer to the end of a month and it appeared that monthly goals would not be met, salespersons were asked to call customers and ask them to take receipt of their orders earlier than anticipated. If these efforts did not produce enough revenue, there were instances where products were shipped to customers who had not ordered, knowing that customers would immediately ship them back to the company. The revenue, however, would

already be recognized for the current month, which resulted in meeting the monthly sales goal.<sup>5</sup>

Notice that those who engaged in this scheme presumed that the accounting information system would record sales when orders were shipped to customers. These individuals were taking advantage of the AIS by forcing products to be shipped early and thereby artificially inflating revenue. Those involved in the deception knew that the shipping of goods to customers would trigger processes that would lead to revenue being recorded. They knew that the AIS would capture and record data as if a sale were proper, because the system is set up to record shipments to customers as sales.

This is only one example of how an accounting information system can be misused to conduct unethical acts. Other examples of some potential unethical behaviors, to name a few, are as follows:

- Fraudulent financial reporting
- Revenue inflation
- Expense account fraud
- Inflating hours worked for payroll purposes
- Computer fraud
- Hacking
- Browsing confidential data

In many cases, unethical acts have also been made illegal. For example, fraudulent financial reporting is unethical, and it is also illegal. However, using a 3 percent bad debt percentage as opposed to a more realistic 4 percent rate to “fudge the numbers” may not be criminal; yet it is unethical. For many reasons, accountants must become aware of the potential unethical behaviors. Some of those reasons are that accountants

1. Assist in developing and implementing internal control structures that should lessen the chance of unethical actions. Those in this role must understand the nature of the various kinds of unethical actions before they can design a system to lessen the risk.

<sup>5</sup> Joseph F. Castellano, Kenneth Rosenzweig, and Harper A. Roehm, “How Corporate Culture Impacts Unethical Distortion of Financial Numbers,” *Management Accounting Quarterly*, Summer 2004, vol. 5, issue 4, p. 39.

2. Are often pressured to assist in, or cover up, unethical actions. Therefore, accountants must understand what actions are ethical and unethical so that they can avoid being coerced into unethical actions.
3. Deal with assets or records that could easily tempt accountants to engage in unethical behavior. For example, someone who handles cash every day may be tempted to steal some of the cash. Accountants have control over or recording responsibilities for many assets. When professional accountants face ongoing temptation, having a better understanding of which actions are unethical may help them to resist temptation to commit unethical acts.

(These unethical behavior examples and many other ethical issues related to AIS will be discussed in the remaining chapters.)

## Summary of Study Objectives

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*An overview of business processes.* Many different business processes occur in organizations. A business process is a prescribed sequence of work steps completed in order to produce a desired result for the organization. A business process is initiated by a particular kind of event, has a well-defined beginning and end, and is usually completed in a relatively short period. Business processes may have direct or indirect effects on accounting records, and these can be categorized into revenue processes, expenditure processes, conversion processes, and administrative processes.

*An overview of an accounting information system.* The accounting information system comprises the processes, procedures, and systems that capture accounting data from business processes; record the accounting data in the appropriate records; process the detailed accounting data by classifying, summarizing, and consolidating; and report the summarized accounting data to users. As business processes occur, accounting data from those processes is entered into the accounting information system, processed, and reported to the appropriate internal and external parties. The internal reports can be used as feedback to monitor and control business processes.

*The business process linkage throughout the supply chain.* Not only do business processes occur within an organization, but they can also be linked to related organizations throughout the supply chain. For example, when an organization buys raw materials, it is engaging in a business process linked to the vendor's selling process. The supply chain is the organizations, processes, and information flows that involve the movement of materials, funds, and related information through the full logistics process, from the acquisition of raw materials to delivery of finished products to the end user. Supply chain management controls all materials, funds, and related information in the logistics process.

*The IT enablement of business processes.* Processes throughout the supply chain can benefit from information technology enablement. IT enablement is the leveraging of IT capabilities to improve the efficiency of a process, reduce the cost of a process,

or both. For example, when an organization sells goods on a website, it is using IT to improve the efficiency and reduce the costs of its sales processes.

*Basic computer and IT concepts.* To understand an AIS and IT enablement of processes, it is important to have an understanding of basic computer and IT concepts. These concepts include the data hierarchy, databases, relational databases, and networks.

*Examples of IT enablement.* Organizations use many different types of IT enablement. Some examples introduced in this chapter include e-business, electronic data interchange, point of sale systems, automated matching of purchasing documents, evaluated receipt settlement, e-payables, and enterprise resource planning systems. IT enablement is described in more detail in later chapters.

*The internal control structure of organizations.* To maintain a strong control environment, there are at least six control-related structures that management should develop and maintain. These are enterprise risk management (ERS), a code of ethics, a set of internal controls, a set of IT controls, a corporate governance structure, and an IT governance structure.

*The importance of accounting information systems to accountants.* Accountants must understand accounting information systems because they are users, participants in the design and implementation, and auditors of the AIS.

*The relation of ethics to accounting information systems.* The accounting information system can be misused to conduct or cover up unethical or fraudulent behavior. In order to fulfill their professional responsibilities, accountants must understand the types of behavior within an organization that are unethical.

## Key Terms

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Accounting information system	Data mining	Evaluated receipt settlement	Operational database
Application controls	Data warehouse	Field	Point of sale system
Automated matching in purchasing	Database	File	Random access
Batch processing	E-business	General controls	Real-time processing
Big Data	Electronic data interchange	Indexed sequential access method	Record
Bit	Electronic invoice	Information technology	Sequential access
Business process	presentment and payment	Internal controls	Structured data
Business process reengineering	Enterprise resource planning software	IT enablement	Supply chain
Byte	Enterprise risk management	IT governance	Supply chain management
Corporate governance	E-payables	LAN	Transaction file
		Master file	Unstructured data
		Online processing	Vendor

## End of Chapter Material

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### Concept Check



- 1 When a company receives returned goods from a customer, the business process to accept the return would most likely be a(n)
  - a. administrative process
  - b. conversion process
  - c. expenditure process
  - d. revenue process
  
- 2 Which of the following is least likely to be an output of the accounting information system?
  - a. check
  - b. A report
  - c. An invoice
  - d. A bar code
  
- 3 Which of the following is not true of the supply chain?
  - a. The supply chain includes vendors.
  - b. The supply chain excludes customers.
  - c. The supply chain includes information flows.
  - d. The supply chain includes secondary suppliers.
  
- 4 Which of the following is not an objective of IT enablement?
  - a. Increased accuracy of data
  - b. Reduced cost
  - c. Reduced security problems
  - d. Increased efficiency
  
- 5 The correct order of the computer data hierarchy is
  - a. byte, bit, record, field, file, database
  - b. bit, byte, record, field, file, database
  - c. bit, byte, field, record, file, database
  - d. bit, byte, field, record, database, file
  
- 6 The process of searching for identifiable patterns in data is called
  - a. sequential processing
  - b. data warehousing
  - c. data mining
  - d. real-time processing
  
- 7 An IT-enabled system for purchasing that is an “invoice-less” system is called a(n)
  - a. automated matching system
  - b. evaluated receipt settlement
  - c. e-payables
  - d. point of sale system
  
- 8 The COSO report written for the purpose of assisting managers in the challenge of managing risk in their organizations is entitled
  - a. “Internal Controls—Integrated Framework”
  - b. “Enterprise Risk Management—Integrated Framework”
  - c. “Corporate Governance Guidance”
  - d. “IT Governance Guidance”
  
- 9 Accountants have some form of use of the AIS in all but which role?
  - a. User
  - b. Programmer
  - c. Auditor
  - d. Designer
  
- 10 Which of the following is not true of unethical behavior?
  - a. The only category of unethical behavior for accountants is inflating revenue.
  - b. Accountants are often pressured to help commit or cover up unethical behavior.
  - c. Hacking is an unethical behavior that accountants should be concerned about.
  - d. An accounting information system can be used to cover up unethical behavior.

### Discussion Questions

- 11 (SO 1) How might the sales and cash collection processes at a Wal-Mart store differ from the sales and cash collection processes at McDonald's?
  
- 12 (SO 1) Can you think of any procedures in place at McDonald's that are intended to ensure the accuracy of your order?
  
- 13 (SO 1) How might the sales and cash collection process at Boeing Co. (maker of commercial passenger jets) differ from the sales and cash collection processes at McDonald's?
  
- 14 (SO 1) Are there business processes that do not in some way affect accounting records or financial statements?
  
- 15 (SO 2) Briefly describe the five components of an accounting information system.
  
- 16 (SO 2) Describe how sales data is captured and recorded at a restaurant such as Applebee's.
  
- 17 (SO 2) What occurs in an accounting information system that classifies accounting transactions?

- 18** (SO 2) What are the differences between internal reports and external reports generated by the accounting information system?
- 19** (SO 3) What types of businesses are in the supply chain of an automobile manufacturer?
- 20** (SO 3) When a company evaluates a supplier of materials, what kinds of characteristics might be evaluated?
- 21** (SO 3) How do you think a company may be able to influence a supplier to meet its business processing requirements?
- 22** (SO 4) Describe any IT enablement that you have noticed at a large retail store such as Wal-Mart or Target.
- 23** (SO 4) How do you think the World Wide Web (WWW) has led to business process reengineering at companies such as Lands' End or J. Crew?
- 24** (SO 4) What two kinds of efficiency improvements result from business process reengineering in conjunction with IT systems?
- 25** (SO 5) Explain the differences between a field, a record, and a file.
- 26** (SO 5) Explain why random access files would be preferable to sequential access files when payroll personnel are changing a pay rate for a single employee.
- 27** (SO 5) Why do real-time systems require direct access files?
- 28** (SO 5) Why is data contained in the data warehouse called nonvolatile?
- 29** (SO 5) How is an extranet different from the Internet?
- 30** (SO 6) Prepare a list of the types of businesses that you have been involved in that use point of sale systems.
- 31** (SO 6) What do you think would be the advantages of an e-payables system over a traditional system that uses paper purchase orders and invoices?
- 32** (SO 7) Describe why enterprise risk management is important.
- 33** (SO 7) What is the difference between general controls and application controls?
- 34** (SO 7) In what way is a code of ethics beneficial to an organization?
- 35** (SO 8) What roles do accountants have in relation to the accounting information system?

## Problems

- 47** (SO 2) If an accounting information system were entirely a manual system (no computers used), explain how data would be captured, recorded,

### Brief Exercises

- 36** (SO 1) For each category of business processes (revenue, expenditure, conversion, and administrative), give an example of a business process.
- 37** (SO 2) Think of a company that you have worked for or with which you have done business. Which departments within the company need reports generated by the accounting information systems?
- 38** (SO 3) Explain a supply chain linkage and give an example.
- 39** (SO 4) Explain how business process reengineering occurs. Also, explain how it differs from the typical changes in company policies.
- 40** (SO 4, 6) Describe automated matching in the purchasing process and explain how this IT enablement has improved efficiency in companies.
- 41** (SO 5) For an accounts receivable system, what kind of data would be found in the master files and transaction files, respectively? What type of structured and unstructured data might relate to an accounts receivable system?
- 42** (SO 5) Describe the differences in the following three types of processing:
- a. batch processing
  - b. online processing
  - c. real-time processing
- 43** (SO 5) The networks discussed in this chapter were LANs, Internet, intranet, and extranet. Explain each.
- 44** (SO 7) Give a brief summary of each of the following:
- a. enterprise risk management
  - b. corporate governance
  - c. IT governance
- 45** (SO 9) Describe why accountants should be concerned about ethics.
- 46** (SO 9) Melissa Simpson is currently pursuing her accounting degree at Fairfield University. She has excelled in each of her major courses to date; however, she tends to struggle in her computer classes and with assignments requiring use of computer technology. Nevertheless, Melissa confidently claims that she will become an excellent accountant. Comment on the practical and ethical implications of her position.

classified, summarized, and reported. Discuss how the sophistication of the company's computer system impacts the accounting output and, alternatively,

- how the requirements for accounting outputs impact the design of the accounting information systems.
- 48** (SO 1, 3) Classify each of the following as a revenue process, expenditure process, conversion process, or administrative process:
- Selling common stock to raise capital
  - Purchasing electronic components to manufacture DVD players
  - Moving electronic components from the stockroom to the production floor to begin making DVD players
  - Paying employees at the end of a payroll period
  - Preparing financial statements
  - Receiving cash payments from customers
  - Buying fixed assets
  - Moving manufactured DVD players from the production floor to the warehouse
- 49** (SO 1) Business processes are composed of three common stages: an initial event, a beginning, and an end. For items a-h listed in Problem 48, identify the applicable initial event, beginning, and end of the process.
- 50** (SO 1, 2, 7) Each of the points listed next represents an internal control that may be implemented within a company's accounting information system to reduce various risks. For each point, identify the appropriate business process (revenue, expenditure, conversion, and administrative). In addition, refer to the description of business processes under Study Objective 2 in this chapter, and identify the appropriate subprocess. (Some subprocesses may be used more than once, and others may not be used at all.)
- Customer credit must be authorized before a business transaction takes place.
  - An authorized price list of goods for sale is provided.
  - A shipping report is prepared for all shipments of goods so that customers may be billed in a timely manner.
  - Access to personnel files and paycheck records is available only in accordance with management specifications.
  - New vendors are required to be authorized before a business transaction takes place.
  - Access to cash is restricted to those employees authorized by management.
  - Costs of goods manufactured is properly summarized, classified, recorded, and reported.
- h.** Amounts due to vendors are reconciled by comparing company records with statements received from the vendors.
- i.** Employee wage rates and paycheck deductions must be authorized by management.
- j.** Specific procedures such as the performance of a background check are carried out for all new employee hires.
- k.** The purchasing manager is notified when stock levels are low so that items may be restocked to prevent backorders.
- l.** Two signatures are required on checks for payments in excess of \$5,000.
- m.** When excess cash is on hand, the funds are invested in short-term securities.
- n.** Goods received are inspected, and any damaged or unmatched items are promptly communicated to the vendor.
- o.** The monthly bank statement is reconciled to the company's cash records by an outside accountant.
- 51** (SO 3) Using the Internet or other research tool, search for the terms "RFID" and "supply chain." Put both of these terms in your search and be sure that "supply chain" is in quotation marks. Read some of the resulting websites you find and answer these questions:
- What is RFID?
  - How is RFID related to the supply chain?
  - How will RFID improve the accuracy of data from the supply chain?
- 52** (SO 7) Go to the COSO website and locate the guidance on enterprise risk management. The executive summary of the article "Enterprise risk management—Integrated Framework" can be downloaded at no cost. Read the sections titled "Roles and Responsibilities" and "Use of this Report." Describe the roles that various parties should play in enterprise risk management.
- 53** (SO 9) Using the Internet or other research tool, search for the term (in quotations) "earnings management." From the items you read, answer the following questions:
- Is earnings management always criminal?
  - Is earnings management always unethical?
- 54** (SO 9) Using the Internet or other research tool, search for "HealthSouth" and "fraud" or "Scrushy" (the name of the company's CEO). Explain the fraud that occurred at HealthSouth Corporation. What was the ultimate result of the prosecution of HealthSouth officials?



## Cases

- 55 The Gas and Java Mart (G & J) is a gas station and convenience market similar to any BP, Shell, or Speedway gas and convenience stores. G & J is a regional chain located in eastern Missouri, with 14 locations.

**Required:**

The section of this chapter identified as Learning Objective 2 describes five work steps, or processes, in the accounting information system. Based on your experience in using similar kinds of gas and convenience marts, briefly describe your impression of how these five work steps would be accomplished at G & J if you buy gas, a bottled soft drink, and a candy bar.

- 56 The fast food industry has been dramatically altered through IT enablement. However, IT enablement has not completely eliminated manual processes in fast food franchise restaurants such as McDonald's, Wendy's, and Burger King.

**Required:**

Using your experience in visiting fast food restaurants, answer the two questions that follow:

- a. List and describe four different activities that are manual parts of business processes at a restaurant such as Wendy's.
  - b. List and describe four different activities that are IT-enabled parts of business processes at a restaurant such as Wendy's.
- 57 Consider any recent purchase you made at a department store such as Target, Walmart, or Kmart. A business process that occurred was the sale of a product to you. However, to make that sale, the department store had to engage in many other processes that support that sales process, or result from that sales process. These other processes may precede or occur after that sales process.

**Required:**

- a. Describe any necessary supporting processes that precede the sale of a product to you.
- b. Describe any necessary supporting processes that occur after a sale to you.

- 58 Cooper's Cues Company is a small manufacturing operation that makes and sells pool cues for sporting goods stores and billiard halls in Baltimore, Maryland, and the surrounding local area. Rob Cooper and his wife, Stacy are the owners and only employees.

Rob Cooper purchases all of the materials needed to make pool cues, including wood, paint, hardware, and supplies. All purchases are made from local suppliers, and all payments are made in cash at the time of the purchase. Rob Cooper is responsible for making the pool cues. He also handles all telephone calls and replacements, and he personally delivers all finished products.

All sales are conducted on account via the Internet. Orders are received electronically through the company's website at [www.cooperscues.com](http://www.cooperscues.com). Stacy Cooper prints the orders and forwards them to her husband in the workshop. Mrs. Cooper is also responsible for website design and maintenance, as well as all accounting and customer collections.

Address the following questions regarding Cooper's Cues:

- a. What are the business processes that apply to this business?
- b. How would the business processes change if Cooper's Cues expanded to a regional focus?
- c. How would the business processes change if Cooper's Cues began selling pool balls and other billiard equipment in addition to cues?

## Solutions to Concept Check

- 1 (SO 1) The business process to accept a customer's return would most likely be a **d. revenue process**. Customer returns are part of the sales return process, which is a revenue process.
- 2 (SO 2) Of the choices presented, **d. a bar code** would be least likely to be an output of the accounting information system. A bar code is usually an input to the accounting information system. For example, the bar code on a grocery product is scanned to process a

sale. The other options are outputs of an accounting information system.

- 3 (SO 3) The following is not true of the supply chain: **b. The supply chain excludes customers**. The supply chain includes vendors, customers, and all intermediaries.
- 4 (SO 4) The following is not an objective of IT enablement: **c. reduced security problems**. IT systems

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usually have increased security problems. The other three answers are objectives of IT enablement.

- 5 (SO 5) The correct order of the computer data hierarchy is **c. bit, byte, field, record, file, database**.
- 6 (SO 5) The process of searching for identifiable patterns in data is called **c. data mining**.
- 7 (SO 6) An IT-enabled system for purchasing that is “invoice-less” is called **b. evaluated receipt settlement**.
- 8 (SO 7) The title of the COSO report that was written for the purpose of assisting managers in the challenge of managing risk in their organizations is

**b. “Enterprise Risk Management—Integrated Framework.”**

- 9 (SO 8) Accountants have some form of use of the AIS in all of the given choices except **b. programmer**. The programming role involves formulation of the AIS to meet users’ needs. It uses input and feedback from a variety of people within the organization and the supply chain to determine its components.
- 10 (SO 9) The following is not true of unethical behavior: **a. The only category of unethical behavior for accountants is inflating revenue**. This is only one of the many forms of unethical behavior that may take place.

# Foundational Concepts of the AIS

### STUDY OBJECTIVES

This chapter will help you gain an understanding of the following concepts:

- 1.** The interrelationships of business processes and the AIS
- 2.** Types of accounting information systems
- 3.** Client-server computing
- 4.** Cloud computing
- 5.** Accounting software market segments
- 6.** Input methods used in business processes
- 7.** The processing of accounting data
- 8.** Outputs from the AIS related to business processes
- 9.** Documenting processes and systems
- 10.** Ethical considerations at the foundation of accounting information systems

The Real World example on the next page will help you understand the context of many concepts in this chapter. Please read that Real World example to begin effective reading and studying of this chapter. As seen in the Real World example, technology has allowed the hospitality industry to provide better, faster, and higher quality service to customers. This trend of taking restaurant orders with an electronic device continues to grow. In fact, many software companies offer a variety of systems that allow servers to take the customers' orders on a hand-held device such as an iPhone or iPod. These are examples of using IT to enable business processes. In addition to the changes for customers, the business processes and the accounting information systems must adapt to these new technologies. These handheld wireless order taking systems improve the business process of taking and filling customer orders, in addition to changing the way the data for each sales transaction is captured. The older method of writing food orders on a hand written ticket and then taking that ticket to a terminal to key in the order is not only less efficient, but more prone to errors. IT systems that reduce errors result in more accurate information in the accounting information system.

The point of these examples is to illustrate that business processes, IT systems, and the accounting information system are inextricably linked. Using IT to enable business processes will change these business processes as well as the manner

in which accounting data is collected. This is true not only in the hospitality industry as in the examples above, but in all industries. All industries have been affected by technology and have in most cases revised business processes and accounting information systems to take advantage of this technology. IT systems have dramatically affected the input of data into accounting information systems, the manner in which data is processed, and the outputs of the accounting information system. This

## The Real World



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Since Au Bon Pain, the Boston-based bakery-café chain, redesigned its interior restaurant spaces, many of its franchisees adopted a simultaneous roll-out of a new ordering system using Apple iPads. At these locations, customers are greeted by a server stationed near the front counter, where orders are taken and entered on the iPad's touch screen. Under a traditional ordering system, prior to the use of iPads, servers at Au Bon Pain took orders manually by writing them on a slip.

During the bustling lunch hour at the Au Bon Pain café at Harvard Square near Harvard University, many of the customers require service at the same time. Upgrading to the iPad system tremendously speeds up the process of taking customer orders. Lines tend to be shorter, as servers and customers can more readily handle the dozens of options available on an Au Bon Pain menu. The efficiency increase allows the cafe to increase revenue by serving more customers. In addition, some of the highest-volume Au Bon Pain franchises found that they are saving up to 1,000 sheets of paper per day since changing to the iPad ordering system.<sup>1</sup>

Some high-end restaurants are also adopting similar iPad ordering systems. For example, iPads are sometimes used to manage a restaurant's wine list, providing customers with detailed information about the selections and allowing them to search for a bottle by wine region, varietal, vintage, or price. Even fast-food restaurants such as McDonald's and casual eateries such as McAlister's Deli have experimented with iPad ordering systems. Not only does this save much time and legwork for servers, it increases the overall operational efficiency of the restaurant. These systems also increase the accuracy and the pricing of items in the order.

chapter begins by revisiting the fundamental concepts of business processes and accounting information systems, emphasizing the interrelationships of the two. It also describes accounting software and the various data input methods, processing, and output of accounting information systems. In addition, important tools in the use of accounting information systems are described. These tools are the methods to document accounting information systems and client-server computing.

## Interrelationships of Business Processes and the AIS (Study Objective 1)

Chapter 1 introduced an accounting information system as a system that captures, records, processes, and reports accounting information. The information captured is the result of financial transactions within the organization or between the organization

<sup>1</sup>The Harvard Crimson, [www.thecrimson.com/video/2011/2/11/au-bon-pain-ipad/](http://www.thecrimson.com/video/2011/2/11/au-bon-pain-ipad/)

and its customers and vendors. When a transaction occurs, there are systematic and defined steps that take place within the organization to complete the underlying tasks of the transaction. These steps are business processes. A **business process** is a prescribed sequence of work steps completed in order to produce a desired result for the organization. A business process is initiated by a particular kind of event, has a well-defined beginning and end, and is usually completed in a relatively short period of time. Business processes occur so that the organization may serve its customers.

Every organization exists to serve customers in some way. Some organizations make and sell products, while others provide services to customers. Nearly everything that an organization does to fulfill its day-to-day activities is part of a business process. When organizations buy, sell, produce, collect cash, hire employees, or pay expenses, they are engaged in business processes, all of which support the objective of serving customers. The examples of beverage or food service to customers are business processes.

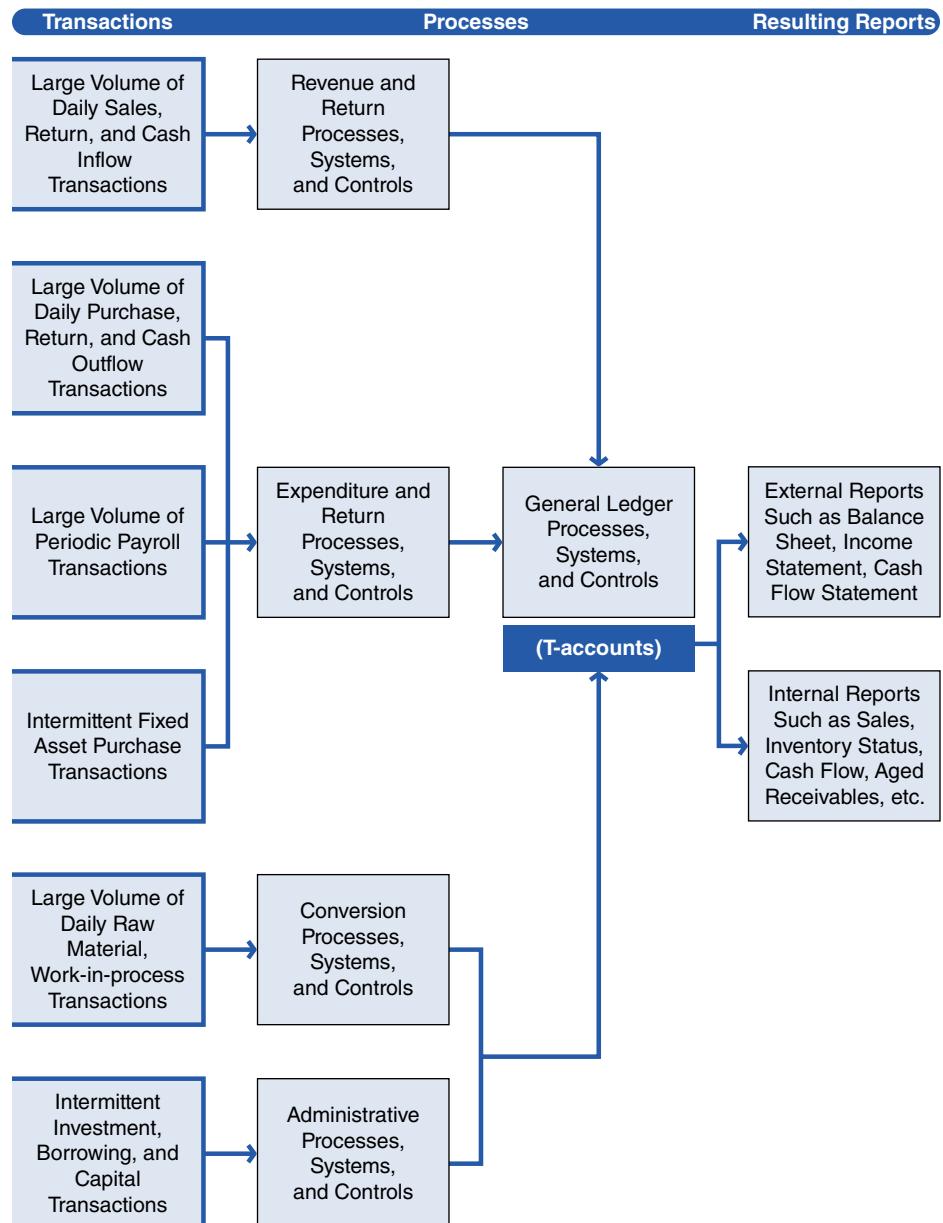
Each business process has a set of systematic steps undertaken to complete it. Some business processes you see in your everyday life. For example, when you eat at a restaurant, the restaurant must have established a systematic set of steps that employees perform to serve you. A host meets you at the door to seat you, and a server has been preassigned to that table. The server takes your order and relays the order to the kitchen. The kitchen personnel have a predesigned set of activities to prepare your meal. The server then delivers your meal, checks on you periodically throughout the meal while you are eating, and presents a bill; then you pay the bill. All of these activities are business processes for a restaurant.

As these many business processes occur, data is generated that must be collected by the accounting information system. The restaurant must have a system to capture and record the revenue generated by your meal, the details of your credit card payment, the food used in your meal and its cost, the wages paid to the server and host, and any tips. For nearly all of the business processes in an organization, there are accounting effects. As the systematic steps are undertaken in a business process, the accounting information system must capture and record the related financial data.

Exhibit 2-1 shows the relationships among transactions, business processes, and the reporting of information. As transactions occur, business processes are undertaken to complete the transaction and record any relevant data. Within any business, there may be hundreds of business processes. Moreover, these business processes may vary from company to company. For example, the business processes of a local, family restaurant are probably very different from the business processes of a global fast food franchise like McDonald's. In addition, the business processes of McDonald's would be vastly different from, for example, the business processes of Samsung, a mobile phone manufacturer. However, regardless of the type of business, as you will recall from Chapter 1, the general categories of business processes that are used to organize the concepts of most business processes include revenues processes, expenditure processes, conversion processes, and administrative processes.

To properly capture and record all relevant financial data, an accounting information system must maintain both detail and summary information. In traditional, manual accounting systems, the detailed transaction data is taken from source documents, special journals, and subsidiary ledgers and is summarized and posted to the general ledger. Exhibit 2-1 depicts the processes that summarize the detailed data into general ledger accounts.

Most accounting systems today are computerized to some extent, but there still remains a need for paper documents in many systems. Regardless of the extent of computerization, all accounting information systems must capture data from transactions within business processes, complete the necessary processing of that data, and provide outputs.



**EXHIBIT 2-1** Overall View of Transactions, Processes, and Resulting Reports

## Types of Accounting Information Systems (Study Objective 2)

There are very many different types of accounting information systems used in business organizations today. The size of the organization, the nature of its processes, the extent of computerization, and the philosophy of management all affect the choice of system. Simply to organize the study of accounting information systems, we have divided the systems in place into three categories, as follows:

1. Manual systems
2. Legacy systems
3. Modern, integrated IT systems

## Manual Systems

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Certainly, most large or medium-size organizations use computerized accounting systems rather than manual record-keeping systems. However, there are many small organizations that use manual systems, in whole or in part, to maintain accounting records. In addition, even those larger organizations that have computerized aspects of the accounting information system may still have parts of their processes that involve manual records. For example, even if the calculation and printing of a paycheck in an organization are computerized, the employee time card may be completed by hand.

Because small organizations often use manual record-keeping systems—and even computerized systems may rely on some manual record keeping—it is important to examine manual processes in accounting information systems. An entirely manual system would require source documents and paper-based ledgers and journals.

A **source document** is a record that captures the key data of a transaction. The data on a source document usually includes the date, purpose, entity, quantities, and dollar amount of a transaction. Some examples of source documents are employee time cards, purchase orders, sales orders, and cash receipts. A source document usually serves three important functions in the accounting system: First, the source document provides the input data necessary for the accounting system to record the transaction. Second, the source document triggers business processes to begin. For example, a purchase order triggers the business processes that will fill the order and ship goods to the customer. Third, the source document serves as part of the permanent audit trail. If necessary, the organization can look up the source document of a transaction to determine the origin and validity of the transaction.

A **turnaround document** is an output of the accounting system that can be used as an input in a different part of the accounting system. An example is your credit card statement, which is a computer output of the system your credit card company uses. The part of that statement you return with your payment is an input that can be used by the company's accounting system to determine your account number. The computer system scans the document to read your account number, and it is not necessary for a person to manually type in your number. The turnaround document improves input efficiency and accuracy by eliminating human error.

These source documents become the inputs to record transactions in ledgers and journals. The **general ledger** provides details for the entire set of accounts used in the organization's accounting systems. Transactions or transaction summaries are posted to the general ledger from the general journal and special journals. The **general journal** is the place of original entry for any transactions that are not recorded in special journals. The general journal is used to record nonroutine transactions and adjusting and closing entries. **Special journals** are established to record specific types of transactions. For example, a sales journal records all sales. Other special journals could include a purchases journal, payroll journal, cash receipts journal, and cash disbursements journal. At regular intervals, such as at the end of each week or month, the subtotals of the special journals are posted to the general ledger. **Subsidiary ledgers** maintain detailed information regarding routine transactions, with an account established for each entity. For example, the accounts receivable subsidiary ledger maintains all detailed information regarding customer purchases, payments, and balances due. An account exists for each customer, and the total of those customer accounts equals the balance in the accounts receivable general ledger account.

The source documents, journals, and ledgers comprise the manual records in a manual accounting system. To record in these journals and ledgers, there must be established processes that employees follow in collecting source documents and entering information from source documents into the appropriate journals and ledgers.

As accounting information systems became computerized, the manual processes of record keeping and posting were transferred to automated systems. Automated systems maintain the same structure of subsidiary ledgers and general ledger accounts; however, the difference is that automated ledgers are computer files rather than paper records. Newer IT systems may not use the same structure and are much more likely to use fewer paper documents and records.

When IT is part of the accounting information system, it is important to understand that the hardware and software are not the *entire* accounting information system. In addition to the hardware and software, the human processes that capture, record, and process information are an integral part. The real-world example at the beginning of this chapter described a wireless order-taking system. However, even that advanced technology needs a human to enter the order. The established process of entering the order is part of the accounting information system because it is part of the business process that captures accounting data. Therefore, accounting information systems include human processes as well as IT processes.

Until the 1990s, most accounting software consisted of modules, or separate programs, for each business process. Accounting software usually has modules for accounts receivable, accounts payable, payroll, and possibly other processes. These modules achieve essentially the same purpose as special journals and subsidiary ledgers. For example, the accounts receivable module processes and records all credit sales and maintains detailed information about customer transactions, collections, and balances due. Traditional accounting software systems, often called legacy systems, are described in the next section.

## Legacy Systems

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A **legacy system** is an existing system in operation within an organization. A legacy system uses older technology in which the organization has a considerable investment and that might be entrenched in the organization. Some legacy systems have been in place for many years; perhaps the organization spent much time developing, maintaining, and customizing the system. Often, legacy systems are based on old or inadequate technology. In large companies, many legacy systems run on host-based mainframe computers. “Host-based” means that all significant computer processing takes place on the mainframe host computer. Accounting software systems running on such computers are often written in programming languages that are nearing obsolescence, such as COBOL, RPG, Basic, and PL1.

During the last couple of decades, even as technology advances have made these systems more outdated, many companies have been reluctant to abandon their legacy systems because they were customized to meet the specific needs of the organization and the process to replace them is expensive and time-consuming. Legacy systems may have served companies very well over many periods, and many organizations have legacy systems that they are still attempting to maintain. There are both advantages and disadvantages to maintaining these older systems. The advantages are that legacy systems

1. have often been customized to meet specific needs in the organization
2. often support unique business processes not inherent in generic accounting software

3. contain invaluable historical data that may be difficult to integrate into a new system
4. are well supported and understood by existing personnel who are already trained to use the system

There are also many disadvantages to maintaining older systems. The disadvantages are that legacy systems

1. are costly to maintain in both dollars and time
2. often lack adequate, up-to-date supporting documentation
3. may not easily run on new hardware, and the old hardware and parts needed for maintenance may become obsolete
4. are not usually based on user-friendly interfaces such as Microsoft Windows or Apple's Mac OS
5. tend to use software written in older computer languages, and fewer programmers are available for maintenance
6. are often difficult to modify to make them Web-based or user-friendly
7. become difficult to integrate when companies merge or acquire other companies, in which case consolidating subsidiary company information into one set of financial statements and reports can involve many manual and error-prone steps

## The Real World

Bowen is a Canadian staffing agency that provides numerous job placement, workforce management, and human resource services. The company was relying on an older accounting and payroll system that it implemented over 10 years ago. Bowen had purchased the source code of this legacy accounting system and hired a consulting firm to modify the program code to revamp the entire system. Bowen was spending approximately \$200,000 per year to maintain and update these custom features in its system. Even

with these modifications, Bowen found that it was doing manual and duplicate entries.

To modernize its accounting system, Bowen purchased and implemented a Microsoft Business platform that integrated the company's finances, field service, customer relationships, and human resources applications. These solutions speed up and simplify the process of managing job assignments/position openings, selecting candidates, and building effective relationships.

Often, companies are faced with the decision whether to replace or update legacy systems. When the benefits outweigh the costs, organizations typically decide to replace legacy systems. Many large corporations replaced legacy systems just prior to the year 2000 in an effort to avoid a glitch known as the Y2K bug, which theoretically would misinterpret date-sensitive information when the computer's clock rolled over from 1999 to 2000.

Organizations do not always completely replace legacy systems with newer hardware and software systems, but they often try to use new technology to enhance the existing systems. One approach is to use **screen scrapers**, or frontware, which add modern, user friendly screen interfaces to legacy systems. There are limitations to this approach, because mainframe systems are not as efficient as newer technology at handling data entry by multiple, simultaneous users.

A second approach to upgrading is to use software that bridges legacy systems to new hardware and software systems and interfaces. These interface bridges are called

**enterprise application integration**, or EAI. EAI is a set of processes, software and hardware tools, methodologies, and technologies to integrate software systems. When EAIs are implemented, they are intended to consolidate, connect, and organize all of the computer applications, data, and business processes (both legacy and new) into a seamlessly interfaced framework of system components. The EAI allows real-time exchange, management, and reformulation of all of the critical information and business processes. EAIs are developed and sold to companies to put a modern, advanced technology front on older legacy systems, accomplishing the necessary integration of legacy systems with user friendly and modern processing of data.

The third method is the complete replacement of legacy systems. If the organization can afford the time and money required, the purchase and implementation of modern, integrated systems may be the best approach. Management must weigh the cost and benefits of these alternative methods when facing the decision to update or replace legacy systems.

## Modern, Integrated Systems

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In today's AIS environment, numerous accounting software systems are available for purchase that integrate many or all of the business processes within an organization. In the early days of computer automation of accounting, much of the accounting software was developed and written internally by the organization's IT staff. Today, companies more frequently purchase software rather than develop it internally. Often, purchased systems are modified by the IT staff to meet specific needs of the organization.

The new programs sold by software development companies are more user-friendly than legacy accounting systems, typically utilize the latest technology in data storage and Internet interfaces, and offer powerful, technologically advanced systems that serve as an important part of the accounting information system.

There are many advantages to purchasing accounting software rather than developing software in-house. Purchased software has a lower cost, shorter implementation time, and fewer bugs. The cost is lower because the development cost can be spread across the many companies that purchase the software, rather than being absorbed completely by the company that developed the software. Implementation time is shorter because it is no longer necessary for the companies to design and program their own accounting systems. Finally, these software systems have fewer bugs because they are not sold until they are fully developed, tested, and proven reliable.

These modern, integrated systems usually run in one of two types of computer architectures, or models. One model is a client–server model, and the other is cloud computing. It is important to understand these two models of computer architecture because the choice has a tremendous impact on the software that is chosen, the cost of the IT system and software, and the risks and controls. The next sections describe client–server computing and cloud computing.

## Client–Server Computing (Study Objective 3)

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Since the mid-to-late 1980s, the client–server model of networks has been commonly used. **Client–server** computing means that there are two types of computers networked together to accomplish application processing. The server is usually a

large computer that contains the database and many of the application programs. Client computers, usually PC-type computers, are networked to the server and work with the server in such a way that the network appears to be one integrated system for users. The advantage of client–server computing is that the PC clients perform as “smart” terminals that can accomplish some share of the processing tasks. In most client–server networks, the server manages and stores the large database, extracts data from the database, and runs the large, complex application programs. The client PC usually works with a subset of data that has been extracted from the server database to accomplish some local processing tasks.

For an example of client–server computing, let us assume that a large national corporation has several regional managers. Each regional manager oversees sales and collection of receivables for his or her area. A manager in Milwaukee, Wisconsin may have a feeling that there is an extremely high number of uncollectible accounts in certain parts of Milwaukee and would like to examine a report to confirm or allay this suspicion. The large database of customers and their receivables balances would reside on the server. The regional manager in Milwaukee would use her client PC to write a query to extract the overdue customer accounts in Milwaukee from the server. This query travels through the network to the main server, which extracts the customer records requested. This subset of customer records is sent to the client PC, where the regional manager can use software to map locations of overdue accounts. Such a map would help the manager review and manage the uncollectible accounts. This scenario is an example of client–server computing, and it exhibits the main characteristics of client server systems. Those characteristics are as follows:

1. Client and server computers are networked together.
2. The system appears to users to be one integrated whole.
3. Individual parts of processing are shared between the server and client.
4. The client computer participates in the processing or data manipulation in some meaningful way.

In client–server computing, tasks are assigned to either the server or the client on the basis of which one can handle each task most efficiently. The server is more efficient in managing large databases, extracting data from databases, and running high-volume transaction processing software applications. The client is more efficient in manipulating subsets of data and presenting data to users in a user-friendly, graphical-interface environment.

A large number of client–server applications are now moving toward a Web-based model. This model of IT is described in the next section.

## Cloud Computing (Study Objective 4)

Recently, there has been a movement away from a client–server approach toward **cloud computing**, a more centralized approach to IT. Because of its many applications, there may be no single, accepted definition of cloud computing. Some view it narrowly as virtual server access and use that is contracted from a third-party provider. The third party cloud or “hosting” provider maintains the hardware, installs software and software updates on the server, and is responsible for the ongoing upkeep and maintenance of the hardware and software. This contractual arrangement sometimes provides smaller, and sometimes larger, companies with a higher level of IT support than the companies can afford to hire as their own staff. The cloud provider focuses on a more narrow scope of IT service and spreads the

cost of professionals over all the companies that contract to use their hosting services. In this definition of cloud computing, the software and data may reside outside the company on the server of the third party. To put it in a context that may be easier to understand, compare the old model of iTunes to today's Apple iCloud. In the early days of iTunes, songs were purchased and downloaded to your computer or iPhone. The songs were actually stored on your computer or iPhone. Apple now has iCloud, in which iTune songs are no longer downloaded to your devices. Instead, the songs stay on Apple's computer servers, from which your devices (computer, smart phone, and iPhone) access the songs. Another example of movement to cloud computing is in e-mail accounts such as Yahoo or Google's Gmail. A few years ago, e-mail was sent to a server and your e-mail software and you then downloaded it from the server and on to your computer (PC or Mac). You read an e-mail and made a choice to keep it or delete it. If you kept it, the e-mail was stored on your computer, not on the server. With Gmail, the e-mail software and the actual e-mail both reside on Google's servers in the "cloud." No copy of the e-mail is maintained on your computer.

There are many advantages to a cloud model of e-mail such as iCloud for iTunes or Gmail. First, it may be accessed and read from any device you use. For example, you can read e-mails on your personal computer, your smart phone, a computer at your school's lab, or even on a friend's computer. This includes all the older e-mails you have not yet deleted. Second, you do not have to maintain e-mail software and data storage to save the e-mails on your computer. If we apply this concept to business and accounting software, an accounting system usually existed on the company's computers and the data was also stored there. This required that the company buy and maintain an extensive amount of computer servers and client computers. If instead the accounting software and data is stored in the cloud computing servers, the company need not have the accounting software and data within the company. Employees can access the accounting software and data through a Web browser.

Similar to the e-mail example, cloud computing allows a manager or salesperson to view or record accounting data from several devices across many locations. Perhaps a salesperson on the road can access the accounting software in the cloud on her smart phone to enter an order, or to look up an inventory item to see if it is in stock. A manager could use his iPad to view accounting reports in the evening while at home. Any device that has access to the Internet could conceivably be used to enter or view accounting data from any location.

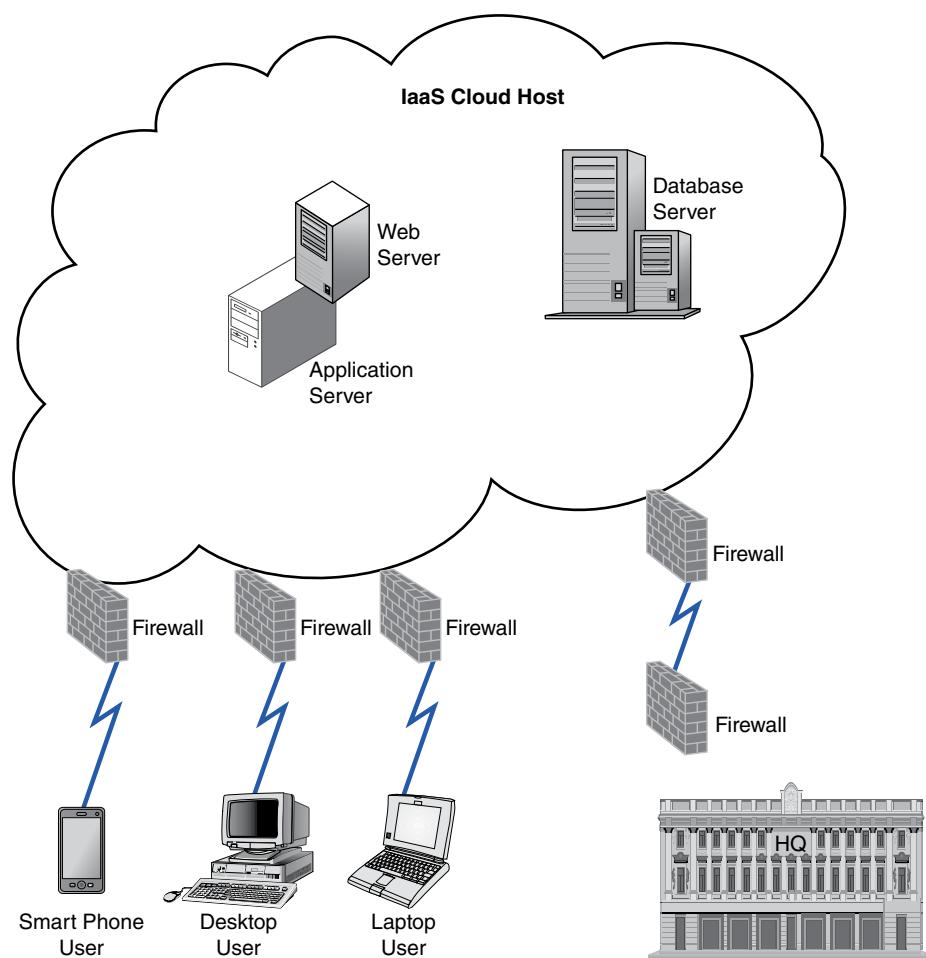
The fact that the software and data reside in the cloud and not on company computers can sometimes save a significant amount of costs. Costs required to maintain and service internal computer servers and to upgrade the software may be eliminated or greatly reduced. Fewer IT employees would be needed if software and data reside in the cloud. To put it simply, it is an outsourcing of IT to a third party. These third parties are large companies with a large amount of servers and data storage. They may service many customers and can easily scale up or scale down their services to a client as their needs change. It is important to note, however, that cloud computing companies or hosting services are provided at a cost to the company utilizing the service. In the case of hosted accounting or ERP systems, this cost can be extensive. Each company must consider the cost of maintaining its systems onsite versus contracting to have a third party host the application. In many cases, the potential savings will come when there are economies of scale realized from a hosting provider spreading the cost of IT services over multiple companies.

For a company using cloud computing services, there are specific and technical names for these services. Software that resides in the cloud is called **Software as a**

**Service** (SaaS). Databases that reside in the cloud are called **Database as a Service** (DaaS). Sometimes the database is combined with an operating system, and it is referred to as **Platform as a Service** (PaaS). Finally, the computer infrastructure in the cloud is called **Infrastructure as a Service** (IaaS). Infrastructure is the actual computer servers, drives on which data is stored, and the networking components. A company that wishes to buy cloud computing services enters into an agreement with a cloud computing provider. This agreement, or contract, is called a **Service Level Agreement** (SLA). Exhibit 2-2 depicts cloud computing for a typical company.

There are many advantages to cloud computing. A partial list of the advantages is as follows:

1. **Scalability.** As a company grows, it can easily purchase new capacity from the cloud provider. It need not buy servers or new data storage, as the cloud provider already has the capacity. This scalability is also a tremendous advantage for spikes in business activity. If a company has a large increase in business volume during certain seasons, it can easily scale up the capacity purchased from the cloud provider. When the seasonal volume declines, it then easily scales down the services it buys from the cloud provider.
2. **Expanded access.** Once the software and data are stored in the cloud, it can be accessed by multiple devices from many different locations. This gives the



**EXHIBIT 2-2** Cloud Hosting of Accounting Software

company much more flexibility for those who use or enter the accounting data. It also makes it easier for users to start up new computing capabilities.

3. **Infrastructure is reduced.** The company has a reduced need for servers and data storage, since most of these resources are provided by the cloud provider. This also means that the cloud provider provides data security and backup of data.
4. **Cost savings.** Because of the detailed advantages, there are usually significant cost savings recognized from cloud computing. Cloud computing is usually a pay-for-service model. In other words, a company pays the cloud provider only for the level of services it actually uses. The scalability of the cloud means that the company no longer needs to maintain an IT system large enough for the peak demand periods. Cloud computing also allows a company to reduce its investment in IT hardware and the personnel needed to support IT hardware. This eliminates the financial risk, because the user company avoids making a significant up-front financial investment in technology-related resources that may have uncertain returns.

There are also disadvantages or risks in cloud computing, and those will be discussed in Chapter 4 with the risks and controls of IT systems.

## The Real World

Thomas Kemper Soda Company of Portland, Oregon, is a small-batch craft-brewer of root beer, ginger ale, and other natural soft drinks sold in the western United States. After years of struggling with information sharing between the members of its mobile workforce, the company began subscribing to a cloud-based communications system. Significant improvements were realized very quickly. Rather than depending upon e-mail for sharing information and documentation, management at Thomas Kemper began accessing its file-share server through the cloud. They saved time; obtained better, more secure,

and up-to-date information; and were therefore able to work together more effectively. Cloud-based conferencing, e-mailing, calendaring, and screen-sharing all make it possible for the employees to stay connected despite their various physical locations. In addition, the company's management team estimated that 40 hours of employee productivity were gained each week due to communication efficiencies, 6 hours were saved each week on technology support, and thousands of dollars of expenses have been avoided, including over \$10,000 of hardware upgrade costs.

The major difference between cloud computing and client-server computing is where the software and data reside. In either case, organizations buy their own accounting software. That is, it is possible to buy software for client-server model systems in which the software and data reside on servers within the company. Alternatively, it is possible to buy accounting software and contract to have a third party host (put in the cloud) the company's software and data. SAP® and Microsoft Dynamics GP are examples of software products that are usually purchased by a company and then deployed either using a client-server or hosted deployment model.

In addition to the client-server and hosted cloud options, a third option, referred to as SaaS or Software as a Service model, is also used for some accounting and ERP systems. As noted earlier, in an SaaS model, the company does not purchase the software; rather, it pays a fee for every period it utilizes the software. The company's

## The Real World

Cole Haan, a wholly owned subsidiary of Nike, Inc., is one of North America's premier designers and marketers of quality footwear, accessories, and outerwear. The company is headquartered in New York City and Yarmouth, Maine.

Prior to implementing SAP, the legacy system in place at Cole Haan was not integrated with the company's other key business systems, including its sales and distribution legacy system. Fresh data entered the accounting system just once a day, as data was processed in batches. This lack of real-time processing of accounting data made it difficult to base business decisions on timely information. In addition, the company found that it was "spending 99 percent of its time just keeping nonintegrated systems in sync," said Bob Cheney, Cole Haan's director of information technology.<sup>2</sup>

The time required to synchronize the systems was wasted time for employees using the financial systems. In addition, the legacy systems did not provide real-time data to product

managers and sales representatives about how specific products, colors, and styles were performing in the marketplace.

To integrate all business processes and systems, and to have real-time data available for decision making, Cole Haan implemented mySAP ERP Financials. SAP is one of the world's largest software companies, and its enterprise resource planning (ERP) products help companies access the data, applications, and analytical tools needed for efficient business management. The features of mySAP ERP Financials address financial control as well as automation and integration of financial and managerial accounting applications. Currently, hundreds of users throughout Cole Haan access the mySAP system on a regular basis. That version of ERP software was an early forerunner of the concept of cloud computing that was hosted on SAP computers and accessed by Web browsers via the Internet. That product is now called SAP Business by Design.

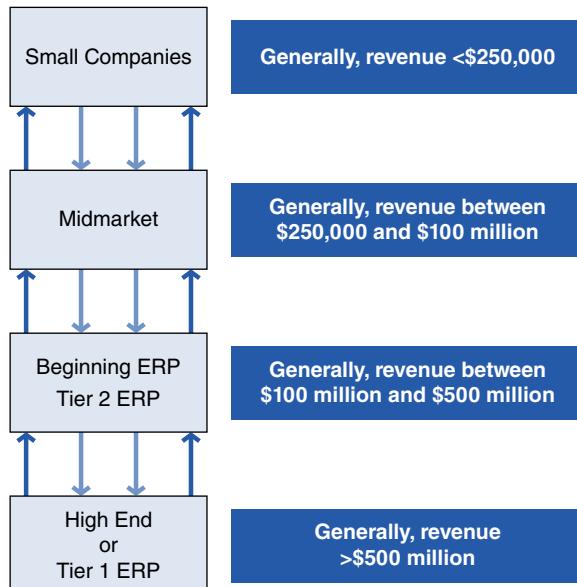
system is accessed via the cloud, which in some cases is operated by the software company and in other cases by a third party software hosting firm. The companies using the software never purchase the software, they "rent or lease" it, paying for their use monthly, quarterly, or annually. NetSuite® is an example of an accounting software system that is sold in an SaaS model. Quickbooks® is an example of a software system that is available as either purchased software or SaaS model. Accounting software that is sold today is generally categorized into market segments, described in the next section.

## Accounting Software Market Segments (Study Objective 5)

The accounting software market today is categorized into four market segments: small company systems, midmarket company systems, beginning ERP systems, and tier 1 ERP systems. Each segment is based on the size of the organization in terms of the amount of its revenue.

Exhibit 2-3 illustrates the four software market segments. Within this hierarchy of market segments, a company with revenue of \$200,000 would probably be

<sup>2</sup>[www.prosalesmagazine.com/news/distributors/out-of-the-box\\_0](http://www.prosalesmagazine.com/news/distributors/out-of-the-box_0)



**EXHIBIT 2-3** The Accounting Software Market Segments and Movement in the Market

classified within the small companies market segment, and would therefore be likely to purchase accounting software that fits in that segment. On the other hand, a large, Fortune 500 corporation might purchase accounting software systems in the tier 1 market segment—that is, an **ERP system**. While Exhibit 2-3 can be used as a guideline, there are also many other factors for a company to consider when selecting the product and the tier. Most software vendors attempt to increase the appeal of their software to more than one market segment, however, so understanding this market segmentation can be difficult. As an example, while Intuit's Quickbooks has traditionally been sold to small companies, its new software product, Quickbooks Enterprise, is intended to appeal to companies in the midmarket segment.

As accounting software development companies attempt to reach other market segments, the differentiation between products becomes blurred. Therefore, not all accounting software systems fit neatly into a single segment.

## The Real World

Hawaii Commercial Real Estate, LLC of Honolulu is a realty and property leasing organization specializing in the sales, leasing, and financing of office buildings, hotels, retail centers, industrial buildings, and investment properties. The success of the company depends on the relationships it builds and its ability to track both clients and properties and the different data associated with each. To improve the efficiency of its operations, Hawaii Commercial Real Estate has created several databases using ACT! Premium Solutions® by Sage Software®. ACT!

provides a host of Web-based productivity tools such as scheduling, social media, e-mail, and database management. For Hawaii Commercial Real Estate, there are customized tabs and data fields to manage all aspects of its business, from sales reporting and sharing notes about current and prospective clients, to launching new advertising efforts. The ACT! system is integral to everyday business and is flexible enough to accommodate remote Web access for agents when they are away from their desks.

Exhibit 2-4 illustrates some of the most popular accounting software systems in each of the four market segments that they most closely fit. Often these software solutions are chosen to more fully integrate business processes across the organization.

The programs listed in Exhibit 2-4 are based on modern technology, and each attempts to integrate many business processes into a single software system. The vendors continue to update these software systems to take advantage of e-commerce, e-business, and integration across business processes. Therefore, even those software systems in small and midmarket segments are becoming more like ERP systems. As described in Chapter 1, ERP systems are multimodule software systems designed to manage all aspects of an enterprise and ERP are usually broken down into modules such as financials, sales, purchasing, inventory management, manufacturing, and human resources. The modules are designed to work seamlessly with the rest of the system and to provide a consistent user interface across modules. Based on a relational database system, ERP systems usually have extensive setup options that allow some flexibility in customizing their functionality to specific business needs.

Many of the software systems in the small and midmarket categories are not true ERP systems in that their modules are not fully integrated as an ERP system would be; the companies that develop and sell these software systems try to assimilate the features of ERP systems. This trend is likely to continue in the future as technological advances allow software development companies to build ever-increasing power and functionality in the software products they offer.

Because of their size and the many complex processes that make up their businesses, large, multinational corporations have specific needs for accounting software systems. The most widely used tier 1 ERP system for large corporations is SAP. A small sample of the many well-known companies using SAP includes Anheuser-Busch, Daimler-Chrysler, Coca-Cola, Exxon, H.J. Heinz, Reebok, and Rubbermaid.

Regardless of the type of accounting software used, computer processing is involved in the input of data, the processing of that data, and the outputs from the system. The next section describes many of the input and processing methods used in IT systems. In addition, the types of outputs produced are described.

**EXHIBIT 2-4****Popular Accounting and ERP Systems within Market Segments**

Small Business	Midmarket	Tier 2 ERP	Tier 1 ERP
Kashoo®	Microsoft Dynamics SL®	Epicor®	JD Edwards®
Quickbooks®	NetSuite®	Infor®	Microsoft Dynamics AX®
Sage One®	Sage 300®	Microsoft Dynamics GP®	Oracle®
Xero Accounting®	Unit4®	Microsoft Dynamics NAV®	SAP®
Zoho Books®		Sage 500®	

## Input Methods Used in Business Processes (Study Objective 6)

As the steps in a business process occur, accounting data is generated that must be captured and recorded in the accounting information system. Accounting data is the input of the accounting information system. For example, a sale generates much accounting data that must be collected and recorded, such as customer identification information, identifying information for items and quantities sold, and information on discounts offered and taken. Most of the business processes in an organization generate accounting data. Because those processes—and the organizations themselves—can differ greatly, there are many different methods to capture and record accounting data, which is the purpose of an input method. Some of the input methods used in organizations today are described in this section, including source documents and keying, bar coding, point of sale systems, EDI, and e-business.

### Source Documents and Keying

Within business processes, the accounting data is often initially captured and recorded on a source document. Source documents are usually preprinted and sequentially prenumbered—preprinted to have an established format to capture data and prenumbered for control purposes to ensure that there are no duplicate or missing source documents and that all source documents are accounted for. One example of capturing data on a source document is the use of a sales order to capture data for a sales invoice to be generated in an automated ERP system. A sales order can be completed manually or within an automated system. The sales order would include the customer, terms of sale, items to be purchased by the customer, and the quantity and cost of each item. Exhibit 2-5 shows the input screen in Microsoft Dynamics GP for entering a customer invoice once the sales order document has been completed. To key in the customer and items ordered, the person

**EXHIBIT 2-5** Entering a Sales Invoice in Microsoft Dynamics GP Software

entering the data would need to enter the information from the source document—the customer sales order.

This is only a single example of source document and keying. While many organizational business processes use this type of input method, it is time consuming and error-prone due to the human efforts required to write on the source documents and to manually key in the data. Information technology has enabled input methods that reduce the time, cost, and errors of data input. The specific type of IT used to enable the input of data varies depending on the type of organization and the type of business process. Bar codes, POS systems, EDI, and e-business systems are technology systems that enable the input of data.

As discussed in the previous section, much of this accounting software is moving toward a cloud computing based model. For example, Microsoft sells accounting software called Microsoft Dynamics GP. The software can be purchased and installed and run on the purchasing company's servers and the data is also stored on the company's data servers. Alternatively, numerous cloud-hosting companies offer the option of purchasing Microsoft Dynamics GP as a Software as a Service model. These companies provide the software and hosting service and the purchaser pays for the software and service on a monthly, quarterly, or annual basis. The software and data reside on the hosting company's servers, and the software is accessed by the purchasing company via the Web, using a Web browser.

## Bar Codes

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A **bar code** is a printed code consisting of a series of vertical, machine-readable, rectangular bars and spaces that vary in width and are arranged in a specific way to represent letters, numbers, and other human-readable symbols. Bar codes are “read” and decoded by bar code scanners. Bar codes are used to identify retail sales products, identification cards, and other items. They also manage work in progress, track documents, and facilitate many other automated identification applications. To track work in process and inventory movement, a bar code tag (a small white label printed with a bar code) is placed on each inventory part and work in progress.

When inventory parts are counted or moved, a bar code scanner reads the bar code to input the necessary identification of that part. That is, the method of inputting data is not a manual keying of data, but a machine reading data by the bar code scanner. Another example of the use of bar codes to input accounting data is employee ID badges. When an organization uses a bar code system on employee IDs, the bar code reader can record the start and ending work times as the employee enters and leaves the workplace. The bar code scanner becomes the method of capturing and recording hours worked, eliminating the manual steps of writing the data on a source document and then later keying the data into software. Eliminating these manual processes reduces the time, cost, and errors of inputting data.

The most well-known use of bar codes, the point of sale system, is in retail sales.

## Point of Sale Systems

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A **point of sale system** (POS) is a method of using hardware and software that captures retail sales transactions by standard bar coding. The bar code label on the products is usually called the universal product code, or UPC. Nearly all large retail stores use POS systems integrated into the cash register. As a customer checks out through the cash register, the bar codes are scanned on the items purchased, prices

are determined by accessing inventory and price list data, sales revenue is recorded, and inventory values are updated. Thus, the POS hardware and software automatically inputs the data when the bar code is read as the product passes over the scanner. As discussed in Chapter 1 regarding the IT enablement of data input, a POS system reduces the time, cost, and errors inherent in the manual input of data.

Retail food service companies such as fast food and casual eatery chains also use point of sale systems; however, the food products are not bar-coded. The POS systems for retail food service use touch screens to input sales rather than bar codes.

## Electronic Data Interchange

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**Electronic data interchange (EDI)** is the intercompany, computer-to-computer transfer of business documents in a standard business format. EDI transmits purchase orders, invoices, and payments electronically between trading partners. Since transmission is electronic, the paper source documents and the manual keying of those documents are eliminated. For example, if Company A plans to purchase from Company B via EDI, Company A transmits a purchase order electronically to Company B. Company B's computer system receives and processes the order electronically. The mailing of a paper purchase order and the keying of that order by Company B has been eliminated. Therefore, we can see that EDI is a method of electronically inputting data into the accounting system. As was true of other IT-enabled input methods, this reduces time, cost, and errors.

## E-Business and E-Commerce

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Data is also electronically exchanged between trading partners in e-business and e-commerce. Recall from Chapter 1 that e-business relates to all forms of online electronic business transactions and processing, whereas e-commerce is a type of e-business that is specific to consumer online buying and selling. A major difference between EDI and e-business (including e-commerce) is that EDI uses dedicated networks, while e-business uses the Internet. As is true for EDI, when data is exchanged electronically between trading partners, much of the manual data input process is eliminated, thereby reducing time, cost, and errors.

## Processing Accounting Data (Study Objective 7)

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After accounting information has been input into the accounting system, it must be processed. Processing accounting data involves calculations, classification, summarization, and consolidation. In manual accounting systems, this processing occurs through the established manual methods and the recording, posting, and closing steps in the journals and ledgers. Automated processing can be accomplished by batch processing or online and real-time processing. These methods are described next.

### Batch Processing

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**Batch processing** requires that all similar transactions are grouped together for a specified time, and then this group of transactions is processed together as a batch. Batch processing is best suited to applications having large volumes of similar

transactions that can be processed at regular intervals. Payroll processing is a good example of a system that is well suited to batch processing. All time cards can be grouped together for a two-week period, for example, and all payroll processing then takes place on the entire set, or batch, of time cards.

Many legacy systems use batch processing to handle large volumes of routine transactions. As described in Chapter 1, batch processing is best suited for business processes where the transactions are stored in sequential access files. The business processes that are often batch-oriented in legacy systems are payroll, accounts payable, and accounts receivable. These processes and legacy systems have master files and transaction files. An example of a master file for accounts receivable is a file that maintains detailed customer information such as name, address, credit limit, and current balance. The transaction file would contain the set of customer transactions for a certain period such as a week. For high-volume, routine transaction processes, batch processing offers many advantages; but there are also disadvantages to this method.

Advantages to batch processing:

1. It is very efficient for large volumes of like transactions where most items in a master file are used during each processing run.
2. The basic accounting audit trail is maintained, because there are well-defined beginning and ending periods and a set of documents to reconcile to the batch being processed.
3. Such systems generally use less costly hardware and software than other methods.
4. The hardware and software systems are not as complicated as online systems and are therefore easier to understand.
5. It is generally easier to control than other types of computerized systems. Batch totals can be used to ensure the batch was processed correctly.
6. When personnel are dedicated to batch processing, they become specialized and efficient in processing those routine transactions.

Disadvantages to batch processing:

1. Processing can take longer than normal if the master files are large and not all records in the master file are used. For example, if only a few customer payments are to be processed from a large master file of customer records, it may take a legacy system with older hardware (that reads all master file records in sequence) as long to deliver the output as it would take if all the customer records were demanded.
2. In legacy systems with older hardware, adding or deleting records takes much computer maintenance time due to the sequential structure of the files.
3. In legacy systems with older hardware, some data duplication is likely, because each batch process often uses its own separate master file. Accounts payable and purchasing may be separate batch processes with separate master files, but in both master files vendor information, for example, would be duplicated.
4. Integration across business processes is difficult in legacy systems that are batch-oriented. The isolated master files and separate batch processing systems make integration very difficult.
5. By necessity, batch systems have a time lag while all transactions in a batch are collected. This means that available information in files will not always be current, as it would in real-time systems.
6. Legacy systems with older hardware may require that both the transaction files and master files be sorted in the same sequential order. This leads to less flexibility in record storage and retrieval.

Even when the hardware and software systems are new, some business processes may still be best suited to batch processing. Because of the periodic nature of payroll, it is probably best processed in a batch even if the hardware and software allow real-time processing.

## Online and Real-Time Processing

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Most modern, integrated systems frequently use online and real-time processing. With **online processing**, transactions are not grouped into batches; rather, each transaction is entered and processed individually. Some online processing systems are also real-time processing systems. **Real-time processing** means that the transaction is processed immediately, and in real time, so that the output is available immediately. Online processing is best suited to applications in which there is a large volume of records, but only a few records are needed to process any individual transaction. Thus, online processing requires that data from the related business processes be stored in random access files, as described in Chapter 1. Real-time processing usually requires a database and database management software systems.

The advantages to real-time processing are as follows:

1. As data is entered in real time, the system checks for input errors. Therefore, errors can be corrected immediately.
2. Information is provided to users on a timely basis, without the time lag inherent in batch systems.
3. Since all data is in a database system and is updated in real time, all files are constantly up to date.
4. The business processes are integrated into a single database so that a single system is achieved.

The disadvantages of real-time systems are as follows:

1. The hardware and software are more expensive than those used for batch systems.
2. A single database that is shared is more susceptible to unauthorized access of data, unless extensive controls are implemented to prevent unauthorized access.
3. Real-time systems can be difficult to audit because of the complexity of the system.

As computer hardware has become more powerful and less expensive, real-time systems have become more prevalent. The advantages of these real-time systems usually far outweigh their extra cost and complexity.

## Outputs from the AIS Related to Business Processes (Study Objective 8)

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Accounting information systems generate many different types of output. There are so many potential outputs that it is not possible to cover all of them in detail here. This section describes the following general categories of outputs:

1. Trading partner documents such as checks, invoices, and statements
2. Internal documents
3. Internal reports
4. External reports

Some of the outputs of the accounting information system are documents exchanged with trading partners such as customers and vendors. Invoices and statements are examples of documents sent to customers. Checks are outputs sent to vendors. These outputs may be in electronic or paper form. For example, electronic outputs include checks sent to vendors via electronic funds transfer and customer invoices sent via electronic data interchange.

Internal documents are another form of output from an accounting information system. Examples of internal documents include credit memorandums, receiving reports, production routing documents, and production scheduling documents. These documents may be printed paper forms, or they may be in the form of screen outputs viewed on the user's computer.

Accounting information systems also generate outputs in the form of reports for either internal or external users of accounting information. External reports are usually financial statements that include a balance sheet, income statement, and statement of cash flows. There are an unlimited number of potential internal reports, as this category comprises any information that management determines is useful to the business. Internal reports provide feedback to managers to assist them in running the business processes under their control. For example, an aged accounts receivable report may be prepared for the manager responsible for accounts receivable; the managers who oversee inventory would be interested in an inventory status report identifying those products that are at low stock levels.

Internal reports vary by process, by manager level, and by the type of organization. They are designed specifically for the function that is the subject of the report. Internal reports may be printed on paper, viewed on a computer screen, or created (either on screen or paper) as customizable queries that allow a manager to "drill down" into the details of the process being managed.

## Documenting Processes and Systems (Study Objective 9)

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Systems professionals and accountants must understand the documentation and charts that describe accounting systems. Such documentation allows the accountant to analyze and understand the procedures and processes of a business process and the systems that capture and record accounting data. The old adage that a picture is worth a thousand words is true for users documenting processes and systems. A picture, or chart, of the system is a concise, complete, and easy-to-understand way to analyze a process or system. The various types of popular pictorial representations of processes and systems used in businesses today include the following:

1. Process maps
2. System flowcharts
3. Document flowcharts
4. Data flow diagrams
5. Entity relationship diagrams (ER diagrams)

### Process Maps

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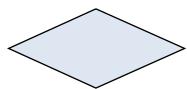
**Process maps** are pictorial representations of business processes in which the actual flow and sequence of events in the process are presented in diagram form—the start of a process, the steps within the process, and a finish of the process. Process maps



An oval is used to show the start and/or finish of a process. The start is usually the input of the business process, and the finish is the output. The input and output may be materials, activities, or information.



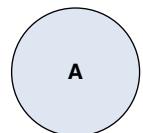
A rectangle shows a task or activity in the process. Typically, only one arrow comes out of a rectangle (one output). However, many arrows can come into a rectangle (inputs).



A diamond represents a point in the process when a decision must be made. In many cases the decision is a yes/no decision, but not always.



An arrow shows the direction of flow within the process.



A circle with a letter or number inside is used as a connector. A connector is used when there is a break in the process. The connector is used at the beginning of the break in the process, and again where the process resumes.

**EXHIBIT 2-6** Process Map Symbols

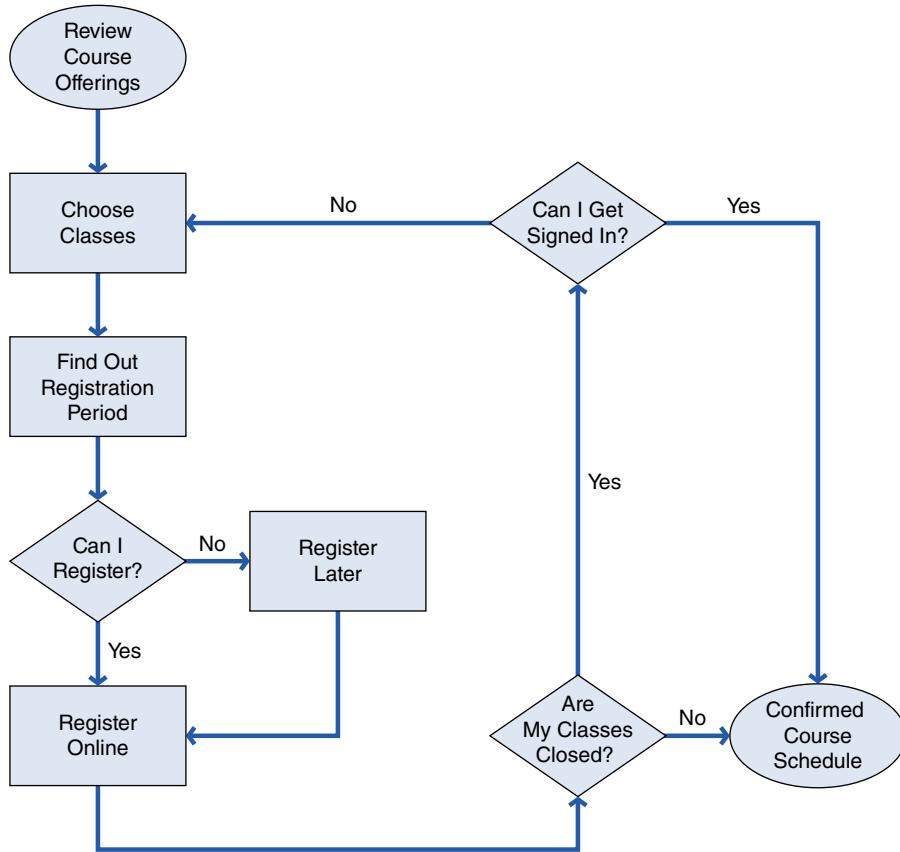
are becoming a popular way to represent business processes, particularly as organizations undergo business process reengineering. Five symbols are used in process maps, as shown in Exhibit 2-6.

With these five symbols, any business process can be depicted. Exhibit 2-7 is a sample process map that depicts a typical course-registration process for college classes. This process map is easy to comprehend because the underlying process is fairly simplistic. For some processes, however, where numerous activities may be performed in multiple departments or functional areas throughout the organization, process maps may be enhanced to depict varying levels of complexity. Each activity or department within a business process may be presented in either a horizontal or a vertical format.

In later chapters, process maps are presented as pictorial representations of the business and accounting processes. Some of these examples are horizontally formatted process maps, while others are shown in a vertical format.

## System Flowcharts

A **system flowchart** is intended to depict the entire system, including inputs, manual and computerized processes, and outputs. System flowcharts do not necessarily show details of each process, but display the overall sequence of processes and the media used for processing and storage. Processing and storage are shown as manual or computerized. Inputs can be documents, keying of input, electronic input, or processes that feed data to other processes. Outputs may be documents, statements, reports,



**EXHIBIT 2-7** Process Map of Class Registration

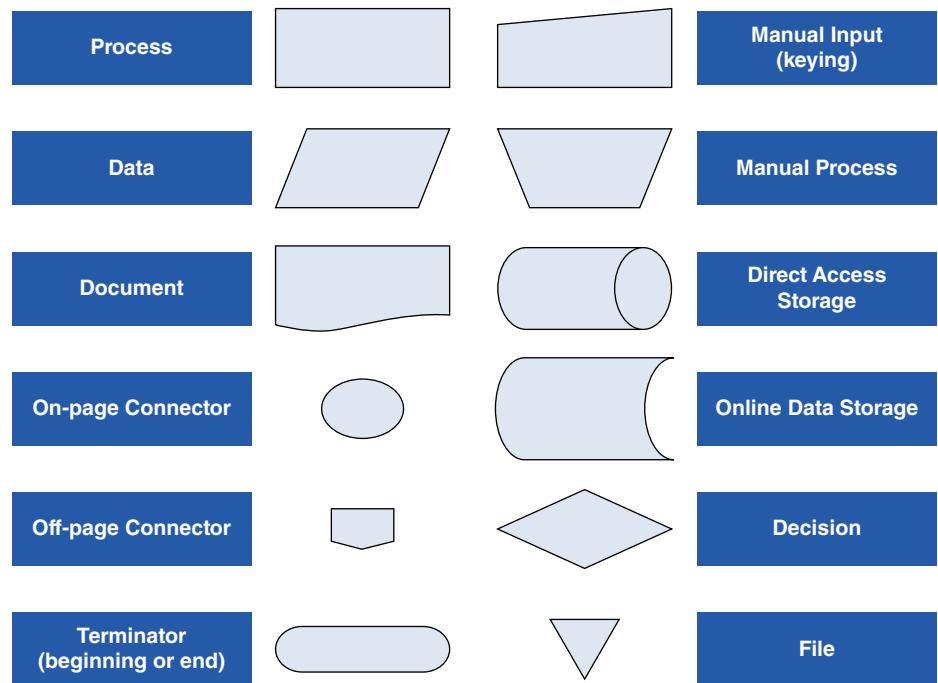
data stored in files, or data fed into other processes. The symbols used in system flowcharts appear in Exhibit 2-8. An example of a system flowchart appears in Exhibit 2-9.

System flowcharts are used by systems professionals in the design and maintenance of IT systems. In general, accountants and auditors do not use system flowcharts extensively. Accountants and auditors are more likely to use process maps, data flow diagrams, and document flowcharts.

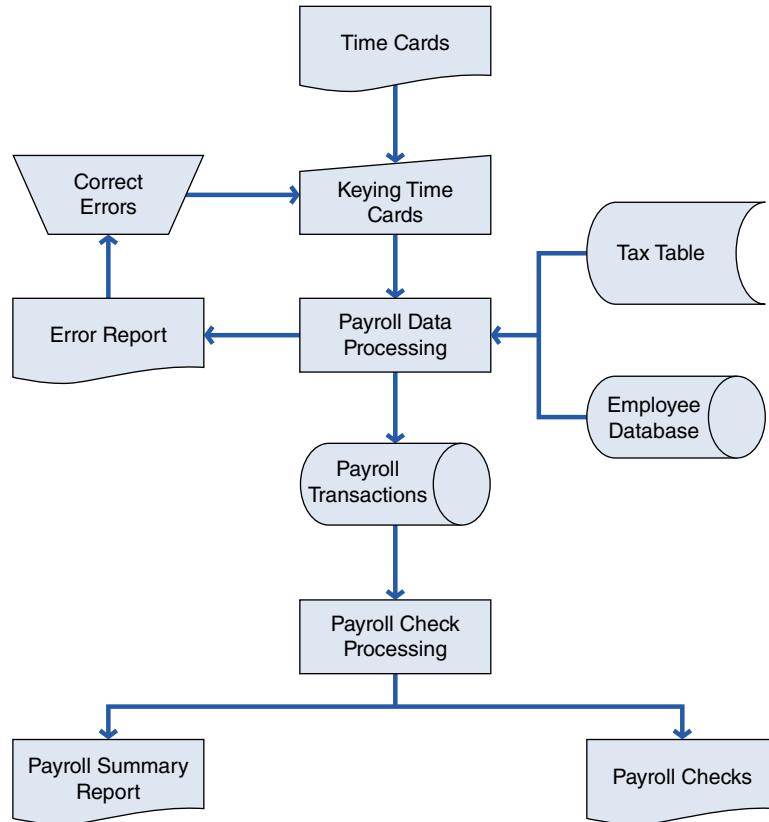
## Document Flowcharts

A **document flowchart** shows the flow of documents and information among departments or units within an organization. Document flowcharts are usually divided into columns, each representing a department or unit of the organization. Document flowcharts trace each document in a process from its origin to its final destination. Thus, the document flowchart shows the origin of a document, the units to which it is distributed, the ultimate disposition of the document, and everything that happens as it flows through the system. For documents prepared in duplicate, the document flowchart shows the flow for each copy of the document.

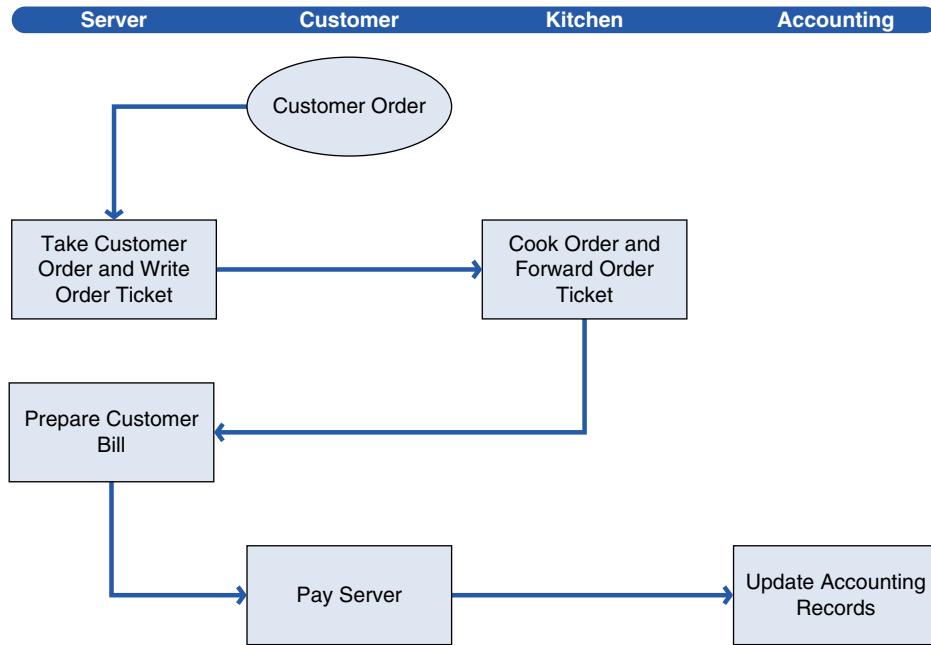
A document flowchart is a special kind of system flowchart that depicts only document flows. However, document flowcharts do not necessarily show all the related business processes. Document flowcharts are useful for not only understanding the flow of documents, but also in understanding internal controls. The symbols used in document flowcharts are similar to those used for system flowcharts, as presented in Exhibit 2-8.



**EXHIBIT 2-8** Common System Flowchart Symbols



**EXHIBIT 2-9** Payroll System Flowchart



**EXHIBIT 2-10** Restaurant Process Map

Document flowcharts, data flow diagrams, and process maps will be used in selected chapters of this book to illustrate business processes. The next three exhibits are examples of how these methods of documenting systems are used to illustrate processes for a small, local restaurant. Exhibit 2-10 is a process map in which the system for processing records and documents is manual rather than computerized. Exhibit 2-11 shows the corresponding document flowchart, and Exhibit 2-12 shows the corresponding data flow diagram. Data flow diagrams are explained in the next section.

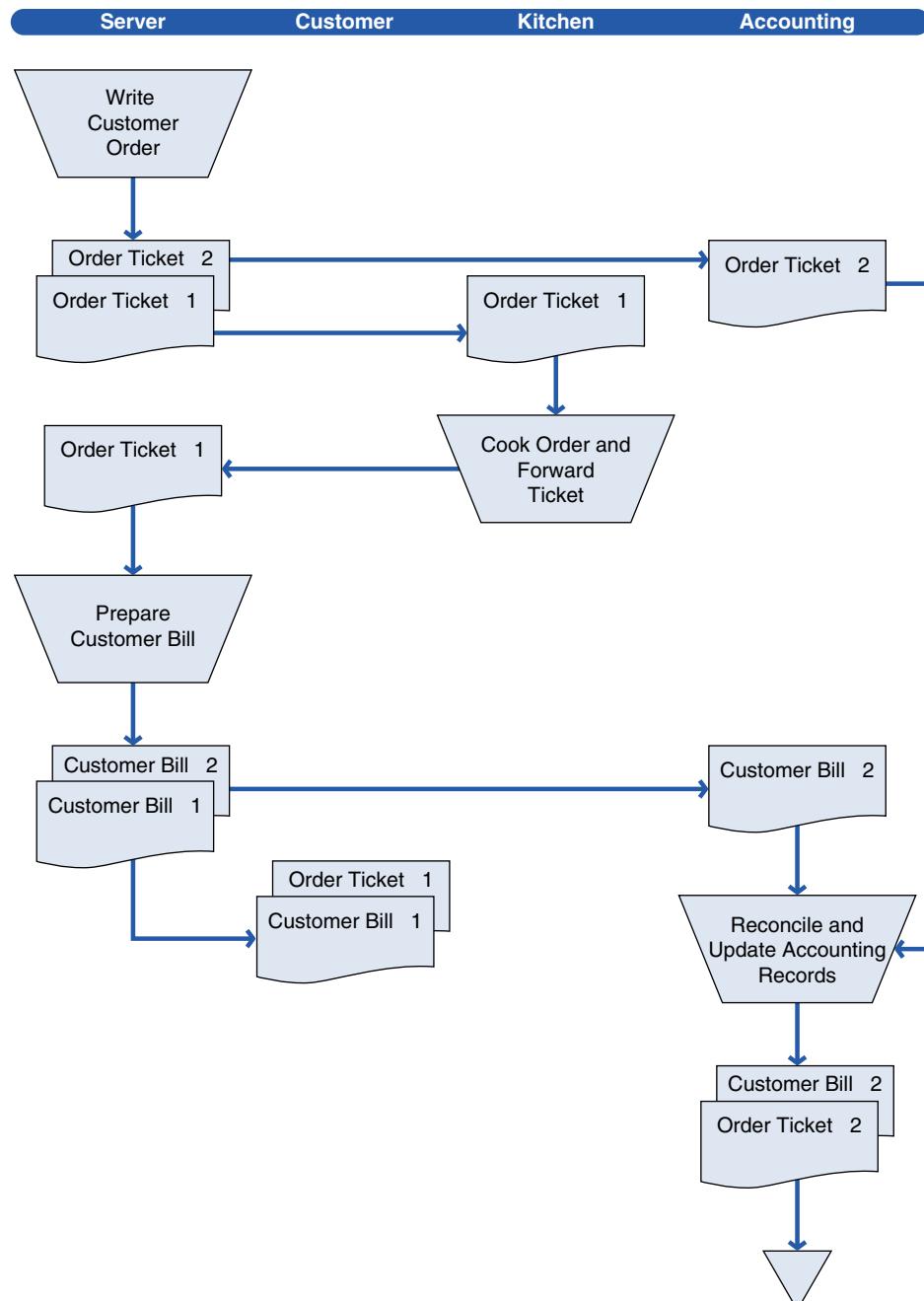
## Data Flow Diagrams

A **data flow diagram**, or DFD, is used by systems professionals to show the logical design of a system. The advantage of DFDs is that they use only four symbols and are simple to read and understand. (See Exhibit 2-13.) Exhibit 2-12 is a sample data flow diagram of the restaurant process shown in Exhibits 2-10 and 2-11.

Data flow diagrams are shown in many of the chapters that follow. Systems professionals use data flow diagrams in structured system design, a process wherein the logical system is diagrammed at a high, conceptual level first. In succeeding steps, the data flow diagrams are exploded into more levels of detail until the logical structures of all detailed tasks have been shown in successive data flow diagrams. “Exploding” means that each individual process is shown in progressively more detail in a subsequent diagram. Although data flow diagrams are easy to read, accountants and business consultants more frequently use process maps.

## Entity Relationship Diagrams

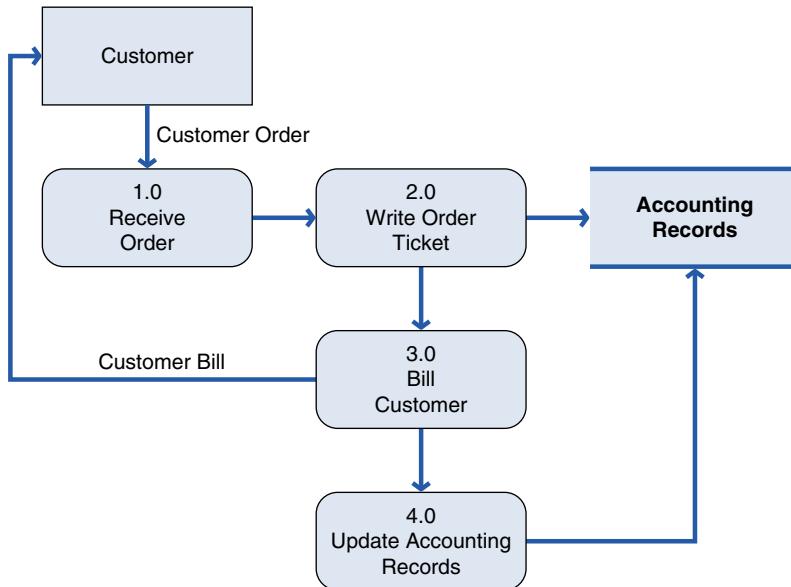
**Entity relationship diagrams**, or ER diagrams, are pictorial representations of the logical structure of databases. An ER diagram identifies the entities, the attributes of entities, and the relationship between entities. Some accountants find ER



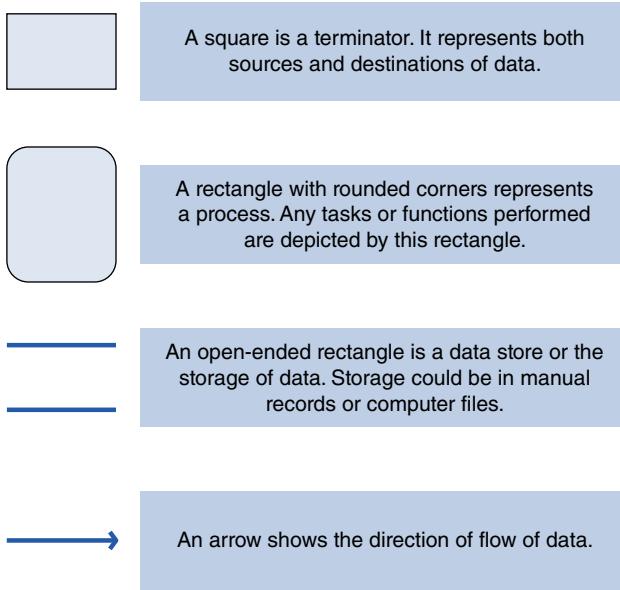
**EXHIBIT 2-11** Restaurant Document Flowchart

diagrams to be an excellent tool to represent the accounting data and entities in accounting systems because ER diagrams are a simple way to analyze the complex relationships between entities in an accounting system.

**Entities** can be thought of as the nouns that represent items in the accounting system. Employees, customers, vendors, and inventory items are examples of entities. Each entity has **attributes**, or characteristics of the entity. For example, employees have attributes such as last name, first name, pay rate, and number of withholdings.



**EXHIBIT 2-12** Restaurant Data Flow Diagram



**EXHIBIT 2-13** Data Flow Diagram Symbols

ER diagrams identify the entities, which become the records in a database, and attributes of entities, which become the fields of those records.

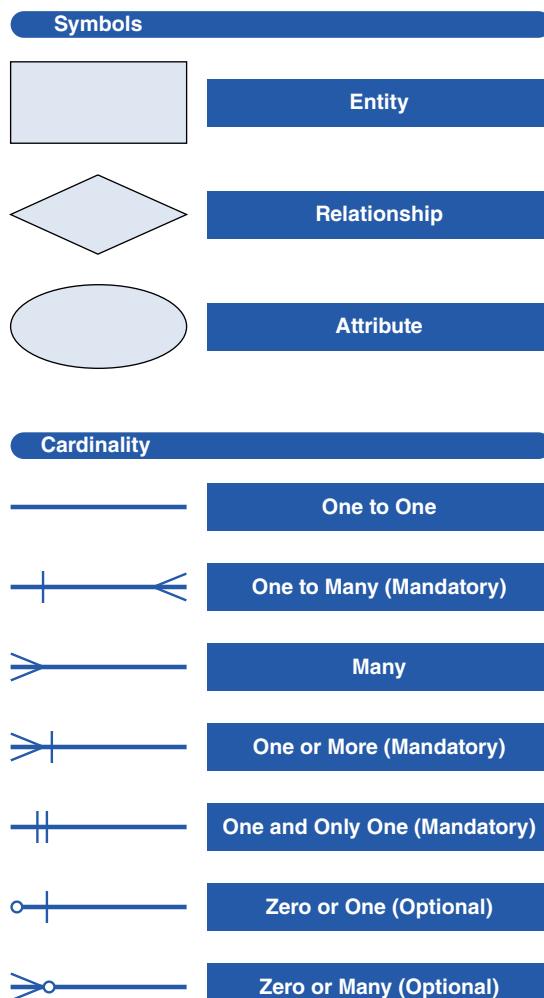
Database structures tend to be complex because entities are related to each other, and these relationships can be complex. For example, vendors and inventory items are two sets of entities that are related because the business buys inventory items from vendors. Any individual inventory item could be purchased from many vendors, and any single vendor could sell many different items to the business. Another example is the relationship between customers and orders. Each customer can have many orders, but any one order belongs to only one customer. The relationships between entities in ER diagrams are depicted by a concept called cardinality. **Cardinality** refers to how many instances of an entity relate to each instance of

another entity. Cardinality describes each of the following three manners in which entities relate to each other:

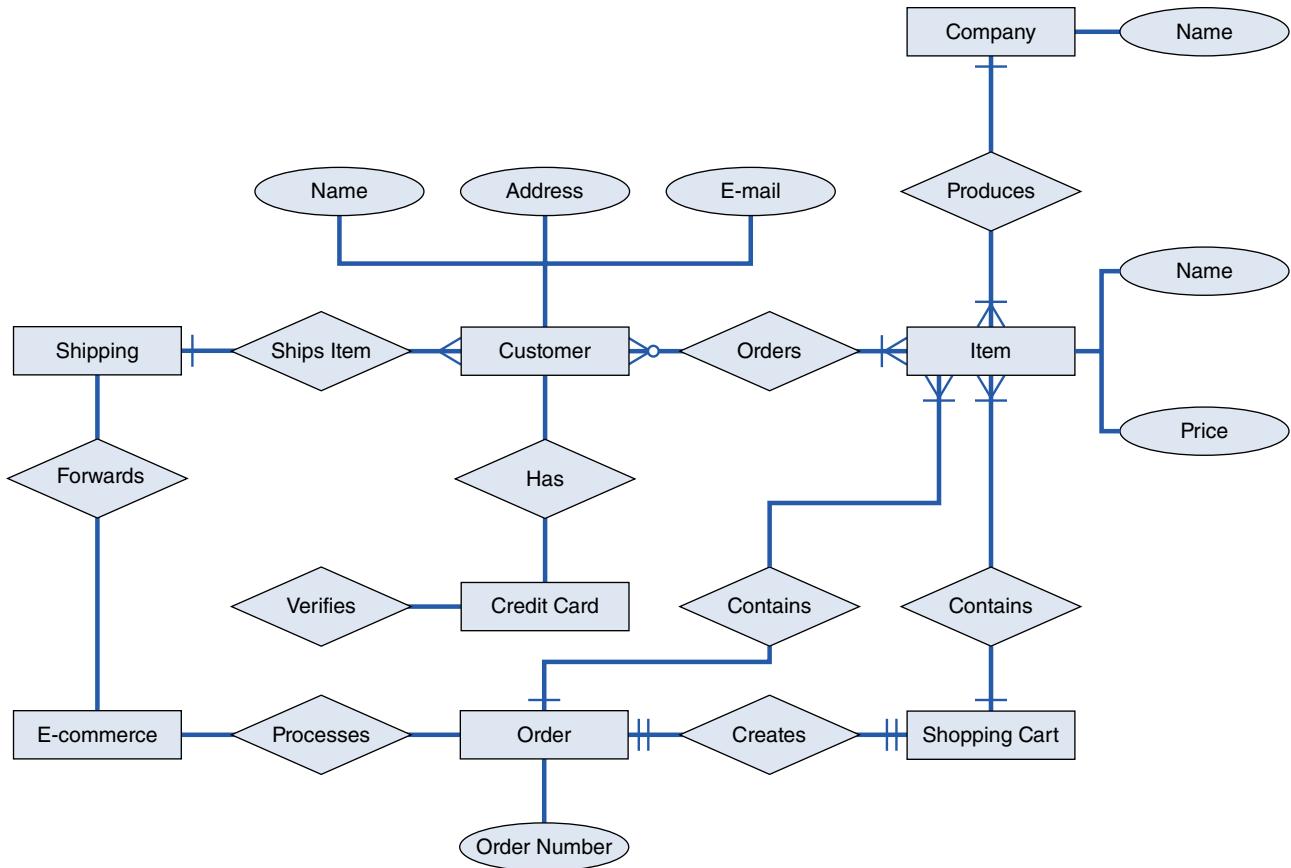
1. One to one: Each employee has one personnel file. Likewise, each personnel file belongs to only one employee.
2. One to many: One supervisor has many employees. Each employee has only one supervisor.
3. Many to many: Each vendor can sell many items, and each item can be purchased from many vendors.

Using symbols for entities, attributes, relationships, and cardinality, ER diagrams provide a pictorial representation of the database. The symbols used in entity relationship diagrams appear in Exhibit 2-14. Exhibit 2-15 presents an example of an entity relationship diagram for a sales database.

ER diagrams are tools to assist users in the understanding of complex database systems and the relationships between data items; however, they are not used in the chapters that follow. Although they are currently not widely used in accounting practice, you may find them employed at some point in your future. They are a useful learning tool in some approaches to understanding accounting information system concepts.



**EXHIBIT 2-14** Entity Relationship Diagram Symbols Adapted from Examples at [www.smartdraw.com](http://www.smartdraw.com)



**EXHIBIT 2-15** Entity Relationship Diagram of Internet Sales Adapted from Examples at [www.smartdraw.com](http://www.smartdraw.com)

## Ethical Considerations at the Foundation of Accounting Information Systems (Study Objective 10)

Several important topics have been presented in this chapter regarding the various features and options for an organization's accounting information systems. Most of these topics relate to business processes that are computerized, at least in part. The existence of computerized accounting information systems presents specific challenges for accountants in terms of the potential for unethical behavior.

Recall from Chapter 1 that the accounting information system is often the tool used to commit or cover up unethical behavior. This is true regardless of the extent of computerization. However, it can be especially difficult to detect instances of computer fraud within certain computerized environments, especially if there is only one person or a limited number of IT personnel within the organization with responsibility for maintaining these computer systems. For instance, if an organization's business processes involve the use of sophisticated software programs, the

number of personnel with sufficient expertise to recognize wrongdoing within the system may be limited. Likewise, if an organization continues to maintain legacy systems and the number of personnel trained to administer the older computer system becomes limited, the company's ability to detect unethical conduct is compromised. Fraud could be perpetrated and go undetected for a long time if these systems are not carefully monitored.

Accountants should be aware of opportunities for unethical behaviors within the various business processes. If accountants are well informed about these risks, they can be better prepared to control such exposure. As a company chooses features and options for its accounting information systems, the importance of monitoring those systems should not be overlooked as a factor in decision making.

## Summary of Study Objectives

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**The interrelationships of business processes and the AIS.** As transactions occur, the systematic and defined steps that take place within the organization to complete the underlying tasks of the transaction are called business processes. These business processes generate accounting information that must be captured, recorded, and processed. The accounting information system comprises the processes, procedures, and systems that capture accounting data from business processes; records the accounting data in the appropriate records; processes the detailed accounting data by classifying, summarizing, and consolidating; and reports the summarized accounting data to internal and external users. Business processes, IT systems, and the accounting information system are inextricably linked.

**The types of accounting information systems.** Simply as a way to organize the study of accounting information systems, we classify the systems in place into three categories: manual systems, legacy systems, and modern integrated systems. Manual systems use paper documents and records, including journals and ledgers. Legacy systems employ older technology in which the organization has a considerable investment and that might be entrenched in the organization. Modern, integrated accounting software offers companies powerful, technologically advanced systems to serve as accounting information systems that integrate business processes across the organization.

**Client-server computing.** Client-server computing means that there are two types of computers networked together to accomplish application processing. The important characteristics of client-server computing are as follows: Both client and server computers are networked together; the system appears to users to be one integrated whole; individual parts of processing are shared between the server and client; and the client computer participates in the data processing or data manipulation in some meaningful way.

**Cloud computing.** Cloud computing offers a centralized approach to IT through virtual servers provided by a third party. The important characteristics of cloud computing are its scalability, reduced computer infrastructure, and ability to be accessed from many different locations. These characteristics enable a company to be more

efficient and to avoid excessive costs associated with maintaining its own IT infrastructure and resources.

**Accounting software market segments.** The market for accounting software can be categorized into four market segments: small companies, midmarket, beginning ERP, and tier 1. There is much movement within these market segments as software development companies attempt to appeal to other segments of the accounting software market.

**Input methods used in business processes.** In manual systems, input is initially captured on source documents. In IT systems, many different methods are available for inputting data. Some of these methods include manual keying of source documents, bar code scanners, point of sale systems, EDI, and e-business. These input methods for IT systems reduce cost, time, and errors in data input.

**The processing of accounting data.** Data can be processed by batch processing or online and real-time processing. Batch processing is less complex, but due to its time lag, the accounting data is not always current. Online and real-time systems process data individually as business transactions occur, making outputs available immediately.

**Outputs from the AIS related to business processes.** The outputs of an accounting information system include trading partner documents, internal documents, internal reports, and external reports. These outputs may be in electronic or paper form.

**Documenting processes and systems.** A useful way to document processes and systems is to prepare a pictorial representation. There are many methods of documenting processes and systems, including process maps, data flow diagrams, system flowcharts, document flowcharts, and entity relationship diagrams. Process maps, data flow diagrams, and document flowcharts appear in selected chapters of this book to illustrate business processes.

**Ethical considerations at the foundation of accounting information systems.** Detecting fraud may be difficult in a computerized environment, especially when there are a limited number of people responsible for maintaining the computer systems. Accountants must recognize the opportunities for unethical behavior within computerized processes, and must carefully monitor those systems.

## Key Terms

Accounting information system	Database as a Service (DaaS)	General journal	Real-time processing
Attribute	Document flowchart	General ledger	Screen scraper
Bar code	Electronic data interchange (EDI)	Infrastructure as a Service (IaaS)	Service level
Batch processing	Enterprise application integration (EAI)	Legacy system	agreement (SLA)
Business process	Entity	Online processing	Software as a Service (SaaS)
Cardinality	Entity relationship diagram	Platform as a Service (PaaS)	Source document
Client–server computing	ERP system	Point of sale system	Special journal
Cloud computing		Process map	Subsidiary ledger
Data flow diagram			System flowchart
			Turnaround document

## End of Chapter Material

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### Concept Check



- 1** Which of the following statements is not true?
- Accounting information systems must maintain both detail and summary information.
  - Business processes may vary from company to company.
  - Regardless of the extent of computerization, all accounting information systems must capture data from the transactions within business processes.
  - Business processes categorized as expenditure processes are not intended to be processes that serve customers.
- 2** In a manual system, an adjusting entry would most likely be initially recorded in a
- special journal
  - subsidiary ledger
  - general journal
  - general ledger
- 3** Which of the following is not a disadvantage of maintaining legacy systems?
- There are fewer programmers available to support and maintain legacy systems.
  - They contain invaluable historical data that may be difficult to integrate into newer systems.
  - Hardware or hardware parts may be unavailable for legacy systems.
  - It can be difficult to integrate various legacy systems into an integrated whole.
- 4** Which of the following is not an advantage of cloud computing when compared to client–server computing?
- It is more scalable.
  - It is less costly.
  - It increases the amount of computer infrastructure in a company.
  - It has expanded availability.
- 5** Which of the following is a disadvantage of purchased accounting software, compared with software developed in-house?
- It is custom-designed for that company.
  - It is less costly.
  - The implementation time is shorter.
  - There are fewer bugs.
- 6** Which of the following is not a method of updating legacy systems?
- Enterprise application integration
  - Backoffice ware
  - Screen scraper
  - Complete replacement
- 7** When categorizing the accounting software market, a company with revenue of \$8 million would most likely purchase software from which segment?
- Small company
  - Midmarket
  - Beginning ERP
  - Tier 1 ERP
- 8** An IT system that uses touch-screen cash registers as an input method is called
- electronic data interchange
  - e-business
  - point of sale system
  - source documents and keying
- 9** When similar transactions are grouped together for a specified time for processing, it is called
- online processing
  - real-time processing
  - batch processing
  - group processing
- 10** Which of the following is not correct regarding the ways that real-time systems differ from batch systems?
- | <b>Real-time Systems</b>                      | <b>Batch Systems</b>                                     |
|---|--|
| a. Must use direct access files.              | Can use simple sequential files.                         |
| b. Processing occurs on demand.               | Processing must be scheduled.                            |
| c. Processing choices are menu-driven.        | Processing is interactive.                               |
| d. Supporting documents are prepared as items | Supporting documents are prepared during scheduled runs. |
- 11** In documenting systems, which pictorial method is described as a method that diagrams the actual flow and sequence of events?
- System flowchart
  - Process map
  - Data flow diagram
  - Entity relationship diagram

- 12 (CMA Adapted) A company in North and South Carolina provides certified flight-training programs for aspiring new pilots of small aircraft. Although awarding a pilot's license requires one-on-one flight time, there is also much preparatory training conducted in classroom settings. The company needs to create a conceptual data model for its classroom training program, using an entity-relationship diagram. The company provided the following information:

Carolina Flights, Inc., has 10 instructors who can teach up to 30 pilot trainees per class. The company offers 10 different courses, and each course may generate up to 8 classes.

Identify the entities that should be included in the entity-relationship diagram:

- a. Instructor, Carolina Flights, Inc., pilot trainee
- b. Instructor, Carolina Flights, Inc., course, enrollment, class
- c. Carolina Flights, Inc., enrollment, course, class, pilot trainee
- d. Instructor, course, enrollment, class, pilot trainee

### Discussion Questions

- 13 (SO 1) What is the relationship between business processes and the accounting information system?
- 14 (SO 1) Why is it sometimes necessary to change business processes when IT systems are applied to business processes?
- 15 (SO 2) Are manual systems and processes completely outdated?
- 16 (SO 2) What is the purpose of source documents?
- 17 (SO 2) What are some examples of turnaround documents that you have seen?
- 18 (SO 2) Why would the training of employees be an impediment to updating legacy systems?
- 19 (SO 2) Why is it true that the accounting software in and of itself is not the entire accounting information system?
- 20 (SO 2) How is integration across business processes different between legacy systems and modern, integrated systems?
- 21 (SO 3) How does client-server computing divide the processing load between the client and server?
- 22 (SO 3) Why do you think the client computer may be a better computer platform for presentation of data?
- 23 (SO 4) What are the distinguishing characteristics of cloud computing?

- 24 (SO 4) Why do you think a company would benefit from using cloud computing rather than client-server computing?
- 25 (SO 4) If your personal data was stored on a server in cloud computing, would you have any concerns about it?
- 26 (SO 5) Why do you think there are different market segments for accounting software?
- 27 (SO 5) How would accounting software requirements for large corporations differ from requirements for small companies?
- 28 (SO 5) What are some of the differences between ERP systems and accounting software for small companies?
- 29 (SO 5) Why would accounting software development companies be interested in expanding their software products into other market segments?
- 30 (SO 6) Given the business and accounting environment today, do you think it is still important to understand the manual input of accounting data?
- 31 (SO 6) What are the advantages to using some form of IT systems for input, rather than manual input?
- 32 (SO 6) Why would errors be reduced if a company switched input methods from manual keying of source documents to a bar code system?
- 33 (SO 7) In general, what types of transactions are well suited to batch processing?
- 34 (SO 7) Why might the time lag involved in batch processing make it unsuitable for some types of transaction processing?
- 35 (SO 7) How would real-time processing provide a benefit to managers overseeing business processes?
- 36 (SO 8) How do internal reports differ from external reports?
- 37 (SO 8) What are some examples of outputs generated for trading partners?
- 38 (SO 8) Why might it be important to have internal documents produced as an output of the accounting information system?
- 39 (SO 9) How does documenting a system through a pictorial representation offer benefits?

### Brief Exercises

- 40 (SO 1) Think about your most recent appointment at the dentist's office. Describe the business processes that affected you as the patient/customer. In addition, describe the administrative and accounting processes that are likely to support this business.

- 41** (SO 2) Describe the purpose of each of the following parts of a manual system:
- Source document
  - Turnaround document
  - General ledger
  - General journal
  - Special journal
  - Subsidiary ledger
- 42** (SO 2) Consider the accounting information system in place at an organization where you have worked. Do you think that it was a manual system, a legacy system, or an integrated IT system? Describe one or two characteristics of that accounting information system that lead you to your conclusion.
- 43** (SO 2) Suppose that a company wants to upgrade its legacy system, but cannot afford to completely replace it. Describe two approaches that can be used.
- 44** (SO 4) Both Gmail and iCloud for iTunes were mentioned as examples of cloud computing. Can you describe any other examples of cloud computing?
- 45** (SO 5, SO 7) Consider the real-world example of Cole Haan presented in this chapter.
- Use Exhibits 2-3 and 2-4 to help you determine the approximate range of Cole Haan's annual revenues.
  - What are the advantages Cole Haan likely realized as a result of having real-time data available?
- 46** (SO 6) Using IT systems to input accounting data can reduce costs, time, and errors. Give an example showing how you think IT systems can lead to these reductions (cost, time, and errors).
- 47** (SO 8) Identify whether the following reports would be categorized as trading partner documents, internal documents, internal reports, or external reports:
- Daily cash receipts listing
  - Accounts receivable aging
  - Wire transfer of funds to a vendor
  - Customer price list
  - General ledger
  - Statement of cash flows
  - Sales invoice
  - Production schedule
  - Customer address list
  - Payroll journal
- 48** (SO 8) Which type of accounting information system reports would likely be prepared most frequently by financial accountants? By managerial accountants?
- 49** (SO 9) Identify which of the cardinal relationships apply, from the following:
- Component part–product
  - Customer–product
  - Employee ID badge–employee
  - Employee–supervisor
  - Vendor–check

## Problems

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- 50** (SO 2) Suppose that a large company is considering replacing a legacy system that is nearing obsolescence. Describe any aspects of this decision that the company should consider.
- 51** (SO 1, SO 9) Visit the campus bookstore at your university. From what you see happening at the bookstore, try to draw a process map of how the processes at that store serve students, the customers.
- 52** (SO 5) Look at Exhibit 2-4 and pick one accounting software product from the midmarket segment and one software product from the tier 1 ERP segment. Using those brand names of software, search the Internet for information about those products. Based on your investigation, what are the differences between the two software products you chose?
- (Hint: To begin your search, you might try examining the following websites: [www.accountingsoftware411.com](http://www.accountingsoftware411.com), [www.findaccountingsoftware.com](http://www.findaccountingsoftware.com), and [www.2020software.com](http://www.2020software.com).)
- 53** (SO 6) Using the Internet or other research tool, search for the term "RFID." From the results you find, describe how RFID will be used as an input method.
- 54** (SO 3) Using the Internet or other research tool, search for the terms "client–server" and "scalable." From the results you find, explain why client–server systems are scalable.
- 55** (SO 4) Using the Internet or other research tool, search for the terms "Amazon elastic cloud." Describe what you find. Why do you believe it is called elastic?

## Cases

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**56** In both Chapters 1 and 2, examples of restaurants and fast food chains were used to describe business processes, as they are deemed to be readily familiar to many students. On the basis of your experiences from using the drive-through window at a fast food chain, prepare one each of the three listed pictorial representations of the food-ordering and delivery processes. Your drawings should portray the restaurant's perspective—that is processing a sales transaction via the drive-through window.

- a. Process map
- b. Document flowchart
- c. Data flow diagram

**57** Kim Sheridan is a college student. Each Monday through Thursday, she commutes to her classes at York Technical College (YTC). Each semester, Kim pays for on-campus parking privileges. Before Wednesday of the week prior to each new semester, Kim writes a check to YTC Parking Services for \$150. She writes her student identification number on the check's memo line and then mails the check to the YTC Parking Services Office.

Upon receipt of student checks, YTC's Parking Services Office clerk issues a current semester parking decal and a receipt for payment received. These items are mailed to each student at the address noted on the check. A daily listing of checks received is prepared and filed by date. A photocopy of the check is made and placed in a file organized by the student's last name. Accordingly, each student has a parking file maintained in the YTC Parking Services office. The checks are endorsed and deposited in the bank on a daily basis. Once each month, the YTC Parking Services office manager reconciles the bank statement.

Prepare the following pictorial presentations of YTC's parking services processes:

- a. Process map
- b. Document flowchart
- c. Data flow diagram

**58** Icementrics is a subcontract manufacturer that produces prototype products for organizations that may possibly want Icementrics to later manufacture their products for them.

Icementrics has a R & D division and a manufacturing division. The R & D division performs research

and develops prototype products for companies for a consulting fee. The manufacturing division manufactures products for companies and charges a fee per unit of product produced.

Current System:	Quick books—GL, AR, AP Inventory/ Manufacturing—on Excel
Annual Revenue:	\$2.5 million
Employees:	25
Customers:	1,000
Vendors:	4,000
Core Business Processes:	Manufacturing Job Cost/Consulting Revenue/Purchasing/Payroll

Research different Midmarket accounting systems and make a recommendation to Icementrics on whether to stay with Quickbooks or implement a new software system.

**A: Write a business report summarizing the following:**

- 1 Background—Existing system and reason for change
- 2 Discussion—including answers to questions
- 3 Software system recommendation and justification for the system selected
- 4 Provide one software product not recommending and reasons for not recommending

**B: Additional Discussion Questions:**

Questions your client (Icementrics) asks during the discovery stage that should be addressed in your final report.

- 1 (SO 1) Will we need to change business processes when we replace Quickbooks?
- 2 (SO 2) Should we fully automate everything or will there still be some manual processes?
- 3 (SO 2) Our CFO wants the system to fully integrate across business processes. Will this system do this? Are there any business processes that will not integrate? If so, what and why not?
- 4 (SO 4) Would our company benefit from using cloud computing rather than client server computing?
- 5 (SO 6) Can you provide examples of how our new system will reduce costs, time, and errors?

## Solutions to Concept Check

- 1 (SO 1) Which of the following statements is not true? **d. Business processes categorized as expenditure processes are not intended to be processes that serve customers** is not a true statement. All business processes either directly or indirectly serve customers. For example, the process to purchase inventory is necessary for stocking inventory to sell to customers.
- 2 (SO 2) In a manual system, an adjusting entry would most likely be initially recorded in a **c. general journal**. The general journal is the book of original entry for nonroutine transactions, closing entries, and adjusting entries.
- 3 (SO 2) The choice that is not a disadvantage of maintaining legacy systems is **b. they contain invaluable historical data that may be difficult to integrate into newer systems**. Since legacy systems may have a large amount of historical data that is difficult to integrate into newer systems, it may be an advantage to keep the legacy system and not lose access to the historical data.
- 4 Which of the following is not an advantage of cloud computing when compared to client-server computing? **a. It increases the amount of computer infrastructure in a company**. Cloud computing reduces, not increases, the amount of computer infrastructure.
- 5 (SO 2) The choice that is not an advantage of purchased accounting software, compared with software developed in-house, is **a. It is custom-designed for that company**. Purchased software is developed to suit the needs of a broad range of customers. Often, companies will purchase and then modify accounting software to meet their specific needs, but the software is not purchased already customized.
- 6 (SO 5) The choice that is not a method of updating legacy systems is **b. backoffice ware**. Screen scrapers, EAIs, and replacement are all methods to update a legacy system. Backoffice ware is not.
- 7 (SO 5) When categorizing the accounting software market, a company with revenue of \$8 million would most likely purchase software from the **b. midmarket**. Of the four market segments, midmarket is generally considered to comprise companies ranging from \$250,000 to \$10 million in revenue.
- 8 (SO 6) An IT system that uses touch-screen cash registers as an input method is called a **c. point of sale system**. Point of sale systems are popularly used at retail stores and fast food restaurants. In retail locations, POS systems use bar code readers; but in fast food and casual eating establishments' POS systems, the server enters customer orders on a touch screen.
- 9 (SO 7) When similar transactions are grouped together for a specified time for processing, it is called **c. Batch processing**.
- 10 (CMA Adapted) (SO 7) The choice that is **not** true regarding the differences in the ways that real-time systems differ from batch systems is  

Real-time Systems	Batch Systems
<b>c. False: Processing choices</b>	<b>False: Processing is menu-driven.</b>
- 11 (SO 9) In documenting systems, the pictorial method described as a method that diagrams the actual flow and sequence of events is a **b. process map**.
- 12 (CMA Adapted) (SO 9) In the classroom flight training program example, the entities that should be included in the entity-relationship diagram are **d. instructor, course, enrollment, class, pilot trainee**.

## CHAPTER 3

# Fraud, Ethics, and Internal Control

### STUDY OBJECTIVES

This chapter will help you gain an understanding of the following concepts:

1. An introduction to the need for a code of ethics and internal controls
2. The accounting-related fraud that can occur when ethics codes and internal controls are weak or not correctly applied
3. The nature of management fraud
4. The nature of employee fraud
5. The nature of customer fraud
6. The nature of vendor fraud
7. The nature of computer fraud
8. The policies that assist in the avoidance of fraud and errors
9. The maintenance of a code of ethics
10. The maintenance of accounting internal controls
11. The maintenance of information technology controls
12. The internal control requirements of the Sarbanes-Oxley Act of 2002

### Introduction to the Need for a Code of Ethics and Internal Controls (Study Objective 1)

The Real World example on the next page will help you understand the context of many concepts in this chapter. Please read that Real World example to begin effective reading and studying of this chapter. During the early 2000s, a wave of information appeared in the news regarding company after company named in fraudulent financial reporting. Among the names were Enron Corp., Global Crossing USA, Inc., Adelphia Communications Corp., WorldCom Inc., and Xerox Corporation. In the case of Enron alone, fraudulent financial reporting led to the loss of billions of dollars for investors, job and retirement-fund losses for employees, the collapse of the Arthur Andersen LLP audit firm, and further depression of an already weak stock market. There are many other examples of such problems. An infamous example of fraud and bankruptcy is the Real World example on the following page outlining the fraudulent activities that transpired at Phar-Mor, Inc. An examination of the Phar-Mor case illustrates the linkages among ethics, fraud, and internal controls.

Although the Phar-Mor fraud scheme is an older example, it is important to study it as a classic case of the wrong approach to concepts in this chapter and the chapters that follow. Phar-Mor had unethical leaders, shoddy ethics enforcement, poor internal controls, relaxed corporate governance, weak IT systems, and faulty audits. It represents the poster child of a poor control environment.

When management is unethical, as in the Phar-Mor case, fraud is likely to occur. On the other hand, if the top management of a company emphasizes ethical behavior, models ethical behavior, and hires ethical employees, the chance of fraud or ethical lapses can be reduced. In the case of a company

## The Real World



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The drugstore chain Phar-Mor is a classic example of fraud leading to a bankruptcy and many other problems for investors and auditors.

At the time Phar-Mor filed bankruptcy, it represented one of the largest cases of fraud in U.S. history. In that bankruptcy, investors lost nearly \$1 billion, and Phar-Mor closed many stores and dismissed thousands of workers. The fraud began when top management attempted to make its earnings match the budgeted amounts. Management, desperately trying to overstate revenues or understate expenses to meet expected earnings targets, used illegal accounting tricks such as falsifying inventory. Phar-Mor's top management behaved unethically and fraudulently in an attempt to achieve a desired result.

such as Phar-Mor, management did not act ethically and did not encourage ethical behavior. Although the company had written and adopted a code of ethics, most of the officers in the company were not aware that it existed.<sup>1</sup> This is an indication that ethics were merely "window dressing" and that management did not wish to emphasize and model ethical behavior.

Another way that the Phar-Mor fraud could have been avoided or detected was through the proper operation of the accounting system and internal controls. For example, a good accounting system will process all checks through a bank account that is part of the normal payment approval process. In the case of Phar-Mor, management maintained a separate bank account and used it for fraudulent purposes. Checks drawn on this account did not go through a regular approval process. In summary, maintaining high ethics and following proper procedures can help prevent or detect many kinds of fraud.

In addition to acting ethically, the management of any organization has an obligation to maintain a set of processes and procedures that assure accurate and complete records and protection of assets. This obligation arises because many groups have expectations of management. First, management has a stewardship obligation to those who provide funds to, or invest in, the company. **Stewardship** is the careful and responsible oversight and use of the assets entrusted to management. This requires that management maintain systems which allow it to demonstrate that it has appropriately used these funds and assets. Investors, lenders, and funding agencies must be able to examine reports showing the appropriate use of funds or assets provided to management. Management must maintain accurate and complete accounting records and reports with full disclosure. Second, management has an obligation to provide accurate reports to those who are not owners or investors, such as business organizations with whom the company interacts and governmental units like the Internal Revenue Service (IRS) and the Securities and Exchange Commission (SEC).

Finally, to efficiently and effectively manage an organization, management and the board of directors must have access to accurate and timely feedback regarding the results of operations. An organization cannot determine whether it is meeting

<sup>1</sup> Stephen D. Williger, "Phar-Mor—A Lesson in Fraud," *The Wall Street Journal*, March 28, 1994.

objectives unless it continuously monitors operations by examining reports that summarize the results of operations. In many cases, these reports are outputs of the computerized system. Therefore, IT systems must provide accurate and timely information in reports. When a vice president at Phar-Mor became concerned about the adequacy of the IT system and the resulting reports, he formed a committee to address the problems; however, the committee was squelched by members of senior management who were involved in the fraud.

The management obligations of stewardship and reporting point to the need to maintain accurate and complete accounting systems and to protect assets. To fulfill these obligations, management must maintain internal controls and enforce a **code of ethics**. If these two items are operating effectively, many types of fraud can be avoided or detected. Internal controls have been defined by several bodies, but perhaps the most encompassing description of accounting internal controls is contained in the Committee of Sponsoring Organization's<sup>2</sup> (COSO) report on internal control.<sup>3</sup> The COSO report defines internal control as follows:

a process, effected by an entity's board of directors, management, and other personnel, designed to provide reasonable assurance regarding the achievement of objectives in the following categories:

- effectiveness and efficiency of operations
- reliability of financial reporting
- compliance with applicable laws and regulations.

These internal control processes and procedures will assist in protecting assets and ensuring accurate records. In addition to the accounting internal controls, an organization should also have internal controls covering its IT systems. If not properly controlled, IT systems may become exposed to the risks of unauthorized access, erroneous or incomplete processing, and interruption of service. Guidelines for IT controls are provided by the AICPA and are discussed later.

To help ensure accurate and complete accounting systems and reports, an organization should have good accounting internal controls, good IT controls, and an enforced code of ethics. A code of ethics is a set of documented guidelines for moral and ethical behavior within the organization. It is management's responsibility to establish, enforce, and exemplify the principles of ethical conduct valued in the organization. The importance of an ethics code is perhaps easier to see by looking at it from the opposite perspective. As has become obvious with the flood of accounting fraud scandals at companies such as Enron, WorldCom, Global Crossing, and others, top management does not always exhibit ethical behavior. If management does not demonstrate ethical behavior, employees at all levels are much more likely to follow suit in their disregard for ethical guidelines. Of course, the opposite should also be true. Management that emphasizes and models ethical behavior is more likely to encourage ethical behavior in employees.

In summary, a company that maintains a good system of accounting and IT internal controls and values ethical behavior will be more likely to avoid fraud, other ethical problems, and errors in accounting records. This chapter describes

<sup>2</sup> The Committee of Sponsoring Organizations includes the following organizations: AICPA, AAA, FEI, IIA, and IMA. The purpose of COSO is to improve the quality of financial reporting through business ethics, effective internal controls, and corporate governance. The COSO website is [www.coso.org](http://www.coso.org).

<sup>3</sup> Committee of Sponsoring Organizations of the Treadway Commission (CSOTC), *Internal Control-Integrated Framework* (COSO Report), 1992 and 2013 edition.

## The Real World

Even companies that have good ethics codes and enforcement must guard against fraud. Johnson & Johnson has always been known as a model of good corporate ethics. However, in 2007 an internal investigation revealed that certain sales units within the company were paying bribes to gain sales of medical devices in foreign countries. Johnson & Johnson voluntarily turned this information over to the U.S. Department of Justice, because such bribes are a violation of the Foreign Corrupt Practices Act. On April 8, 2011, Johnson & Johnson announced it had

reached a negotiated settlement with the Department of Justice that avoided prosecution, yet the company did pay fines exceeding \$70 million to the United States and Germany. The company's self-disclosure, full cooperation, and improved controls probably significantly reduced the punishment. This is an example of how fraud should be handled when discovered within a company's management. Strong attention to ethics and controls may not always prevent fraud, but it usually helps uncover fraud and reduce its adverse effects.

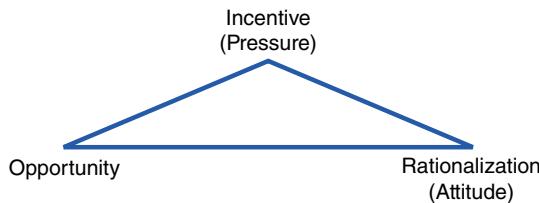
some types of fraud that can occur and provides details of internal control systems and ethics codes. It is not possible for a single chapter to include all potential types of fraud or the controls to prevent them. The purpose of this chapter is to explain some of these fraud schemes to help you see the nature of the risks involved. With an understanding of the risks, you will find it easier to learn the nature of accounting and IT internal control systems intended to prevent or detect errors and fraud.

## Accounting-Related Fraud (Study Objective 2)

**Fraud** can be defined as the theft, concealment, and conversion to personal gain of another's money, physical assets, or information. Notice that this definition includes concealment. In most cases, a fraud includes altering accounting records to conceal the fact that a theft occurred. For example, an employee who steals cash from his employer is likely to alter the cash records to cover up the theft. An example of conversion would be selling a piece of inventory that has been stolen. The definition of fraud also includes theft, not only of money and assets, but also of information. Much of the information that a company maintains can be valuable to others. For example, customer credit card numbers can be stolen. An understanding of the nature of fraud is important, since one of the purposes of an accounting information system is to help prevent fraud.

In fraud, there is a distinction between misappropriation of assets and misstatement of financial records. **Misappropriation of assets** involves theft of any item of value. It is sometimes referred to as a **defalcation**, or **internal theft**, and the most common examples are theft of cash or inventory. Restaurants and retail stores are especially susceptible to misappropriation of assets because their assets are readily accessible by employees. **Misstatement of financial records** involves the falsification of accounting reports. This is often referred to as **earnings management**, or **fraudulent financial reporting**.

In order for a fraud to be perpetrated, three conditions must exist, as shown in Exhibit 3-1. These three conditions, known as the **fraud triangle**, are as follows:



**EXHIBIT 3-1** The Fraud Triangle

- *Incentive* to commit the fraud. Some kind of incentive or pressure typically leads fraudsters to their deceptive acts. Financial pressures, market pressures, job-related failures, or addictive behaviors may create the incentive to commit fraud.
- *Opportunity* to commit the fraud. Circumstances may provide access to the assets or records that are the objects of fraudulent activity. Only those persons having access can pull off the fraud. Ineffective oversight is often a contributing factor.
- *Rationalization* of the fraudulent action. Fraudsters typically justify their actions because of their lack of moral character. They may intend to repay or make up for their dishonest actions in the future, or they may believe that the company owes them as a result of unfair expectations or an inadequate pay raise.

Understanding these conditions is helpful to accountants as they create effective systems that prevent fraud and fraudulent financial reporting. Fraud prevention is an increasingly important role for accounting and IT managers in business organizations, because instances of fraud and its devastating effects appear to be on the rise.

## The Real World

The Association of Certified Fraud Examiners publishes studies of occupational fraud cases. Some statistics from its most recent reports follow<sup>4</sup>:

- Certified fraud examiners estimate that 5 percent of revenues are lost annually as a result of occupational fraud and abuse. Applied to the World Gross Domestic Product, this translates to losses of approximately \$3.7 trillion.
- The median loss due to fraud was \$145,000, and 22 percent of the cases of frauds caused losses in excess of \$1 million.
- Over 85 percent of occupational frauds involve asset misappropriations, and the median loss was \$135,000. Cash is the targeted asset 90 percent of the time.

- As perpetrators are at higher levels of authority, the amount of fraud losses are higher.
- Fraudulent financial statements account for less than 9 percent of the cases, but they were the most costly form of occupational fraud, with median losses of over \$4 million per scheme.
- The average scheme in this study lasted 18 months before it was detected.
- The most common method for detecting occupational fraud is by a tip from an employee, customer, vendor, or anonymous source.
- Small businesses (having fewer than 100 employees) are the most vulnerable to occupational fraud and abuse.

<sup>4</sup> Report to the Nation on Occupational Fraud and Abuse, Association of Certified Fraud Examiners, 2014, p. 4.

As indicated by the fraud report from the Association of Certified Fraud Examiners, fraud occurs in many different ways. The general categories of fraud and examples of these are explained in the sections that follow.

## Categories of Accounting-Related Fraud

In an organization, fraud can be perpetrated by four categories of people: management, employees, customers, and vendors. (See Exhibit 3-2.)

**EXHIBIT 3-2**

### Categories of Accounting-Related Fraud

Fraud Category	Example	Can Internal Control Be Effective in Preventing or Detecting?	Example of an Internal Control That Can Be Effective
Management fraud	Misstating financial statements	Usually not, because of management override	n/a
Employee fraud	Inflating hours worked on time card	Yes	Require supervisor to verify and sign time card
Customer fraud	Returning stolen merchandise for cash	Yes	Provide refund only if proper sales receipt exists
Vendor fraud	Requesting duplicate payment for one invoice	Yes	Pay only those invoices that have a matching purchase order and receiving report, and cancel documents when they are paid

## The Nature of Management Fraud (Study Objective 3)

**Management fraud**, conducted by one or more top-level managers within the company, is usually in the form of fraudulent financial reporting. Oftentimes, the chief executive officer (CEO) or chief financial officer (CFO) conducts fraud by misstating the financial statements through elaborate schemes or complex transactions. Managers misstate financial statements in order to receive such indirect benefits as the following:

1. Increased stock price. Management usually owns stock in the company, and it benefits from increased stock price.
2. Improved financial statements, which enhance the potential for a merger or initial public offering (IPO), or prevent negative consequences due to noncompliance with debt covenants or decreased bond ratings.
3. Enhanced chances of promotion, or avoidance of firing or demotion.
4. Increased incentive-based compensation such as salary, bonus, or stock options.
5. Delayed cash flow problems or bankruptcy.

Management fraud may involve overstating revenues and assets, understating expenses and liabilities, misapplying accounting principles, or any combination of these tactics. While there are numerous examples of management fraud, two examples are presented next.

## The Real World

Enron was forced to restate (reduce) earnings by approximately \$600 million because of improper financial reporting. Enron's top management had been hiding debt and losses by using a complex set of special purpose entities (SPEs). These SPEs were partnerships controlled by members of Enron's top management, such as the CEO and CFO. The SPEs were treated as unrelated entities and, therefore, were not included in the Enron financial statements.

Shortly after restating its financial statements, Enron filed the biggest bankruptcy in history.

The company had previously been considered by many to be one of the largest and most successful companies ever. The unraveling of Enron caused its stock price to fall from \$90 in 2000 to less than \$1 by the end of 2001. Many investors and employees were devastated by their losses. This fraudulent misstatement led not only to the demise of Enron, but also to the dissolution of Arthur Andersen, one of the oldest and most prestigious audit firms in the world.

## The Real World

In 2002, the SEC filed a civil fraud suit against Xerox Corporation,<sup>5</sup> alleging that top managers at Xerox approved and encouraged accounting practices that violated GAAP and accelerated revenue recognition. These bad accounting practices included the following:

1. Incorrectly reporting service and financing lease revenue at the beginning of the contract rather than over the life of the lease
2. Shifting revenue from financing to equipment sales, which increased gross margin

3. Improperly recognizing a gain from a one-time event, commonly referred to as establishing "cookie jar" reserves

The effect of these frauds on the financial statements was to artificially increase pre-tax earnings by \$1.5 billion over the four-year period of 1997–2000. Top management encouraged these practices so that the company could meet expected earnings targets. As a result of the SEC action, Xerox agreed to pay a \$10 million fine and restate earnings.

These two examples illustrate that management fraud typically

1. Is intended to enhance financial statements
2. Is conducted or encouraged by the top managers
3. Involves complex transactions, manipulations, or business structures
4. Involves top management's circumvention of the systems or internal controls that are in place—known as **management override**

Management fraud, like the examples at Enron and Xerox, is conducted by top-level managers and usually involves manipulation of the financial statements so that the manager can benefit by such things as increases in compensation or stock price. Many management frauds include complex transactions or entities, such as Enron's use of SPEs. Moreover, managers operate above the level of internal controls—that is, internal controls can be overridden or circumvented by managers. Therefore, a good set of internal controls may not be as effective in reducing the chance of management fraud as it would be in reducing the chance of fraud committed by an

<sup>5</sup> Securities and Exchange Commission, Litigation Release No. 17465, April 11, 2002.

## The Real World

An example of management override of internal controls was discovered in 2010 at the Koss Corporation, a headphone manufacturer. Sue Sachdeva, the vice president of finance, pleaded guilty to embezzling \$34 million from Koss over a period of about five years. This is a very large dollar amount of fraud in a company of this size, since Koss's average net income over

those years was about \$6 million. Ms. Sachdeva's wrongdoings included fraudulent wire transfers to pay her personal credit card bills, fraudulent checks, and fraudulent petty cash disbursements. In addition, she overstated assets and expenses to hide the theft. Since she was the VP of finance, she could override the normal internal control processes that should prevent this type of fraud.

employee, vendor, or customer. The most effective measure to prevent or detect management fraud is to establish a professional internal audit staff that periodically checks up on management activities and reports to the audit committee of the board of directors.

## The Nature of Employee Fraud (Study Objective 4)

**Employee fraud** is conducted by nonmanagement employees. This usually means that an employee steals cash or assets for personal gain. While there are many different kinds of employee fraud, some of the most common are as follows:

1. *Inventory theft.* Inventory can be stolen or misdirected. This could be merchandise, raw materials, supplies, or finished goods inventory.
2. *Cash receipts theft.* This occurs when an employee steals cash from the company. An example would be the theft of checks collected from customers.
3. *Accounts payable fraud.* Here, the employee may submit a false invoice, create a fictitious vendor, or collect kickbacks from a vendor. A **kickback** is a cash payment that the vendor gives the employee in exchange for the sale; it is like a business bribe.
4. *Payroll fraud.* This occurs when an employee submits a false or inflated time card.
5. *Expense account fraud.* This occurs when an employee submits false travel or entertainment expenses, or charges an expense account to cover the theft of cash.

Cash receipts theft is the most common type of employee fraud. It is often pulled off through a technique known as **skimming**, where the organization's cash is stolen before it is entered into the accounting records. This type of theft is the most difficult to discover, since there is no internal record of the cash. For example, consider the case of a ticket agent in a movie theater who accepts cash from customers and permits those customers to enter the theater without a ticket. The cash collected could be pocketed by the agent, and there would be no record of the transaction.

Fraudsters may also steal the company's cash after it has been recorded in the accounting records. This practice is known as **larceny**. Consider an example of an employee responsible for making the bank deposit who steals the cash after it has been recorded in the accounts receivable records. This type of fraud is uncommon because the fraudster is likely to be caught, since the accounting records provide

## The Real World

Dow Chemical Company has engaged in fraud investigations aimed at detecting employee fraud. The most common frauds at Dow are expense report fraud, kickback schemes, and embezzlement. Dow identifies the following examples of warning signs during its fraud investigations.<sup>6</sup>

### Expense Report Fraud

- Excessive amount of expenses without receipts or supporting documentation
- Handwritten rather than computer-generated receipts
- Purchases from retail establishments, including toy stores and sporting-goods stores, which may indicate personal expenses
- Excessive cash advances taken against a company credit card
- Numerous expenses under the minimal amount requiring a receipt, which is usually less than \$25

### Kickback Schemes

- Vendor contracts awarded without bids
- Repeated use of the same vendor
- Excessive complaints about product quality
- Invoiced prices that differ from prices listed in the contract
- Employee living beyond his/her means
- Employee not taking any vacation time
- Photocopied invoices
- Vendor address listed as a Post Office box
- Continual instances of missing inventory

### Embezzlement

- Discrepancies between invoice amount and amount paid
- Invoices for unusual items, with no supporting documentation
- Unexplainable cost variances between budget and actual amounts
- Duplicate or invalid employee Social Security numbers or addresses (may indicate ghost employees)
- Inflated salaries or travel expenses

evidence of collecting cash. Larceny is typically detected when performing a reconciliation of cash accounts (to the accounts receivable or payable records) or when preparing the bank reconciliation.

In some cases, fraud may involve collusion. **Collusion** occurs when two or more people work together to commit a fraud. Collusion can occur between employees, employees and customers, or employees and vendors. Collusion between employees within a company is the most difficult to prevent or detect because it compromises the effectiveness of internal controls. This is true because collusion can make it much easier to conduct and conceal a fraud or theft even when segregation of duties is in place. For example, if a warehouse employee stole inventory and an accounting clerk covered it up by altering the inventory records, the fraud would be difficult to detect.

## The Nature of Customer Fraud (Study Objective 5)

**Customer fraud** occurs when a customer improperly obtains cash or property from a company, or avoids a liability through deception. Although customer fraud may affect any company, it is an especially common problem for retail firms and companies that sell goods through Internet-based commerce. Examples of customer fraud include

<sup>6</sup> Paul Zikmund, "Ferreting Out Fraud," *Strategic Finance*, April 2003, pp. 3–4.

credit card fraud, check fraud, and refund fraud. **Credit card fraud** and **check fraud** involve the customer's use of stolen or fraudulent credit cards and checks. **Refund fraud** occurs when a customer tries to return stolen goods to collect a cash refund.

## The Nature of Vendor Fraud (Study Objective 6)

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**Vendor fraud** occurs when vendors obtain payments to which they are not entitled. Unethical vendors may intentionally submit duplicate or incorrect invoices, send shipments in which the quantities are short, or send lower-quality goods than ordered. Vendor fraud may also be perpetrated through collusion. For example, an employee of a company could make an agreement with a vendor to continue the vendor relationship in the future if the employee receives a kickback.

More and more companies are conducting vendor audits as a way to protect themselves against unscrupulous vendors. **Vendor audits** involve the examination of vendor records in support of amounts charged to the company. Since many vendor contracts involve reimbursement for labor hours and other expenses incurred, the company can review supporting documentation for these expenses incurred by its vendor. This could reveal whether or not the vendor is honest in reporting expenses, and may be the basis for continuing or terminating the business relationship.

## The Nature of Computer Fraud (Study Objective 7)

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In addition to the frauds described in previous sections, organizations must also attempt to prevent or detect fraudulent activities involving the computer. Again, there are so many different kinds of **computer fraud** that it is not feasible to describe all the possibilities in this chapter. In some cases, the computer is used as a tool to more quickly and efficiently conduct a fraud that could be conducted without a computer. For example, an individual could perpetrate **industrial espionage**, the theft of proprietary company information, by digging through the trash of the intended target company. However, it would probably be more efficient for a hacker to gain access to the information through the target company's computer system. In other cases, the fraud conducted is unique to computers. For example, a computer is required to accomplish **software piracy**, the unlawful copying of software programs.

Another characteristic of computer fraud is that it can be conducted by employees within the organization or unauthorized users outside the organization. We categorize these two sources of computer fraud into internal computer fraud and external computer fraud.

### **Internal Sources of Computer Fraud**

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When an employee of an organization attempts to conduct fraud through the misuse of a computer-based system, it is called internal computer fraud. Internal computer fraud concerns each of the following activities:

1. Input manipulation
2. Program manipulation
3. Output manipulation

Input manipulation usually involves altering data that is input into the computer. For example, altering payroll time cards to be entered into a computerized payroll system is a type of input manipulation. Other examples of input manipulation would be creating false or fictitious data inputs, entering data without source documents, or altering payee addresses of vendors or employees.

Program manipulation occurs when a program is altered in some fashion to commit a fraud. Examples of program manipulation include the salami technique, Trojan horse programs, and trap door alterations.

A fraudster may use the **salami technique** to alter a program to slice a small amount from several accounts and then credit those small amounts to the perpetrator's benefit. For example, a program that calculates interest earned can be altered to round down to the lower 10-cent amount; that small excess of interest earned can be deposited to the perpetrator's account. Although it would take many transactions of this type to be of much benefit, the nature of interest calculation is such that it occurs frequently on many accounts; therefore, the amount of the fraud benefit could build quickly.

A **Trojan horse program** is a small, unauthorized program within a larger, legitimate program, used to manipulate the computer system to conduct a fraud. For example, the rogue program might cause a certain customer's account to be written off each time a batch of sales or customer payments are processed.

A **trap door alteration** is a valid programming tool that is misused to commit fraud. As programmers write software applications, they may allow for unusual or unique ways to enter the program to test small portions, or modules, of the system. These entranceways can be thought of as hidden entrances, or trap doors. Before the program is placed into regular service, the trap doors should be removed, but a programmer may leave a trap door in place in order to misuse it to commit fraud.

Computer systems generate many different kinds of output, including checks and reports. If a person alters the system's checks or reports to commit fraud, this is known as output manipulation. This kind of fraud is often successful simply because humans tend to trust the output of a computer and do not question its validity or accuracy as much as they might if the output were manually produced.

## External Sources of Computer Fraud

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In most cases, external computer frauds are conducted by someone outside the company who has gained unauthorized access to the computer. These fraudsters are commonly known as hackers. However, it is possible that someone within the organization—essentially, anyone who can gain access to an organization's computer system—could attempt these frauds. Two common types of external computer fraud are hacking and spoofing.

**Hacking** Hacking is the term commonly used for computer network break-ins. Hacking may be undertaken for various reasons, including industrial espionage, credit card theft from online databases, destruction or alteration of data, or merely thrill-seeking. Regardless of the purpose of the break-in, tremendous damage can be done to a company in terms of immediate financial loss or loss of customer confidence.

A hacker usually gains access to a network through the various network connections that most businesses and organizations have. Most companies are connected to networks for many reasons, such as to conduct Internet commerce, to connect various geographic locations of the same company, to allow telecommuting for

## The Real World

Computer hacking incidents have occurred at many organizations, including Data Processors International, a firm that processes credit card transactions for retailers, and Target Corporation, the mega discount retail store. These external

computer frauds occurred when hackers broke into the computer system and gained access to millions of credit card numbers belonging to consumers.

employees who work at home, and to connect to the computer systems of vendors or customers. The existence of any of these types of network connections opens an opportunity for hackers to violate that connection. This is the paradox faced in today's computer world. To operate efficiently, organizations need to connect to networks, but such connections increase security risks exponentially.

**DoS Attacks** A particular kind of hacking that has increased dramatically in recent years is denial of service (DoS) attacks. A **denial of service attack** is intended to overwhelm an intended target computer system with so much bogus network traffic that the system is unable to respond to valid network traffic. A hacker takes advantage of the automated, repetitive nature of computers to accomplish a DoS attack by taking control of one or more computers on a network and using those computers to continually send bogus network traffic to a target computer. If the hacker can take over several computers and force each of them to send bogus traffic to one targeted computer system, the targeted system becomes overwhelmed. Attacks such as these that use several computers to attack one computer are called distributed denial of service attacks, or DDoS attacks. DDoS attacks are often used to distract the target company's security measures so that data theft can be undertaken.

## The Real World

In February of 2000, several high-profile companies were the targets of DoS attacks. Companies including Yahoo, Inc., Turner Broadcasting System, Inc., eBay, Inc., and Amazon.com experienced DoS attacks that shut down their websites for hours as they worked to wipe out the harmful effects on their computer servers and networks.

Such attacks are still common today. The second quarter of 2015 had a record number of DoS attacks. A phone carrier in the United Kingdom, Carphone Warehouse, was a target of DoS attacks that allowed the perpetrators to steal the data of millions of Carphone customers.

**Spoofing** **Spoofing** occurs when a person, through a computer system, pretends to be someone else. There are two kinds of spoofing that are currently prevalent: Internet spoofing and e-mail spoofing. Internet spoofing is the most dangerous to the accounting and control systems, because a spoofer fools a computer into thinking that the network traffic arriving is from a trusted source. Within the Internet, each computer server is identified by a unique Internet protocol (IP) address. Any network traffic between computers is broken into small "packets" of data. Each

packet includes the IP addresses of both the sender and receiver of the packet. In spoofing, the originating IP address is intentionally changed to make it appear that the packet is coming from a different IP address. Many computer systems include a security system that accepts packets only from known and trusted sources—essentially, an address book of trusted IP addresses. A spoofer circumvents that system by pretending that the packet originates from a trusted source. These packets can contain malicious data such as viruses, or programs that capture passwords and log-in names.

While e-mail spoofing is not typically as problematic as Internet spoofing is to the direct financial interests of most business organizations, it is nevertheless a source of irritation and inconvenience at the workplace. E-mail spoofing might flood employees' e-mail boxes with junk mail but usually does not result in defrauding their company. E-mail spoofing is usually used in an attempt to scam consumers. For example, a bank customer might get an e-mail that looks as if it comes from the customer service department, asking recipients to provide confidential information such as their log-in and password. With these fake e-mails, the sender is hoping that unsuspecting customers will reply and divulge confidential information that will allow the spoofer to commit fraud. This type of fraud must be controlled by consumers and police authorities; internal control systems within a company can do little to prevent e-mail spoofing.

## Policies to Assist in the Avoidance of Fraud and Errors (Study Objective 8)

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Following are three critical actions that an organization can undertake to assist in the prevention or detection of fraud and errors:

1. Maintain and enforce a code of ethics.
2. Maintain a system of accounting internal controls.
3. Maintain a system of information technology controls.

These ongoing actions will not entirely prevent or detect all fraud or errors, but they can greatly reduce the chance of fraud and errors. Each of these actions is discussed next.

## Maintenance of a Code of Ethics (Study Objective 9)

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In response to the many fraudulent financial reports generated in 2001, the United States Congress passed the **Sarbanes-Oxley Act** of 2002. The Act was intended to reform accounting, financial reporting, and auditing functions of companies that are publicly traded in stock exchanges. One requirement is that public companies adopt and disclose a code of ethics for directors, officers, and employees. Documenting and adhering to a code of ethics should reduce opportunities for managers or employees to conduct fraud. This will only be true, however, if top management emphasizes this code of ethics and disciplines or discharges those who violate the code. Exhibit 3-3 presents the type of concepts that are usually found in a business organization's code of ethics.

**EXHIBIT 3-3****Concepts in a Code of Ethics**

Establishing and maintaining a culture where ethical conduct is recognized, valued, and exemplified by all employees. This includes

- Obeying applicable laws and regulations that govern business
- Conducting business in a manner that is honest, fair, and trustworthy
- Avoiding all conflicts of interest
- Creating and maintaining a safe work environment
- Protecting the environment

## The Real World

In a recent survey of management accountants and financial managers, the effect of ethics codes on management behavior was studied. The survey concluded, in part, that "Nearly 62 percent of the respondents (13 out of 21) from corporations reporting that ethics don't matter also report pressure to alter or 'manage' financial results. In contrast, in corporations where the tone

at the top favors ethical conduct, only 19 percent (35 out of 189) reported pressure to alter results. Similar results were shown with specific financial reporting measures, such as income, balance sheet, and return on investment."<sup>7</sup> Another survey reported that 24 percent of accountants participating in the study had been "bullied" to fudge financial numbers in company reports.<sup>8</sup>

## Maintenance of Accounting Internal Controls (Study Objective 10)

Much of the early part of this chapter focused on the nature and sources of fraud. Understanding fraud makes it easier to recognize the need for policies and procedures that protect an organization. Internal control systems provide a framework for fighting fraud. However, attempting to prevent or detect fraud is only one of the reasons that an organization maintains a system of internal controls.

The objectives of an internal control system are as follows:

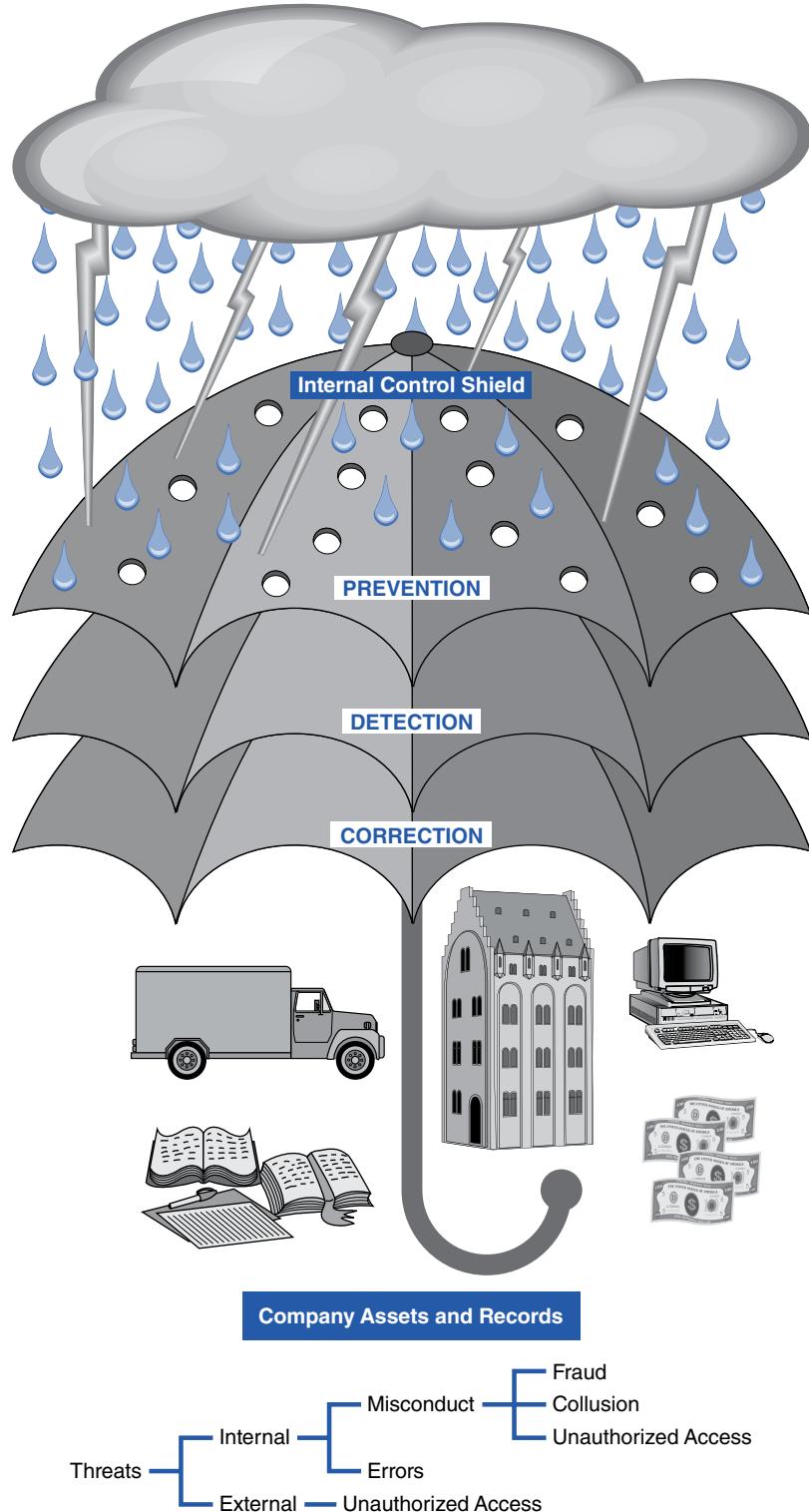
1. Safeguard assets (from fraud or errors).
2. Maintain the accuracy and integrity of the accounting data.
3. Promote operational efficiency.
4. Ensure compliance with management directives.

To achieve these objectives, management must establish an overall internal control system, the concept of which is depicted in Exhibit 3-4. This control system includes three types of controls. **Preventive controls** are designed to avoid errors, fraud, or events not authorized by management. Preventive controls intend to stop

<sup>7</sup> Barbara Lamberton, Paul H. Mihalek, and Carl Smith, "The Tone at the Top and Ethical Conduct Connection," *Strategic Finance*, March 2005, p. 38.

<sup>8</sup> Olen L. Greer and George D. Schmelzle, "Are You Being Bullied?" *Strategic Finance*, September 2009, p. 41.

Because of cost–benefit considerations, some “holes” may exist in the internal control structure, which may allow threats to penetrate the business.



**EXHIBIT 3-4** Internal Controls as Shields to Protect Assets and Records

undesirable acts before they occur. For example, keeping cash locked in a safe is intended to prevent theft. Since it is not always possible to prevent all undesirable events, **detective controls** must be included in an internal control system. Detective controls help employees to uncover or discover errors, fraud, or unauthorized events. Examples of detective controls include matching physical counts to inventory records, reconciling bank statements to company records, and matching an invoice to its purchase order prior to payment. When these types of activities are conducted, it becomes possible to detect problems that may exist. Finally, **corrective controls** are those steps undertaken to correct an error or problem uncovered via detective controls. For example, if an error is detected in an employee's time card, there must be an established set of steps to follow to assure that it is corrected. These steps would be corrective controls.

Any internal control system should have a combination of preventive, detective, and corrective controls. As an example, refer back to the situation presented earlier in this chapter involving the movie-theater agent who stole a customer's cash and allowed the customer to enter the theater without a ticket. The movie theater could protect itself from losses due to this type of fraud by implementing a combination of preventative, detective, and corrective controls such as the following:

- A separate ticket taker could be employed who would allow access to the theater only to those customers who present a valid ticket (preventative control).
- An automated system could be used whereby tickets are dispensed only when payment is received and recorded (preventative control).
- Theater agents could be required to reconcile activities at the end of their shifts, such as comparing payments received with the number of tickets sold and the number of occupied seats in the theater (detective control).
- Procedures could be implemented to require that records are adjusted for the effect of any errors found in the system, and employees are held responsible for discrepancies found during their shifts (corrective control).

If these kinds of controls were in place, fraud occurrences would be reduced, because it is more likely that fraud would be disallowed by the system, spotted by employees, or rectified before any perpetrator could carry out the act. However, even with an extensive set of preventive, detective, and corrective controls, there are still risks that errors or fraud may occur. The idea that the internal control system cannot prevent, detect, and correct all risks is illustrated by the holes in the umbrella in Exhibit 3-4.

It is not possible to close all of the holes (or eliminate all of the risks) for many reasons. There will always be some weaknesses caused by human error, human nature, and the fact that it may not be cost effective to close all of the holes. The following sections describe the details of internal controls and the risk exposures, or holes, in those internal controls.

## The Details of the COSO Report

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Due to ongoing problems with fraudulent financial reporting, the **Committee of Sponsoring Organizations (COSO)** undertook a comprehensive study of internal control and in 1992 issued the Internal Control Integrated Framework, commonly known as the COSO report. The **COSO report** has provided the standard definition and description of internal control accepted by the accounting industry. The framework has been updated and expanded in 2013 to provide various clarifications and enhancements to its internal control guidance. According to the COSO report,

there are five interrelated components of internal control: the control environment, risk assessment, control activities, **information and communication**, and monitoring. Each of these components is discussed next.

**Control Environment** The **control environment** sets the tone of an organization and influences the control consciousness of its employees. The control environment is the foundation for all other components of internal control, and it provides the discipline and structure of all other components. Control environment factors include:

- The integrity and ethical values of the entity's people
- Management's oversight responsibility, including its philosophy and operating style
- The way management establishes structure and assigns authority and responsibility
- The way management develops its people and demonstrates commitment to competence
- The board of directors demonstrates independence from management and exercises oversight of internal control
- The organization holds individuals accountable for their internal control responsibilities.

In each of these areas, management could establish an operating style that is either risky or more conservative. Exhibit 3-5 shows characteristics of internal control environments that are considered more risky and less risky. These examples are not intended to indicate that a company with characteristics such as those in the right-hand, "more risky" column will always experience fraud. It implies only that companies represented in the right-hand column are more likely to experience fraud because of risks in the control environment. Conversely, companies with characteristics such as those in the "less risky" column are less likely to experience

### EXHIBIT 3-5

#### Factors of the Control Environment

Factor	Example of a Less Risky Control Environment	Example of a More Risky Control Environment
Integrity and ethics	The company has a code of ethics, and it is rigidly enforced.	The company does not have a code of ethics, or if it has one, it is not enforced.
Philosophy and operating style	Management is very conservative in its approach to things such as mergers.	Management is very aggressive and risk-taking in its approach to things such as mergers.
Assignment of authority and responsibility	Lines of authority are well established, and managers' jobs and duties are clear to them.	Managers have overlapping duties, and oftentimes managers are not quite sure whether or not they have certain responsibilities and authority.
Development of competent people	Management carefully trains and cultivates employees to be able to take on more responsibility.	Management does not spend much money or time on the training of employees.
Attention and direction by the board of directors	Members of the board examine reports and hold top management accountable for the accuracy of the reports.	Members of the board do not prepare for the meetings they attend and are merely "big-name" figureheads.

fraud, because they are more conservative in their approach to the establishment of a control environment; in other words, these companies tend to play it safe by implementing protective measures.

The philosophy and operating style of management is evident in how it approaches the operation and growth of its company. For example, some managers are very aggressive in setting high earnings targets, in developing new products or markets, or in acquiring other companies. Such companies may reward management with incentive compensation plans that award bonuses for increased earnings. Management, therefore, has more motivation to be aggressive in achieving earnings growth. In this environment where aggressive growth is sought, there can be pressure to “fudge the numbers” to achieve those targets.

The operating environments as described previously are established by top management. A company’s CEO can either encourage or discourage risky behaviors. Thus, the tone at the top flows through the whole organization and affects behavior at every level. For this reason, the control environment established by management is a very critical component of an internal control system. COSO identifies the tone set by management as the most important factor related to providing accurate and complete financial reports. The control environment is the foundation upon which the entire internal control system rests. No matter how strong the remaining components are, a poor control environment is likely to allow fraud or errors to occur in an organization.

**Risk Assessment** Every organization continually faces risks from external and internal sources. These risks include factors such as changing markets, increasing government regulation, and employee turnover. Each of these can cause drastic changes in the day-to-day operations of a company by disrupting routines and processes, including those designed to help prevent or detect fraud and errors. In order for management to maintain control over these threats to its business, it must constantly be engaged in **risk assessment**, whereby it considers existing threats and the potential for additional risks and stands ready to respond should these events occur. Management must develop a systematic and ongoing way to do the following:

1. Specify the relevant objectives to enable the identification and assessment of risks relating to objectives.
2. Identify the risks (both internal and external, and due to both fraud or error), and determine how the risks should be managed.
3. Consider the potential for fraud in assessing risks.
4. Identify and assess changes that could significantly affect the system of internal control.

**Control Activities** The COSO report identifies **control activities** as the policies and procedures that help ensure that management directives are carried out and that management objectives are achieved. A good internal control system must include control activities that occur at all levels and in all functions within the company, including controls over technology.

The internal control framework requires that an organization accomplish the following:

- Develop control activities that contribute to the mitigation of risks.
- Develop general controls over technology (this concept is discussed in Chapter 4).
- Deploy control activities through policies that establish expectations and procedures to put those policies into action.

The control activities include a range of actions that should be deployed through the company's policies and procedures. These activities can be divided into the following categories:

1. Authorization of transactions
2. Segregation of duties
3. Adequate records and documents
4. Security of assets and documents
5. Independent checks and reconciliations

**Authorization of Transactions** In any organization, it is important to try to ensure that only authorized transactions are carried out. **Authorization** refers to an approval, or endorsement, from a responsible person or department in the organization that has been sanctioned by top management. Every transaction that occurs must be properly authorized in some manner. For example, some procedure should be followed to determine when it is allowable to purchase goods, or when it is permissible to extend credit. A common example that you may have encountered occurs at some grocery and department stores. If you have ever stood in a long checkout line while the shopper in front tried to pay with an out-of-state check, you probably groaned silently, knowing that the line would be further delayed while the checkout clerk waited for a manager to approve the payment method. Notice that in this example, for the transaction that carries extra risk (the possibility of a bounced out-of-state check), the company has established a control procedure to discourage bad check-writing (the requirement for specific authorization from a manager before the transaction can be completed).

The preceding example also helps illustrate the difference between specific authorization and general authorization. **General authorization** is a set of guidelines that allows transactions to be completed as long as they fall within established parameters. In the example of a grocery or department store, the established guidelines are that the checkout clerk can process anyone through the line as long as the customer pays by cash, credit card, debit card, or an in-state check. If any transaction is an exception to these payment methods, as in the case of the customer paying with an out-of-state check, the transaction requires specific authorization. **Specific authorization** means that explicit approval is needed for a transaction to be completed.

Another example of the difference between these two types of authorization can be seen in the procedures that a company uses when making purchases. Management usually has established reorder points for inventory items, and when inventory quantities drop to that predetermined level, purchasing agents have general authority to initiate a purchase transaction. However, if the company needs to purchase a new fleet of vehicles, for instance, a specific authorization from upper-level management is likely to be required.

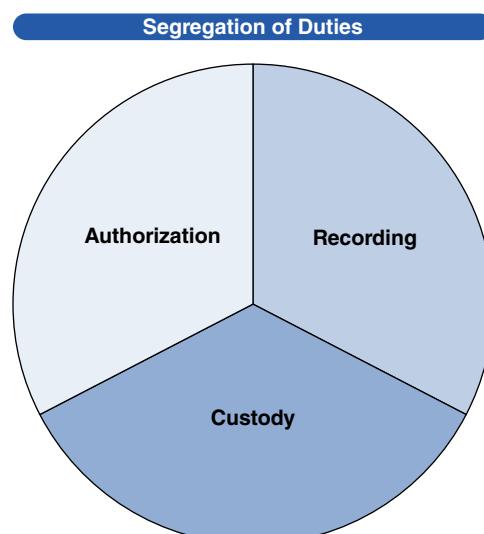
Any organization should establish and maintain clear, concise guidance as to procedures that fall under general authorization as opposed to those requiring specific authorization. Not only does such a practice assure that all transactions are properly authorized; it also makes the organization more efficient. In our example of a grocery store, the checkout line can move quickly and efficiently for low-risk transactions involving payment by cash, credit card, debit card, or in-state check. However, when high-risk transactions are encountered, the extra risk warrants a brief inefficiency (the slowdown in the line) to assure that the risk is controlled by a specific authorization. Another important aspect is that the employee must be well trained and must understand when this specific authorization is needed.

In summary, an important part of a company's control procedures is the guidelines regarding general and specific authorization. Top managers must appropriately delegate the authorization of transactions and establish authorization procedures and practices to assure that the guidelines are followed. They must ascertain that managers and employees have been trained to understand and carry out these policies and practices.

**Segregation of Duties** When management delegates authority and develops guidelines as to the use of that authority, it must assure that the authorization is separated from other duties. This separation of related duties is called **segregation of duties**. For any transaction, there are usually three key functions: authorization of the transaction, recording the transaction, and custody of the related asset(s). Ideally, management should separate these three functions by assigning each function to a different person or department within the organization. The person or department authorizing a transaction should neither be responsible for recording it in the accounting records nor have custody of the related asset. To understand the possible effect of not segregating these duties, consider a payroll example. If a foreman were allowed to hire employees, approve their hours worked, and also distribute the paychecks, then authorization would not have been segregated from custody of the checks. This would give a dishonest foreman the perfect opportunity to make up a fictitious employee and collect the paycheck. However, if paychecks were distributed to employees by someone other than the foreman, the opportunity for this kind of payroll theft would be reduced.

When it is reasonably possible to do so, all three functions—authorization, recording, and custody—should be segregated. Exhibit 3-6 illustrates this segregation of duties.

It may not always be possible or reasonable to segregate all incompatible functions within a company. This is especially true in small organizations where there may not be enough workers to adequately segregate. However, in smaller companies there is usually much closer supervision by the owner or manager, which helps compensate for the lack of segregation. Thus, supervision is a **compensating control** that lessens the risk of negative effects when other controls are lacking. Supervision as a compensating control is appropriate in larger organizations, too, where there may be situations in which it is difficult to fully segregate duties.



**EXHIBIT 3-6** Segregation of Duties

**Adequate Records and Documents** When management is conscientious and thorough about preparing and retaining documentation in support of its accounting transactions, internal controls are strengthened. Accounting documents and records are important, because they provide evidence and establish responsibility. In general, a good system of internal controls includes the following types of documentation:

- Supporting documentation for all significant transactions, including orders, invoices, contracts, account statements, shipping and receiving forms, and checks. Whenever possible, original documentation should be retained as verification of authenticity. Specific types of documentation are discussed in subsequent chapters within the presentations of the various business processes.
- Schedules and analyses of financial information, including details of account balances; reconciliations; references; comparisons; and narrative explanations, comments, and conclusions. These documents should be independently verified from time to time in order for their accuracy to be assessed.
- Accounting cycle reports, including journals, ledgers, subledgers, trial balances, and financial statements.

Documents and records provide evidence that management's policies and procedures, including internal control procedures, are being carried out. They also provide an **audit trail**, which presents verifiable information about the accuracy of accounting records. If accurate, sufficient documentation is maintained, then an audit trail can be established, which can re-create the details of individual transactions at each stage of the business process in order to determine whether proper accounting procedures for the transaction were performed.

All paper documentation should be signed or initialed by the person(s) who authorized, recorded, and/or reviewed the related transactions. This practice establishes responsibility within the accounting function. When records are maintained in electronic format, the organization should take steps to control access to the related files and ensure that adequate backup copies are available in order to reduce the risk of alteration, loss, or destruction. In a computerized system, the audit trail usually includes a detailed transaction log, because the computer system automatically logs each transaction and the source of the transaction. In today's business world, where many records are maintained within computerized systems, managers and auditors must understand, access, and control those accounting records maintained within an electronic environment.

In addition to accounting documents and reports, business organizations should maintain thorough documentation on their policies and procedures. In order to provide clarity and promote compliance within the organization, both manual and automated processes and control procedures should be formalized in writing and made available to all responsible parties.

**Security of Assets and Documents** Organizations should establish control activities to safeguard their assets, documents, and records. These control activities involve securing and protecting assets and records so that they are not misused or stolen. In the case of assets, physical protection requires limiting access to the extent that is practical. For example, cash must be on hand for a company to operate, but this cash can be locked in safes or cash registers until needed. Assets such as inventory should be protected by physical safeguards such as locks, security cameras, and restricted areas requiring appropriate ID for entry.

In addition to physical safeguards of assets, it is also important to limit access to documents and records. Unauthorized access or use of documents and records

allows the easy manipulation of those documents or records, which can result in fraud or cover-up of theft. For example, unauthorized access to blank checks can lead to fraudulent checks being written. All blank documents must be controlled by limiting access to only those who require access as part of their job duties.

In both cases—protecting physical assets and protecting information—there is a trade-off between limited access and efficiency. The more access is limited, the harder it becomes to do a job efficiently. This is why controls must have a benefit greater than their cost. For example, a company could have all employees searched as they leave at the end of their shifts in order to discourage inventory theft. However, the cost of this intrusion in terms of its impact on employee morale and turnover may be greater than the savings from theft avoidance. This concept of the **cost-benefit** consideration for internal controls is discussed later in the chapter.

**Independent Checks and Reconciliation** Independent checks on performance are an important aspect of control activities. **Independent checks** serve as a method to confirm the accuracy and completeness of data in the accounting system. While there are many procedures that accomplish independent checks, examples are as follows:

- Reconciliation
- Comparison of physical assets with records
- Recalculation of amounts
- Analysis of reports
- Review of batch totals

An example of each of these independent checks on performance follows. A **reconciliation** is a procedure that compares records from different sources. For instance, a bank *reconciliation* compares independent bank records with company records to ensure the accuracy and completeness of cash records. Similarly, a *comparison of physical assets with records* occurs when a company takes a physical count of inventory and compares the results to the inventory records. Any differences are recorded as adjustments to inventory and result in correct inventory records. *Recalculation of amounts* can help uncover math or program logic errors. For example, recalculating price times quantity may uncover errors in invoices that were caused by either human error or bad program logic. *Analysis of reports* is the examination of a report to assess the accuracy and reliability of the data in that report. A manager who regularly reviews reports is likely to notice errors that crop up in the reports; the manager may not always notice such errors, but many times will. Finally, *review of batch totals* is an independent check to assure the accuracy and completeness of transactions processed in a batch. Batch processing occurs when similar transactions are grouped together and processed as a group. For example, time cards can be collected from all employees within a department and processed simultaneously as a batch. In batch processing, it is possible to calculate a **batch total**, which is merely a summation of key items in the batch (such as hours worked), and compare this batch total along various stages of processing. If at some stage of processing the batch totals no longer match, this means that an error has occurred in processing.

These descriptions of independent checks are examples of control activities, but they only scratch the surface of the number and types of independent checks that may be necessary in an organization. Such independent checks can serve as both detective and preventative controls. They are detective in that they uncover problems in data or processing; they are preventive in the sense that they may help discourage errors and fraud before they occur. For example, employees know that when a company regularly takes a physical inventory and compares the counts with records, shortages are more likely to come to light. Therefore, employees may be

less likely to steal inventory, because they presume they will get caught. This preventive effect becomes more obvious if you consider the opposite environment, in which a company never takes a physical inventory. When employees know this, they recognize that it would be easier to carry out a fraudulent act without getting caught.

**Information and Communication** The COSO internal control framework requires that an organization create and use an information and communication system that includes the following factors:

- The system obtains or generates and uses relevant quality information to support the functioning of internal control.
- The system internally communicates information, including objectives and responsibilities for internal control.
- The system communicates with external parties regarding matters affecting the functioning of internal control.

To assess, manage, and control the efficiency and effectiveness of operations of an organization, management must have access to feedback information and reports. The feedback consists of operational and financial information, much of it generated by the accounting system. An effective accounting system will provide accurate and complete feedback. Therefore, the better the accounting system, the better management can assess and control operations.

The entire accounting system is therefore a very important component of the internal control system. An ineffective accounting system will likely generate inaccurate or incomplete reports, which leads to difficulty in properly controlling activities. An effective accounting system must accomplish the following objectives:

1. Identify all relevant financial events (transactions) of the organization.
2. Capture the important data of these transactions.
3. Record and process the data through appropriate classification, summarization, and aggregation.
4. Communicate this summarized and aggregated information as needed for internal and external purposes.

Whether an accounting system is manual or computerized, it must achieve these objectives to be effective. In addition to maintaining an effective accounting system, the entity must implement procedures to assure that the information and reports are communicated to the appropriate management level. The COSO report describes this communication as “flowing down, across, and up the organization.” Such a flow of communication assists management in properly assessing operations and making changes to operations as necessary.

**Monitoring** The COSO internal control framework requires that an organization establish monitoring systems that accomplish the following:

- Select, develop, and perform ongoing or separate evaluations to ascertain whether the components of internal control are present and functioning.
- Evaluate and communicate internal control deficiencies in a timely manner to responsible parties who can take corrective action.

Any system of control must be constantly monitored to assure that it continues to be effective. **Monitoring** involves the ongoing review and evaluation of the system. For example, your home may have a heating system with a thermostat. The thermostat constantly measures temperature and turns the heat on or off to maintain the

desired temperature. Thus, the thermostat is a control system. However, due to wear and tear or other changes, the thermostat and heater may begin to malfunction. To keep them operating at peak effectiveness, there must be periodic checks on the thermostat and heating system to make sure they are working correctly. The same is true of an internal control system in an organization. To keep the controls operating effectively, management must monitor the system and attempt to improve any deficiencies. This is especially important as organizations undergo changes. Employee and management turnover, new business processes or procedures, and market changes may all affect the functionality of internal controls.

There are many ways an organization can monitor its internal control system. To be most effective, both continuous and periodic monitoring should take place. As managers carry out their regular duties of examining reports, they are performing a type of continuous monitoring. Management should notice major weaknesses or breakdowns in internal controls as they accomplish their duties. In computerized systems, there may be continuous monitoring within the system itself. That is, the computerized accounting system may include modules within the software that review the system on an ongoing basis. In addition, some monitoring, such as internal and external audits, occurs on a regular periodic basis. These audits include examinations of the effectiveness of internal controls. As weaknesses or problems are uncovered through continuous and periodic monitoring, these issues must be reported to management to allow for appropriate evaluation and correction.

All five internal control components prescribed by the COSO report are necessary for the establishment and maintenance of a capable system of internal controls. The control environment, risk assessment procedures, control activities, information and communication processes, and ongoing monitoring of the system each play a part in strengthening the overall system. There is an old saying that a chain is only as strong as its weakest link. This is also true of the five components of internal control. If any one of the five is weak, the entire system of internal controls will be weak. Much as the links of a chain work together, these components work together to make an effective control system.

## **Reasonable Assurance of Internal Controls**

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A company that is well managed will maintain a good system of internal controls because to do so makes good business sense. An appropriate internal control system can help an organization achieve its objectives. However, there are limits to what an internal control system can accomplish. Internal controls provide reasonable assurance of meeting the control objectives. **Reasonable assurance** means that the controls achieve a sensible balance of reducing risk when compared with the cost of the control. It is not possible for an internal control system to provide absolute assurance, because there are factors that limit the effectiveness of controls, such as the following:

1. Flawed judgments are applied in decision making.
2. Human error exists in every organization.
3. Controls can be circumvented or ignored.
4. Controls may not be cost beneficial.

No matter how well an internal control system is designed, it is limited by the fact that humans sometimes make erroneous judgments and simple errors or mistakes. Even when a person has good intentions, an error in judgment or a mistake, such as simply forgetting to do a step that provides an internal control, can cause harm.

For example, it would be easy for a supervisor to simply forget to sign time cards for a particular pay period.

Another limit to the effectiveness of internal controls is that they can be circumvented. One way to circumvent internal controls is through collusion. Two people working together can thwart internal control procedures. For example, assume that one employee prepares time cards and a second employee distributes paychecks. Working alone, the first employee cannot easily make up a fake employee, submit a fake time card, and get access to the resulting paycheck. But if these two employees agree to work together and split the resulting paycheck, it would be very difficult to prevent. In this example, collusion negates the control effect of segregation of duties.

For every control procedure that an organization considers using, the benefits must outweigh the costs. Benefits can be measured by the positive effect the control has. If a control reduces the chance of errors, then an assessment could be made of the savings that would result from lower errors. The cost of the control procedure can be monetary or measured in terms of reduced operating efficiency. For example, a control procedure that requires all purchase transactions of any size to be approved by the CEO would dramatically slow the pace of purchasing. The CEO's desk would become a bottleneck of purchase requests waiting to be approved. This approval procedure would not be cost-effective. However, it may be cost-effective to have the CEO approve only those purchases involving very large dollar amounts, or highly unusual orders. Before adoption, every control procedure should be analyzed to be sure that it results in benefits that exceed the costs of implementing and maintaining the control.

## Maintenance of Information Technology Controls (Study Objective 11)

Over time, the cost of computer hardware and software has dramatically decreased, while computing power has vastly increased. This means that today most small companies can afford to maintain computerized accounting systems, while larger companies place even greater reliance on computer-based systems. Information technology plays such an important role in organizations that any failure in these systems can halt such ongoing operations as sales, manufacturing, or purchasing. IT systems have become the lifeblood of operations for most companies.

There is a paradox in this increased use of information technology. Computerized systems increase the efficiency and effectiveness of the organizations that use them; but at the same time, they increase vulnerability. The more that an organization relies on information technology, the greater the risks are, including unauthorized access, hackers, business interruption, and data inaccuracies. These extra risks call attention to the need for internal controls over and above those described in the COSO report.

In response to this need, the Information Systems Audit and Control Association (ISACA) developed an extensive framework of information technology controls, entitled **COBIT**, for Control Objectives for Information Technology.<sup>9</sup> COBIT is extremely important guidance for those who design or audit IT systems. The AICPA and the Canadian Institute of Chartered Accountants have jointly developed IT

<sup>9</sup> COBIT 4.1, IT Governance Institute, Rolling Meadows, IL, 2007.

control guidelines, related to COBIT, commonly referred to as the Trust Service Principles.<sup>10</sup> This guidance addresses risks and opportunities of information technology, and the most recent version became effective in 2006. The **Trust Services Principles** set forth guidance for CPAs who provide assurance services for organizations. Many types of work performed by CPAs can be called assurance services, but the specific types covered by the Trust Services Principles are Trust Services, SysTrust®, and WebTrust®. For these services, a CPA firm is hired to examine the company's IT and Web-based systems and to issue an opinion and recommendations about the security, availability, processing integrity, privacy, and confidentiality of the systems. Hence, the Trust Services Principles describe the type of IT controls that an IT auditor would expect to find in an audit of IT systems.

In the subsequent chapters of this text that include business processes and controls, the Trust Services Principles' internal control structure will be used as the context in which IT internal controls are described. For any business process, there should be both accounting internal controls as in COSO, and IT controls as in the Trust Services Principles. The following section describes the Trust Services Principles.

Risk and controls in IT are divided into five categories in the Trust Services Principles, as follows:

1. **Security.** The risk related to security is unauthorized access, which may be both physical access and logical access. An example of unauthorized physical access would be a person breaking into the computer room and damaging computer equipment. An example of logical access would be an unauthorized hacker stealing data such as credit card numbers. Internal controls must be designed and implemented to limit both types of unauthorized access.
2. **Availability.** The risk related to availability is system or subsystem failure due to hardware or software problems. An example of a risk that can cause interruptions to the system would be a virus that causes the system to slow down or fail. Internal controls can be implemented to limit the chances of failure and thereby help improve availability of the system to process information and support ongoing business.
3. **Processing integrity.** The risk related to processing integrity could be inaccurate, incomplete, or improperly authorized information. An example of this type of risk would be an error in entering hours worked for a worker's pay. The person keying hours worked into the payroll software might accidentally type an incorrect number of hours. Controls should be implemented to reduce erroneous, incomplete, or unauthorized transactions or data.
4. **Online privacy.** The risk in this area is that personal information about customers may be used inappropriately or accessed by those either inside or outside the company. An example is the theft of credit card numbers when orders are placed through the company website. Internal controls should be implemented to limit the chance of personal information being misused.
5. **Confidentiality.** The risk related to confidentiality is that confidential information about the company or its business partners may be subject to unauthorized access during its transmission or storage in the IT system. Examples of confidential information are banking information and price lists. Most

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<sup>10</sup> Trust Services, Principles, Criteria and Illustrations, American Institute of Certified Public Accountants, Inc. and Canadian Institute of Chartered Accountants, 2009 ([www.aicpa.org](http://www.aicpa.org)).

companies do not wish to allow their bank account numbers or price lists to be available to competitors or other external parties. Controls can be implemented to limit unauthorized access to confidential information.

When IT controls are being considered, it is important to understand the nature of the risks so that the controls can be designed and used to limit these risks. As in the case of COSO accounting controls, any IT control implemented should have benefits that exceed the costs of the control. As the risks and controls are described, many controls can be effective in several of the five categories. For example, the use of a password when a user logs in should be of assistance in limiting risks related to security, availability, processing integrity, privacy, and confidentiality. That is, the use of passwords helps limit unauthorized access that could result in security problems (security), theft of private or confidential data (privacy and confidentiality), unauthorized transactions being processed (processing integrity), and hacking that interrupts system processing (availability). The next chapter describes risks and controls in the first four categories: security, availability, processing integrity, and confidentiality. Because privacy is more closely related to e-commerce, it is discussed in the chapter on e-business and e-commerce, later in the text.

## The Sarbanes-Oxley Act of 2002 (Study Objective 12)

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The Sarbanes-Oxley Act was signed into law on July 30, 2002, for the purpose of improving financial reporting and reinforcing the importance of corporate ethics. The legislation was enacted in an effort to curb the corruption and accounting blunders that had been recently discovered in connection with the bankruptcies of such corporate giants as Enron and WorldCom. In these cases, many Americans suffered tremendously as the values of stock prices and employee retirement plans plunged. It became apparent that change was needed to improve investor faith in America's financial reporting systems.

The Sarbanes-Oxley Act ("the Act") applies to public companies and the auditors of public companies. In order to carry out the provisions of the Act, the Public Company Accounting Oversight Board (PCAOB) was established. The PCAOB comprises five members who are appointed by the SEC. The PCAOB governs the work of auditors of public companies by providing standards related to quality controls. The PCAOB has investigative and disciplinary authority over the performance of public accounting firms. The Act includes 11 "titles," or categories of provisions. Each title includes several sections. Two of those titles are critically important regarding the topics of this chapter, Sections 404 and 406.

### **Section 404—Management Assessment of Internal Controls**

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An internal control report is required to accompany each financial statement filing. The internal control report must establish management's responsibility for the company's internal controls and related financial reporting systems. It must also include an assessment of the effectiveness of the company's internal controls and related financial reporting systems. If there are any weaknesses in internal controls, they must be disclosed in this report.

The SEC defines internal controls over financial reporting as a process that is the responsibility of the company CEO and CFO, to provide reasonable assurance that the financial reporting systems are reliable. A reliable system of internal controls must include policies and procedures to provide reasonable assurance that

- detailed records accurately reflect the underlying transactions
- transactions are recorded in accordance with generally accepted accounting principles
- transactions are being carried out only in accordance with management's authorization
- unauthorized transactions are being prevented or detected

Management's internal control evaluation must be based on a recognized framework. The framework that is used by most U.S. companies is COSO's Internal Control-Integrated Framework. Again, notice that these provisions of the Sarbanes-Oxley Act require establishment of the internal controls described in this chapter and in Chapter 4.

In addition to management's increased responsibility regarding internal controls, there are also legal requirements for the auditors of public companies regarding the internal control structure of their clients. As part of their audit procedures, auditors must attest to the internal control effectiveness. This means that an auditor's report on the overall fairness of financial statements must include a statement regarding the effectiveness of the company's controls over financial reporting.

## **Section 406—Code of Ethics for Senior Financial Officers**

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The Act requires all public companies to have in place a code of ethics covering its CFO and other key accounting officers. The code must include principles that advocate honesty and moral conduct, fairness in financial reporting, and compliance with applicable governmental rules and regulations.

The immediate impact of these two sections of the Sarbanes-Oxley Act was to require all publicly traded companies to maintain internal control systems and a code of ethics. The top management of the companies can be held legally responsible to maintain, evaluate, and enforce good internal control systems and a code of ethics. Managers are required to produce an internal control report in each annual report that they provide the Securities and Exchange Commission, and that report must include an assessment of the effectiveness of the internal control structure.

The secondary effect of these Sarbanes-Oxley requirements was that it put pressure on other companies and organizations that are not publicly traded to maintain internal controls and a code of ethics. Auditors are reluctant to keep audit clients that do not follow Sarbanes-Oxley rules even if those companies are not legally required to do so by Sarbanes-Oxley Act. Thus the necessity to maintain good internal control structures and a code of ethics has dramatically increased because of the Sarbanes-Oxley Act.

## **Summary of Study Objectives**

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**An introduction to the need for a code of ethics and internal controls.** Managers of organizations are entrusted with the assets and funds of their organizations; therefore, they have an ethical duty to appropriately protect and use those assets and funds.

As stewards of assets and funds, managers must ensure that policies and procedures are in place to provide protection and to accurately record and report the flow and use of assets and funds. Codes of ethics and strong systems of internal control are important parts of these policies and procedures. Properly enforced codes of ethics and internal controls can establish an operating environment that discourages fraud and errors.

**The accounting-related fraud that can occur when ethics codes and internal controls are weak or not correctly applied.** In organizations where codes of ethics are not enforced or when proper controls are not correctly applied, fraud and errors are much more likely to occur. There are many kinds of fraud that can occur, including management fraud, employee fraud, customer fraud, and vendor fraud.

**The nature of management fraud.** Management fraud is conducted by upper-level managers and usually involves fraudulent financial statements. Managers are above the level of most internal controls; therefore, internal controls are usually not effective in preventing or detecting management fraud.

**The nature of employee fraud.** Employee fraud is conducted by non-management employees and usually involves theft or misuse of assets. Internal accounting controls such as the five components of internal control in COSO are intended to assist in the prevention or detection of employee fraud.

**The nature of customer fraud.** Customer fraud occurs when customers engage in credit card fraud, check fraud, or refund fraud. Internal controls can assist in the prevention or detection of some customer fraud.

**The nature of vendor fraud.** Vendor fraud is usually conducted by vendors requesting fictitious or duplicate payments. Internal controls can assist in the prevention or detection of some vendor fraud.

**The nature of computer fraud.** Computers can be used internally or by those outside the organization as a tool to conduct such fraud as manipulating transactions or data, and hacking or other network break-ins. Internal controls and IT controls can assist in the prevention or detection of computer fraud.

**The policies that assist in the avoidance of fraud and errors.** There are three sets of policies that an organization can institute to help prevent or detect fraud, errors, and ethical violations: implementation and maintenance of a code of ethics, accounting internal controls, and IT controls.

**The maintenance of a code of ethics.** When management is unethical, fraud is likely to occur. On the other hand, if the top management of a company emphasizes ethical behavior, models ethical behavior, and hires ethical employees, the chance of fraud or ethical lapses can be reduced. Maintaining and enforcing a code of ethics helps reduce unethical behavior in an organization.

**The maintenance of accounting internal controls.** The components of accounting internal controls are defined by the COSO report as the control environment, risk assessment, control activities, information and communication, and monitoring. Control activities include authorization, segregation of duties, adequate record keeping, security over assets and records, and independent verifications.

**The maintenance of information technology controls.** IT controls can be categorized as designated within the AICPA's Trust Services Principles. The risk categories are security, availability, processing integrity, online privacy, and confidentiality.

**The internal control requirements of the Sarbanes–Oxley Act.** While there are several requirements in the Act, Section 404 requires publicly traded companies to establish and maintain an effective internal control system. It also requires management to assess and monitor the internal control system and in the yearly financial report, management must report on the effectiveness of the company's internal controls and related financial reporting systems. If there are any weaknesses in internal controls, they must be disclosed in this report.

## Key Terms

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Audit trail	Defalcation	Internal controls	Salami technique
Authorization	Denial of service attack	Internal theft	Sarbanes–Oxley Act
Availability	Detective controls	IT resources	Security
Batch totals	Earnings management	Kickbacks	Segregation of duties
Check fraud	Employee fraud	Larceny	Skimming
COBIT	Foreign Corrupt Practices Act	Management fraud	Software piracy
Code of ethics	Fraud	Management override	Specific authorization
Collusion	Fraud triangle	Misappropriation of assets	Spoofing
Compensating control	Fraudulent financial reporting	Misstatement of financial records	Stewardship
Computer fraud	General authorization	Monitoring	Trap door alteration
Confidentiality	Hacking	Preventive controls	Trojan horse program
Control activities	Independent checks	Privacy	Trust Services Principles
Control environment	Industrial espionage	Processing integrity	Vendor audit
Corrective controls	Information and communication	Reasonable assurance	Vendor fraud
COSO	Information criteria	Reconciliation	
Cost–benefit		Refund fraud	
Credit card fraud		Risk assessment	
Customer fraud			

## End of Chapter Material

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### Concept Check

-  1 The careful and responsible oversight and use of the assets entrusted to Management is called
- the control environment
  - stewardship
  - preventive controls
  - security
- 2 Which of the following is **not** a condition in the fraud triangle?
- Rationalization
  - Incentive
  - Conversion
  - Opportunity

- 3 There are many possible indirect benefits to management when management fraud occurs. Which of the following is **not** an indirect benefit of management fraud?
- Delayed exercise of stock options
  - Delayed cash flow problems
  - Enhanced promotion opportunities
  - Increased incentive-based compensation
- 4 Which of the following is **not** an example of employee fraud?
- Skimming
  - Larceny
  - Kickbacks
  - Earnings management

- 5 Which of the following is **not** a common form of employee fraud?
- Inventory theft
  - Expense account fraud
  - Payroll fraud
  - Refund fraud
- 6 Segregation of duties is a fundamental concept in an effective system of internal controls. Nevertheless, the effectiveness of this control can be compromised through which situation?
- A lack of employee training
  - Collusion among employees
  - Irregular employee reviews
  - The absence of an internal audit function
- 7 The most difficult type of misstatement to discover is fraud that is concealed by
- over-recording the transactions
  - nonrecorded transactions
  - recording the transactions in subsidiary records
  - related parties
- 8 The review of amounts charged to the company from a seller that it purchased from is called a
- vendor audit
  - seller review
  - collusion
  - customer review
- 9 Which of the following is generally an external computer fraud, rather than an internal computer fraud?
- Spoofing
  - Input manipulation
  - Program manipulation
  - Output manipulation
- 10 Which control activity is intended to serve as a method to confirm the accuracy or completeness of data in the accounting system?
- Authorization
  - Segregation of duties
  - Security of assets
  - Independent checks and reconciliations
- 11 COSO describes five components of internal control. Which of the following terms is best described as “policies and procedures that help ensure management directives are carried out and management objectives are achieved”?
- Risk assessment
  - Information and communication
  - Control activities
  - Control environment
- 12 Proper segregation of duties calls for separation of the functions of
- authorization, execution, and payment
  - authorization, recording, and custody
  - custody, execution, and reporting
  - authorization, payment, and recording
- 13 The AICPA Trust Services Principles identify five categories of risks and controls. Which category is best described by the statement, “Information processes could be inaccurate, incomplete, or not properly authorized”?
- Security
  - Availability
  - Processing integrity
  - Confidentiality
- 14 A company’s cash custody function should be separated from the related cash recordkeeping function in order to
- physically safeguard the cash
  - establish accountability for the cash
  - prevent the payment of cash disbursements from cash receipts
  - minimize opportunities for misappropriations of cash
- ### Discussion Questions
- 15 (SO 1) Management is held accountable to various parties, both internal and external to the business organization. To whom does management have a stewardship obligation and to whom does it have reporting responsibilities?
- 16 (SO 2, SO 4) If an employee made a mistake that resulted in loss of company funds and misstated financial reports, would the employee be guilty of fraud? Discuss.
- 17 (SO 2, SO 3) Do you think it is possible that a business manager may perpetrate fraud and still have the company’s best interest in mind? Discuss.
- 18 (SO 7) Distinguish between internal and external sources of computer fraud.
- 19 (SO 7) Identify and explain the three types of internal source computer fraud.
- 20 (SO 7) Describe three popular program manipulation techniques.
- 21 (SO 7) Distinguish between Internet spoofing and e-mail spoofing.
- 22 (SO 10) What are the *objectives* of a system of internal control?

- 23 (SO 10) Name and distinguish among the three *types* of internal controls.
- 24 (SO 10) Identify the COSO report's five interrelated *components* of internal controls.
- 25 (SO 10) Name the COSO report's five internal control *activities*.
- 26 (SO 10) Distinguish between general and specific authorization.
- 27 (SO 10) Due to cost/benefit considerations, many business organizations are unable to achieve complete segregation of duties. What else could they do to minimize risks?
- 28 (SO 10) Why is a policies and procedures manual considered an element of internal control?
- 29 (SO 10) Why does a company need to be concerned with controlling access to its records?
- 30 (SO 10) Many companies have mandatory vacation and periodic job rotation policies. Discuss how these practices can be useful in strengthening internal controls.
- 31 (SO 10) Name the objectives of an effective accounting system.
- 32 (SO 10) What does it mean when information flows "down, across, and up the organization"?
- 33 (SO 10) Provide examples of continuous monitoring and periodic monitoring.
- 34 (SO 10) What are the factors that limit the effectiveness of internal controls?
- 35 (SO 11) Identify and describe the five categories of the AICPA Trust Services Principles.
- 36 (SO 11) Distinguish between the Trust Services Principles of privacy and confidentiality.
- 37 (SO 12) What does section 404 of the Sarbanes-Oxley Act require of management regarding internal control systems?
- Brief Exercises**
- 38 (SO 2, SO 3) What possible motivation might a business manager have for perpetrating fraud?
- 39 (SO 5) Discuss whether any of the following can be examples of customer fraud:
- An employee billed a customer twice for the same transaction.
  - A customer remitted payment in the wrong amount.
  - A customer received merchandise in error, but failed to return it or notify the sender.
- 40 (SO 7) Explain the relationship between computer hacking and industrial espionage. Give a few additional examples of how hacking could cause damage in a business.
- 41 (SO 9) What are some ways a business could promote its code of ethics?
- 42 (SO 10) Describe why the control environment is regarded as the foundation of a business's system of internal control.
- 43 (SO 10) Think of a job you have held, and consider whether the control environment was risky or conservative. Describe which you chose and why.
- 44 (SO 10) Identify the steps involved in risk assessment. Do you think it would be effective for an organization to hire external consultants to develop its risk assessment plan? Why, or why not?
- 45 (SO 10, SO 11) Discuss the accuracy of the following statements regarding internal control:
- The more computerized applications exist within a company's accounting system, the lower the risk will be that fraud or errors will occur.
  - The more involved top management is in the day-to-day operations of the business, the lower the risk will be that fraud or errors will occur.
- 46 (SO 12) Read a summary of an academic study of section 404 of the Sarbanes-Oxley Act at the following website: <http://merrilldisclosuresolutions.org/2015/10/07/sarbanes-oxley-section-404-on-internal-control-reporting-might-not-pack-a-punch/>

Discuss the effectiveness of the SEC enforcement of this section.

## Problems

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- 47 (SO 10) Identify whether each of the following accounting positions or duties involves authorization, recording, or custody:
- Cashier
  - Payroll processor
  - Credit manager
  - Mailroom clerk
  - Data entry clerk
  - Deliver paychecks
  - Deliver the bank deposit
  - Prepare the bank reconciliation
  - Check signer
  - Inventory warehouse supervisor
  - Staff accountant

- 48** (SO 10) Identify whether each of the following activities represents preventive controls, detective controls, or corrective controls:
- Job rotation
  - Preparation of a bank reconciliation
  - Segregation of duties
  - Recalculating totals on computer reports
  - Use of passwords
  - Preparing batch totals for check processing
  - Establishing a code of ethics
  - Use of a security guard
  - Verifying source documents before recording transactions
  - Matching supporting documents before paying an invoice
  - Independent review of accounting reports
  - Performing comparisons of financial statement items
- 49** (SO 10) Shown are a list of selected sources of internal control guidelines, given in order of issuance, followed by a list of primary purposes. Match each guideline with its primary purpose.
- I. Foreign Corrupt Practices Act
  - II. COSO
  - III. SAS 99
  - IV. Sarbanes–Oxley Act
  - V. Trust Services Principles
- a. Required auditors to focus on risks and controls and to conduct audits with skepticism
  - b. Prevented bribery and established internal control guidelines
  - c. Curbed fraud by requiring additional internal control reporting within annual reports
  - d. Established internal control concepts based on comprehensive study
  - e. Established essential criteria for evaluating reliability of business systems
- 50** (SO 1, 3, 10) Using a search engine on the Internet, find articles or descriptions of the collapse of Enron. The collapse began in November 2001, and many articles appeared over the next two to three years.
- Required:**
- a. Briefly describe the fraud that occurred.
  - b. Discuss what you see as weaknesses in the control environment.
- 51** (SO 3) Using a search engine on the Internet, search for articles on fraud that occurred in 2000 to 2002 in the following companies:
- Adelphia  
Enron  
Global Crossing  
WorldCom  
Xerox
- Try to locate articles or information about stock prices, how the fraud was conducted. You might wish to look at the following websites: edgar.sec.gov, www.hoovers.com, www.forbes.com.
- Required:**
- a. Find information to help you complete the table at the bottom of the page.
  - b. Discuss the common characteristics that you see in each of the examples given in the table at the bottom of the page.
- 52** (SO 3) Using a search engine, search for articles on the following two companies, which were paying bribes in foreign countries: Siemens and Johnson & Johnson. The settlements were in 2011. For each company, describe
- a. How it was discovered
  - b. The end result of the investigation
  - c. What you think the company might have done to prevent this, or lessen the impact
  - d. What you learned about the Foreign Corrupt Practices Act

Company Name	Brief Description of Fraud	Position of Those Conducting Fraud	Stock Price When Fraud Was Uncovered	Stock Price One Year Later	Shares Outstanding	Loss to Investors
Adelphia						
Enron						
Global Crossing						
WorldCom						
Xerox						

## Cases

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**53** At the old city hall, mail was sorted in a glorified closet—not the sort of place you'd expect to be frequented by a high-ranking city official with multiple degrees. However, the city of Weston's chief financial officer, Steve Kaufmann, had an unusual interest in the mail. He was often known to greet the postal carrier at the door to receive the day's delivery, take it to the mail closet, then immediately remove selected envelopes and parcels and take them to the privacy of his own office. Other times, he would request hand delivery of incoming payments, circumventing the mail closet altogether.

These activities were part of an elaborate embezzlement scheme that resulted in the loss of millions of dollars for the city. Mr. Kaufmann was intercepting checks written to the city and endorsing them to his personal bank account.

The procedural manual for Weston's accounting department described mailroom policies, including the requirement for a clerk to log checks into a computer file and prepare a receipt. Another employee was responsible for preparing an independent verification of the amount of the receipts, and a third employee made the bank deposit. Despite these written guidelines, Mr. Kaufmann was often known to carry out some of these tasks himself, or to claim to be doing so.

In response to the news of this fraud, the CFO of a neighboring community commented that many cities are unable to achieve strong internal controls because of the limitations of small staff size and tight operating budgets. Rather, small cities often have no choice but to rely on the integrity of their employees.

**Required:**

- a. Which internal control activity was violated in order for Mr. Kaufmann to perpetrate this fraud?
- b. Do you consider this case to be an example of management fraud or employee fraud?
- c. Was the city's procedural manual adequate for prescribing internal controls to prevent this type of fraud? Why, or why not?
- d. Why do you think no one reported the unusual mailroom practices of Mr. Kaufmann? To whom would such a violation be reported?
- e. Do you think a business in Weston could be guilty of customer fraud if it agreed to deliver its payments to Mr. Kaufmann personally rather than send them to the city's mailing address?
- f. The comments made by the neighbor CFO express which type of limitation of internal control systems discussed in this chapter?

**54** The following description is excerpted from "Coupon Accounting Abuse," *Management Accounting*, January 1993, p. 47.



It's November 15, and Gary, brand manager for a major consumer products firm, is contemplating his year-end bonus. It is becoming increasingly obvious that unless he takes action, he will not achieve his brand profitability target for the year. Gary's eyes fall to the expense estimate for the new coupon "drop" slated for later in the month. His hand trembles slightly as he erases the 4 percent anticipated redemption rate on his estimate sheet and replaces the figure with 2 percent. Gary knows from experience that 2 percent is an unrealistically low figure, but he also knows that neither the firm's independent nor internal auditors will seriously challenge the estimate. This way, Gary's product profitability report will reflect the increased revenue associated with the coupon "drop" this year, but the entire redemption cost will not be expressed until next year.

"That should put me over," he muses. A wry smile crosses his face. "If the auditors question the rate, I'll give them a story about seasonality and shifting consumer patterns. They won't know enough about marketing to question my story." Eventually, of course, the real cost of the coupon drop will have to be expensed, and that will hurt next year's profit figure. "But, that's next year," Gary reasons, "and I can always figure out a way to make it up. Besides, by the end of next quarter, I'll be handling a bigger brand—if I can show a good profit this year."

A brief description of coupons and proper accounting for coupons might help us to interpret the situation just presented. Coupons are "cents-off" privileges, such as \$0.50 off when you buy a certain brand of yogurt. When a company offers coupons to consumers, it must estimate the redemption rate and record an expense and the corresponding liability. This is similar in concept to warranty expenses.

**Required:**

- a. Discuss whether the situation described can happen to a company with a good control environment.
- b. Describe any steps a company could take to prevent such abuse.
- c. List those parties who might be harmed by this situation.
- d. Do you consider this example to be management fraud or employee fraud? Describe how it fits the definition of your choice.



- 55** The CEO of Missouri Motor Company, Jason Bell, resigned on November 1, 2014. His resignation had been negotiated with the Board of Directors of Missouri Motor after it was revealed that Mr. Bell violated the company's corporate ethics policy by having an affair with a subordinate employee. The policy forbids intimate relationships with anyone who "works through his or her management chain." This resignation essentially forced him into early retirement.

During the next year, the College of Business at Mountain State University hired Mr. Bell as a part-time instructor to teach business strategy courses. The dean of the college suggested that the relationship was a personal matter and that Mr. Bell's wealth of experience is beneficial to students. Some who supported the hiring pointed out that other faculty members are not questioned about their personal lives. Others suggested that since management ethics is so important, someone who violated a company ethics policy should not be teaching students about the proper management of organizations.

**Required:**

- a. Discuss whether Mr. Bell's violation of corporate ethics policy affects or reflects the control environment of the company.
- b. Since the violation is personal in nature, should Mr. Bell have been forced to resign?
- c. Should Mountain State have hired him to teach business strategy courses?



- 56** Lynn Roberts frequently makes purchases from mail-order catalogs. Recently, she ordered a dress she intended to wear to her cousin's wedding. Unfortunately, she did not receive the package on time, and on the evening before the wedding, Lynn went shopping and purchased another outfit at a local dress shop.

Lynn's neighbor, Jake, actually received the mail order package intended for Lynn. Because Jake had been out of town last week, he had not had the chance to promptly bring the package to Lynn's house. Even though the box correctly showed Lynn's name and address, it appears that the carrier merely left the package on the doorstep of the wrong house.

Disgusted with this chain of events, Lynn decided to claim that she had never received the package. After all, she was not able to wear the dress for its intended purposes; she should not have to pay for it. Moreover, the carrier was not able to provide proof of delivery.

**Required:**

- a. Discuss which type of fraud is involved in this case, from the perspective of the mail order company.
- b. Which of the AICPA Trust Services Principles most closely relates to this situation?
- c. Describe a preventive control that could be performed by the carrier to avoid the possible recurrence of this type of fraud.

- 57** Cody Chambers agreed to help his fraternity obtain sponsors for its annual charitable event to be held during Homecoming week. He accepted this responsibility at the recommendation of last year's fund-raiser, who told Cody that the task would require approximately 10 hours of time and would likely result in total sponsorships of \$1,000.



After spending approximately 10 hours calling on previous sponsors, Cody felt that he had hit a brick wall. For many reasons, most of last year's sponsors were unwilling to continue their involvement with this annual fund-raiser. Cody needed to look for additional sources of funding. He spent several hours researching potential new contributors and finally located a database containing a list of businesses within the local zip code. Since the list included e-mail addresses, Cody developed a letter of request and e-mailed it to all these businesses.

The response was overwhelming. Cody collected over \$3,000 from this new pool of business contacts. While compiling the checks received to turn over to the fraternity treasurer, Cody noticed that one business had made its \$200 check payable to Cody personally.

Rationalizing that the additional time he had spent on the project and the success he was able to achieve were worthy of compensation, Cody decided to keep this one check. He wrote a letter of acknowledgment to the donor and deposited the \$200 in his personal account.

**Required:**

- a. Do you think Cody's actions were justified? What would you have advised him to do in this situation?
- b. What internal control activities could the fraternity have implemented in order to prevent Cody's actions?
- c. Can you think of a detective control that could uncover the omission of the \$200 check?

## Solutions to Concept Check

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- 1 (SO 1) The careful and responsible oversight and use of the assets entrusted to management is called **b. stewardship**.
- 2 (SO 2) **c. Conversion** is **not** a condition in the fraud triangle. Incentive, opportunity, and rationalization make up the fraud triangle.
- 3 (SO 3) **a. Delayed exercise of stock options** is **not** an indirect benefit of management fraud. When managers conduct fraud, they are expecting indirect benefits such as delayed cash flow problems, enhanced promotion opportunities, and increased compensation. However, delaying stock option exercise is not a benefit.
- 4 (SO 4) **d. Earnings management** is **not** an example of employee fraud. Earnings management is a type of management fraud. The other answers are examples of employee fraud.
- 5 (SO 4) **d. Refund fraud** is **not** a common form of employee fraud. Refund fraud is a form of customer fraud, not employee fraud.
- 6 (CMA Adapted) (SO 4) Segregation of duties is a fundamental concept in an effective system of internal controls. Nevertheless, the effectiveness of this control can be compromised through **b. collusion among employees**. When employees who perform segregated duties work together, they can circumvent controls and perpetrate fraud.
- 7 (CPA Adapted) (SO 4) The most difficult type of misstatement to discover is fraud that is concealed by **b. nonrecorded transactions**. If there is no record of the fraud, it is especially difficult to detect.
- 8 (SO 6) The review of amounts charged to the company from a seller that it purchased from is called a **a. vendor audit**. A vendor audit involves the examination of vendor records in support of amounts charged to the company. Since many vendor contracts involve reimbursement for labor hours and other expenses incurred, the company can review supporting documentation for these expenses incurred by its vendor.
- 9 (SO 7) **a. Spoofing** is generally an external computer fraud, rather than an internal computer fraud. Spoofing occurs when a person, through a computer system, pretends to be someone else. Internet spoofing is the most dangerous to the accounting and control system.
- 10 (SO 10) The control activity intended to serve as a method to confirm the accuracy or completeness of data in the accounting system is **d. independent checks and reconciliations**. Independent checks and reconciliations on performance are important aspects of control activities. They usually involve the reconciliation, or comparison, of two sets of records, such as a bank reconciliation's comparison of the bank statement with the company's cash records.
- 11 (SO 10) COSO describes five components of internal control. **c. "Control activities"** is the term that is best described as "policies and procedures that help ensure management directives are carried out and management objectives are achieved." Control activities involve authorization, segregation, security of assets and records, adequate documentation, and independent checks. Policies and procedures of the organization establish the appropriate authorizations, segregations, security of assets and records, adequate documentation, and independent checks.
- 12 (CPA Adapted) (SO 10) Proper segregation of duties calls for separation of the functions of **b. authorization, recording, and custody**.
- 13 (SO 11) AICPA Trust Services Principles identify five categories of risks and controls. **c. Processing integrity** is the category best described by the statement, "Information processes could be inaccurate, incomplete, or not properly authorized."
- 14 (CIA Adapted) (SO 2, 10) A company's cash custody function should be separated from the related cash recordkeeping function in order to **d. minimize opportunities for misappropriations of cash**. A lack of segregation of duties makes it possible for assets to be stolen, and the related records may be manipulated to conceal the theft.

## CHAPTER 4

# Internal Controls and Risks in IT Systems

### STUDY OBJECTIVES

This chapter will help you gain an understanding of the following concepts:

- 1.** An overview of internal controls for IT systems
- 2.** General controls for IT systems
- 3.** General controls from a Trust Services Principles perspective
- 4.** Hardware and software exposures in IT systems
- 5.** Application software and application controls
- 6.** Ethical issues in IT systems

### An Overview of Internal Controls for IT Systems (Study Objective 1)

The Real World example on the next page will help you understand the context of many concepts in this chapter. Please read that Real World example to begin effective reading and studying of this chapter. The Real World example provides several examples where internal controls for IT systems failed and confidential company and customer data was accessed.

For most organizations, computer systems are critical to ongoing operations. One of the critical functions within IT systems is the accounting information system. As described in Chapter 1, the accounting information system collects, processes, stores, and reports accounting information. IT systems have become so critical that organizations would hardly be able to operate if their IT systems were suddenly to fail. Since IT systems are such a crucial and valuable resource for account-

ing systems, you should learn and understand the types of threats to which they are vulnerable so that these threats can be minimized. As an analogy, when you park your car in a public garage, you give some thought to whether it is susceptible to theft or vandalism and take some precautions such as locking the door or turning on a car alarm. Likewise, it is important for you to consider possible threats to the IT system and to know how to implement controls to try to prevent those threats from becoming reality. Unchecked threats and risks can lead to events that interrupt or stop computer operations, which can be severely damaging to the organization. Not only can they stop or disrupt normal operations, but they can also lead to incorrect or incomplete accounting information. This chapter provides an overview of controls in IT systems, the risks that these controls are intended to reduce, and important hardware and software components of IT systems to which controls should be applied.

Knowledge about IT systems and the related risks and controls are important factors in gaining an understanding of business processes and the recording, summarizing, monitoring, and reporting of results. Later chapters will describe the usual

## The Real World



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On Christmas day in 2011, a loosely organized hacker group called Anonymous hacked into the U.S. data security firm Stratfor, based in Austin, Texas. A few days later, Anonymous revealed that it had collected 200 gigabytes of data from Stratfor, including clients' credit card numbers, e-mail addresses, passwords, and mailing addresses. It posted the credit card numbers of over 30,000 Stratfor clients.

In 2013, a hack of Target computers resulted in over 40 million credit and debit card numbers stolen. In 2014, Home Depot disclosed that hackers had used malware to access 56 million credit card and debit card data. In 2015, a data breach at Anthem caused 80 million customer and employee data to be exposed. Credit card information, social security numbers, and birth dates were all stolen.

These kinds of computer security threats continue even as companies try to prevent them. As of 2015, the average costs of cyber crime to large U.S. companies is \$15.42 million per year.

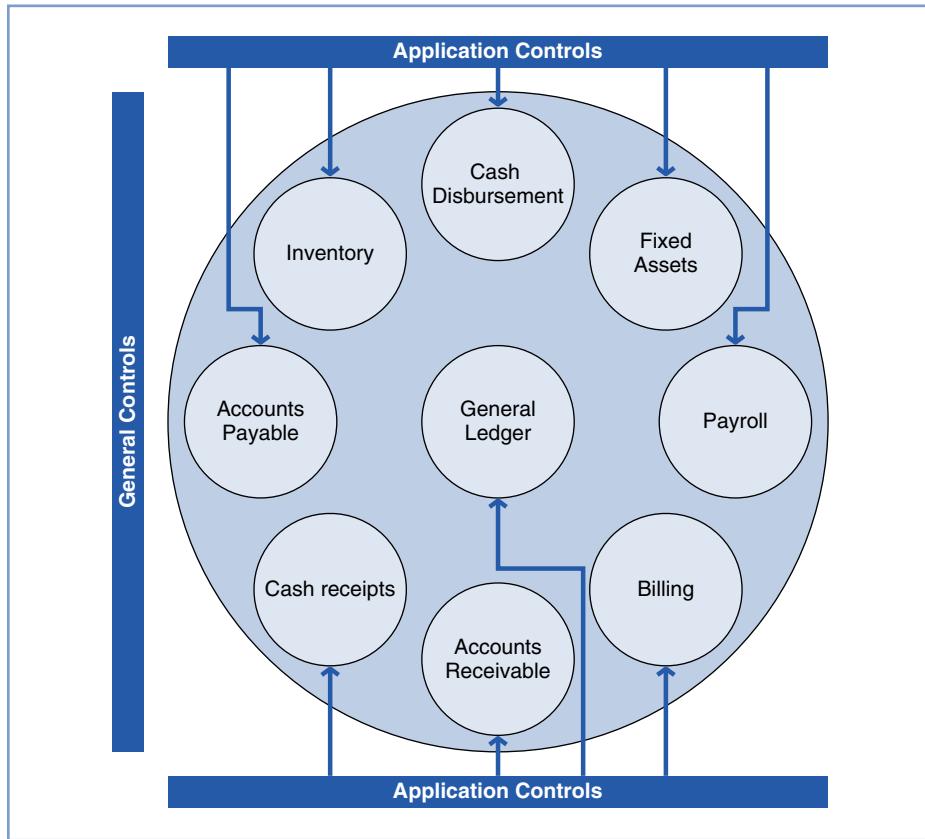
While it will never be possible to prevent all such computer network breaches, companies must implement proper controls to try to reduce the chance of computer security problems. Controls are necessary to protect company and customer data. This chapter describes the inherent risks in IT systems and the IT controls that should be implemented to reduce them.

business processes such as those involving revenues, expenditures, conversion, and administrative processes. The data resulting from these processes is usually recorded, monitored, and stored in IT systems. The material you learn in this chapter regarding risks and controls in IT hardware and software will prepare you to better understand the systems for revenue, expenditures, conversion, and administrative processes described in later chapters.

An important set of concepts in this chapter is the matching of controls to risks. To master risks and controls and how they fit together, three areas must be understood fully. The first area is the description of the general and application controls that should exist in IT systems. The second is the type and nature of risks in IT systems. Third and most important is the recognition of how these controls can be used to reduce the risks in IT systems. The fit of controls to risks is explained through the use of terminology, concepts, and the framework from the AICPA Trust Services Principles. The Trust Services Principles were briefly described in Chapter 3 and will be covered in more depth in this chapter.

From the early days of computer use in accounting, internal controls for computer-based systems have been described as being of two types: general controls and application controls. (See Exhibit 4-1.) **General controls** apply overall to the IT accounting system; they are not restricted to any particular accounting application. An example of a general control is the use of passwords to allow only authorized users to log in to an IT-based accounting system. Without regard to processing data in any specific application, passwords should be employed in the IT system.

**Application controls** are used specifically in accounting applications to control inputs, processing, and outputs. Application controls are intended to ensure that



**EXHIBIT 4-1** General and Application Controls in IT Systems

inputs and processing are accurate and complete and that outputs are properly distributed, controlled, and disposed. An example of an input application control is a **validity check**. Within a specific accounting application, such as payroll, the system can use programmed input controls to reduce input errors. For example, in Exhibit 4-2, the date of hire that was entered (02/30/2016) was invalid, since February does not have 30 days. A programmed input check called a validity check can examine the date and alert the user to an invalid entry. You can see the error message a Microsoft Dynamics GP user receives in Exhibit 4-2.

A larger set of application controls is described in detail in a later section of this chapter.

## General Controls for IT Systems (Study Objective 2)

The general controls described in this section are divided into five broad categories:

1. Authentication of users and limiting unauthorized access
2. Hacking and other network break-ins
3. Organizational structure
4. Physical environment and physical security of the system
5. Business continuity

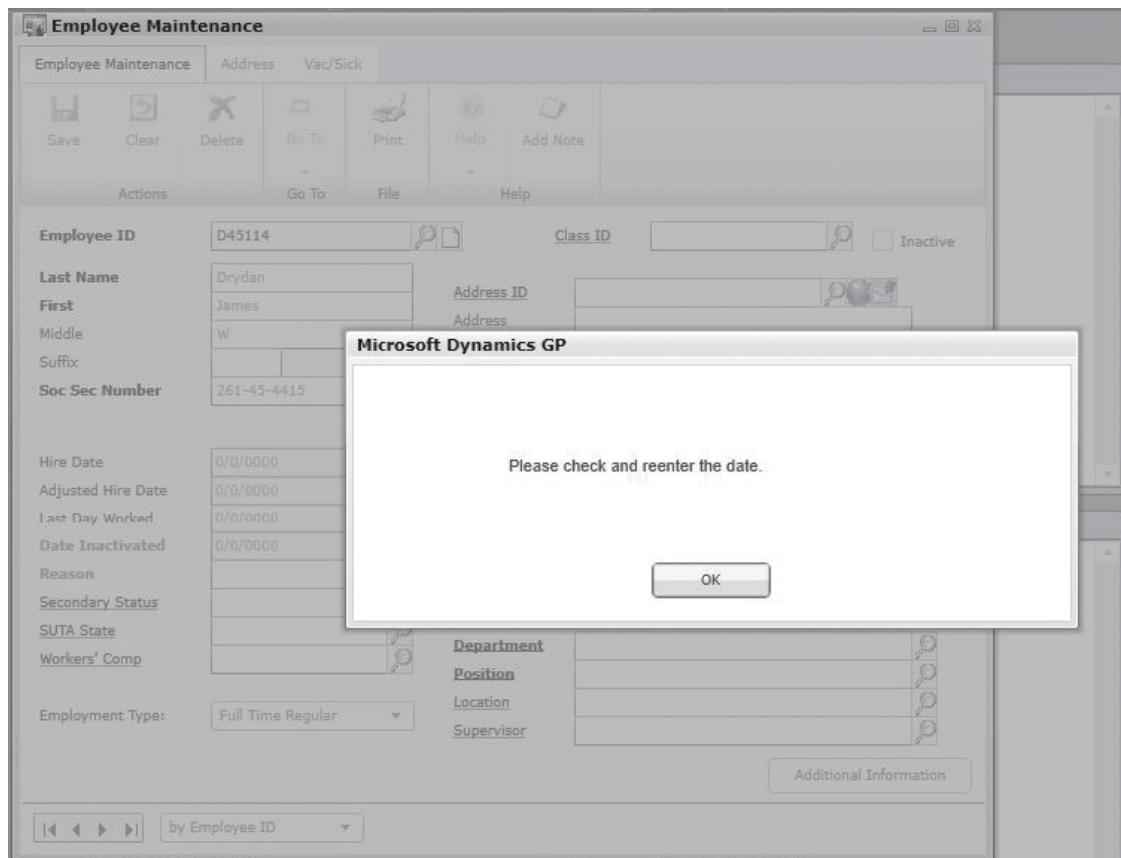


EXHIBIT 4-2 Validity Check—an Input Application Control

## Authentication of Users and Limiting Unauthorized Users

**Authentication of users** is a process or procedure in an IT system to ensure that the person accessing the IT system is a valid and authorized user. Unauthorized users trying to access IT systems is a prevalent, difficult, and ongoing problem that organizations must try to control. Unauthorized users may be hackers or people outside the organization, or users within the company trying to gain access to data they are not entitled to. In order to limit unauthorized access, there are many general controls that should be in place.

First, it is important to authenticate users as they attempt to access the IT system. Users may be authenticated in one or more of several ways. An IT system should require that users log in with a distinct user identification, or user ID, and password. **Log in** means to make the computer recognize you in order to create a connection at the beginning of a computer session. To increase the effectiveness of log-in restriction, **user IDs** must be unique for each user. A **password** is a secret set of characters that identifies the user as the authentic owner of that associated user ID. Passwords should be at least eight characters in length and contain at least one nonalphanumeric character. Such passwords would be difficult to guess. For example, a password such as xEq7f\$23 would be much more difficult to guess than the user's initials. Passwords should also be case-sensitive and changed every

90 days. The weak link in passwords is the human aspect. Many people have trouble remembering passwords, particularly if the password meets the strict criteria just mentioned. In addition, many people have several passwords for the different work and private systems they access. Therefore, some users write passwords down and keep them under the keyboard or in a drawer. This, of course, defeats the purpose of having passwords. Due to the weaknesses in passwords, some organizations use passwords in conjunction with other tools such as smart cards, tokens, and biometrics.

The use of passwords can be strengthened by the use of a **smart card** that the user carries. The smart card is plugged into the computer's card reader and helps authenticate that the user is valid. The smart card is a credit card-sized device with an integrated circuit that displays a constantly changing ID code. The user enters her password, and then the smart card displays an ID that she uses to log in. The smart card typically changes the user ID every 5 minutes or so.

A newer technology to authenticate users is a **security token**, which plugs into the USB port and thereby eliminates the need for a card reader. Otherwise, the purpose and use of the security token are the same as those of a smart card. Exhibit 4-3 shows the size and portability of a USB security token.

The use of smart cards or tokens can reduce unauthorized access, since the person who logs in must physically possess and use the smart card or token. The authentication of the user is called **two-factor authentication** because it is based on something the user has, the token, and something the user knows, the password. A hacker located several hundred miles away from the organization would not have access to the smart card or token.

The more recent version of two-factor authentication is the use of a smart phone app to create the second factor of authentication. When an authorized user logs in to a computer, a text to a smart phone includes a unique numeric code to enter to complete the log in. As an alternative, the smart phone app can be used for a "push" notification and approval. When the user attempts to log in to a computer, an approval "push" notification appears on the user's smart phone to approve or deny. The intent is to deny any push notification if it is not the user logging in, but to approve if the user is indeed trying to log in. In such cases, the smart phone becomes the second factor in two-factor authentication.



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**EXHIBIT 4-3** A USB Security Token

Biometric devices can also be used to authenticate users and limit unauthorized access. **Biometric devices** use some unique physical characteristic of the user to identify the user and allow the appropriate level of access to that user. Examples of physical characteristics being used in biometric devices are fingerprint matching, retina scans, voice verification, and face verification. Of these methods, fingerprint recognition is the most widely used technology. For example, it is possible to buy a mouse with a small window for your thumb or finger that scans the fingerprint to authenticate the user. Biometric devices are intended to allow only the authorized user to log in, according to his or her unique fingerprint, iris, voice, or facial features. Biometric devices are becoming more popular as their prices decrease and their reliability increases.

All of the methods described here are intended to limit log-ins exclusively to authorized users. However, none of these methods is foolproof, and it is important to have additional controls. First, all accesses should be logged. The organization should maintain a computer log of all log-ins. This log serves two purposes. The **computer log** is a complete record of all dates, times, and uses for each user. Any abnormalities in log-in or use can be examined in more detail to determine any weaknesses in log-in procedures. Also, the log-in procedures and logs establish nonrepudiation of users. **Nonrepudiation** means that a user cannot deny any particular act that he or she did on the IT system. That is, if a user logged in and changed data fraudulently, the log-in procedures and logs help establish undeniably which user took the action. Nonrepudiation is extremely important in verifying sales to customers. A danger is that a customer could log in via the company website, place an order that is subsequently received, and then deny that he or she initiated the transaction. Log-in of customers and computer logs help establish nonrepudiation of sales transactions.

The log-in procedure should also be established so that the session is terminated after three unsuccessful attempts and that these terminated sessions are also logged. Again, the purpose of the log is to allow proper follow-up if there are patterns of abnormal log-in or terminated log-ins. To maintain a record of log-in attempts, the system should keep an automated log to detect suspicious or unusual log-in attempts.

After a user logs in with valid authentication, the access granted in the IT system should be limited by the user profile. The **user profile**, which should be established for every authorized user, determines each user's access levels to hardware, software, and data according to the individual's job responsibilities. For example, an employee who enters payroll data does not need access to sales data, so this user's access to sales data should be restricted. In addition, the level of access must be established within the authority tables. An **authority table** contains a list of valid, authorized users and the access level granted to each one. For instance, one user within the payroll area may need to both read and write data, while another may need only read access. These user profiles may be defined in authority tables. Authority tables are an integral part of the computer system, and when a user logs in, the system looks up the nature and type of access to which that user is entitled. The authority table defines the type of access that a user has to data within the computer. A sample authority table is illustrated in Exhibit 4-4.

The IT system also has **configuration tables** for hardware, software, and application programs that contain the appropriate set-up and security settings. It is important to limit user access to these configuration tables so that security settings are not changed by unauthorized users. The hardware and operating system configuration table contains security and operating settings for hardware and the operating system. The application software configuration table contains security and operating

**EXHIBIT 4-4****Authority Table**

<b>User</b>	<b>Password</b>	<b>Type of Access</b>		
		<b>Sales Data</b>	<b>Payroll Data</b>	<b>Fixed Asset Data</b>
Chandler	bY5gF\$22	Read	—	—
Monica	Ybd7#qui	—	Read	—
Ross	KfG6!e41	—	Read/Write	—
Phoebe	hJ7d*R7^	—		Read/Write

settings for the application software. In a large-scale IT system, access to configuration tables is limited by the user profile and by control of physical access to the tables. The user ID and password for a particular user should not allow access to the configuration tables unless that user is authorized to change configuration settings.

## Hacking and Other Network Break-Ins

When an IT system is networked to either internal networks or the Internet, those networks are open to opportunities for unauthorized access. The more extensive the series of network connections, the greater chance there is for unauthorized access by hackers, others outside the organization, and unauthorized employees. When an IT system has network connections, the organization should employ one or more firewalls in the network. A **firewall** is hardware, software, or a combination of both that is designed to block unauthorized access. All data traveling between the internal network and the Internet should pass through the firewall first. The firewall examines all data passing through it, and if the firewall detects unauthorized attempts to pass data, it prevents the flow of such data. The firewall can prevent the unauthorized flow of data in both directions, blocking access to data on the network server by preventing unauthorized requests to log in or read data. Ideally, a firewall would be like a brick wall and allow nothing to pass through it. However, this would stop legitimate as well as illegitimate network traffic. Thus, the firewall has to examine data flow and attempt to block only the traffic that appears to be unauthorized. A way to think of the firewall is to compare it to the building security system at a large company. The security system will let employees with the proper badges enter and exit the building, but visitors without ID badges are stopped at the door. Similarly, information passes through a firewall in individual packets, and each packet must have the proper ID. Packets without the proper ID are stopped by the firewall.

Since these authorization and access controls cannot be completely effective, there are still possibilities that unauthorized access will occur. To limit the potential damage of unauthorized access, sensitive data should be encrypted. **Encryption** is the process of converting data into secret codes referred to as cipher text. Encrypted data can only be decoded by those who possess the encryption key or password. Encryption renders the data useless to those who do not possess the correct encryption key.

There are two types of encryption: symmetric encryption and public key encryption. **Symmetric encryption** uses a single encryption key that must be used to encrypt data and also to decode the encrypted data. The sender of the data and the receiver must have the same encryption key. However, it is difficult for the sender to

communicate the encryption key to the receiver without compromising the key. **Public key encryption** uses both a public key and a private key. The public key, which can be known by everyone, is used to encrypt the data, and a private key is used to decode the encrypted data. Knowing which public encryption method a receiver uses enables the sender to use that public key to encrypt the data, and the receiver will use her private key to decode the data.

The strength of the encryption refers to how difficult it would be to break the code. Much the same as with passwords, the longer the encryption key is in bits, the stronger the encryption will be and the harder it will be to break the code. Many Internet encryption schemes use 128-bit encryption; that is, the encryption key is 128 bits in length. Under current U.S. standards, the longest encryption keys are 256 bits, but they are not yet widely adopted. Examining the possible combinations of keys proves the difficulty of breaking the encryption key. A 128-bit key size can create 340 undecillion different possible combinations, or 340 followed by 36 zeros. A 256-bit key size can create a combination set of 11 followed by 76 zeros. Someone who wished to randomly guess at the encryption key would potentially have to attempt all of these key possibilities. Even the use of a computer to try the various possibilities is infeasible because of the sheer number of possible combinations.

Encryption is especially important for wireless networks, which send network data as high frequency radio signals through the air. As in the case of radio transmissions, anyone who has the correct receiver can intercept network data waves in a wireless network. Since anyone within range of these radio signals can receive the data, protecting data through encryption is extremely important. A wireless network must have an access point, or a transmitter, that sends the network signals. The computer connected to the wireless network must have a wireless network card to receive the signals. Wireless network equipment, such as access points and wireless network cards, uses an encryption method called **wired equivalency privacy**, or WEP. Depending on the equipment used, WEP employs 64-, 128-, or 256-bit encryption methods. The encryption is symmetric in that both the sending and receiving network nodes must use the same encryption key. Because WEP has proven to be susceptible to hacking, the industry has developed a new wireless network security system called **wireless protected access**, or WPA, which has improved encryption and user authentication. With the improved encryption method, WPA can check to see whether encryption keys have been tampered with. WEP is based on a computer-specific address, which is easy for hackers to determine and misuse; A wireless network that uses WPA, on the other hand, requests connection to the network via an access point. The access point then requests the user identity and transmits that identity to an authentication server. Thus, WPA authenticates the computer and the user.

Another important security feature that should be used in wireless networks is a unique **service set identifier**, or SSID. The SSID is a password that is passed between the sending and receiving nodes of a wireless network. Most wireless network equipment sets a default SSID of “any” so that any wireless equipment can connect to it. For example, if you have a laptop computer with wireless network equipment built in, it theoretically can connect to any similarly equipped networks if the same SSID is used in the laptop and other network nodes. However, security is improved if “any” is changed to a unique SSID that only those within the organization use. Using a unique SSID makes it more difficult for an outsider to access the wireless network.

In many organizations, authorized employees may need to access the IT system from locations outside the organization. There are at least two examples of the need for such legitimate outside access. One is employees who telecommute and are permitted to work from home, using a computer connected to the IT system.

A second example is sales staff who may be traveling to other cities, but must have access there to the IT system in order to service customers. In these cases, the authorized employees should connect to the IT system by using a virtual private network (VPN). A **virtual private network** utilizes tunnels, authentication, and encryption within the Internet network to isolate Internet communications so that unauthorized users cannot access or use certain data. A VPN is employed when the employee connects to the IT system through a public network such as the Internet. A VPN uses the Internet—it is therefore not truly private, but virtually private. The network traffic can be made to be virtually private by technology. Tunnels are end-to-end connections of network cards or other hardware; The VPN traffic can be thought of as traveling through a separate tunnel within the Internet network of public lines.

In addition, network traffic between the organization and all authorized users that is sent via the Internet should limit access by the use of Web-based technology called **secure sockets layer**, or **SSL**. SSL is a communication protocol built into Web server and browser software that encrypts data transferred on that website. If you have ever ordered products on a website, you were probably using SSL technology to encrypt personal data such as your credit card number. You can determine whether such sites use SSL technology by examining the URL address. Most website addresses begin with `http://` preceding the URL, but SSL addresses begin with `https://` preceding the URL.

IT system operations are also threatened by the many network break-in attempts that are undertaken to insert viruses or worms into a system. A **virus** is a self-replicating piece of program code that can attach itself to other programs and data and perform malicious actions such as deleting files or shutting down the computer. A worm is a small piece of program code that attaches to the computer's unused memory space and replicates itself until the system becomes overloaded and shuts down. To avoid destruction of data programs and to maintain operation of the IT system, an organization must employ **antivirus software**, which continually scans the system for viruses and worms and either deletes or quarantines them. Antivirus software renders virus and worm program code harmless.

All of the authentication controls mentioned in this section should assist in limiting unauthorized access. However, people who attempt to access an organization's systems in an unauthorized manner are continually exploiting new ways to gain access. Therefore, an organization must maintain a plan to continually monitor and test the vulnerability of its IT system to unauthorized access. To monitor exposure long range, the organization should engage in vulnerability assessment, intrusion detection, and penetration testing. **Vulnerability assessment** is the process of proactively examining the IT system for weaknesses that can be exploited by hackers, viruses, or malicious employees. When an organization engages in vulnerability assessment by using manual testing or automated software tools, it can identify weaknesses before they become network break-ins and attempt to fix these weaknesses before they are exploited. **Intrusion detection** systems are specific software tools that monitor data flow within a network and alert the IT staff to hacking attempts or other unauthorized access attempts. An intrusion detection system can be thought of as the burglar alarm for the IT system in that it alerts the appropriate users of break-ins. **Penetration testing** is the process of legitimately attempting to hack into an IT system to find whether weaknesses can be exploited by unauthorized hackers. Penetration testing is sometimes done by the IT staff within an organization, but more often an outside consultant with experience in penetration testing is hired to complete the tests.

## Organizational Structure

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Organizations with extensive IT systems should govern the overall development and operation of IT systems through the use of an **IT governance committee**, usually made up of top executives. Its function is to govern the overall development and operation of IT systems. The committee, which would include officers such as the chief executive officer (CEO), chief financial officer (CFO), chief information officer (CIO), and the heads of business units such as the vice president of marketing, has several important responsibilities, including the following:

1. Align IT investments to business strategy. Investing funds and resources in the most beneficial IT systems should enhance the long-range goal of achieving the business strategy.
2. Budget funds and personnel for the most effective use of the IT systems.
3. Oversee and prioritize changes to IT systems. Within organizations, many user groups will concurrently request improvements or changes to their subsystem within the IT system. The IT governance committee will appoint a steering committee to prioritize these requests according to the best match to the business strategy and the feasibility of designing, developing, and implementing the necessary changes.
4. Develop, monitor, and review all IT operational policies. The organization should maintain policies and descriptions of procedures for operating and developing its IT systems.
5. Develop, monitor, and review security policies. The organization should maintain policies and descriptions of procedures related to security. For example, the organization should have established procedures to monitor and follow up on security breaches to the IT system.

While there are many types of IT policies that must be in place, the description of policies in this section will focus only on those that are related to general controls over IT systems. It is important to understand that the IT governance committee delegates many of its duties by the policies that it develops. Because the IT governance committee consists of top management, its role is to develop policies and to delegate duties such that those policies are properly implemented. Perhaps the most important factor in controlling IT systems is the competence of the personnel. Thus, it is important that the IT governance committee ensure that the organization maintains hiring and promotion procedures which screen candidates and verify the background and references of applicants. The IT governance committee should also see that the organization maintains written job descriptions and requirements for IT positions.

The manner in which an organization establishes, delegates, and monitors IT system functions is part of the general control over IT systems. The division of duties and the policies of the organization in relation to those duties must be so designed that they strengthen control over IT systems. The functional responsibilities within an IT system must include proper segregation of duties. This segregation is different from the accounting-related segregation described in Chapter 3. In an IT system, the duties to be segregated are those of systems analysts, programmers, operators, and the database administrator. **Systems analysts** analyze and design IT systems, while **programmers** actually write the software, using a programming language. **Operations personnel** are employees who are responsible for processing operating data. The **database administrator** develops and maintains the database and ensures adequate controls over data within the database. In a properly segregated IT system, no single

person or department should develop computer programs and also have access to data that is commensurate with operations personnel. Similarly, the database administrator should not develop or write programs.

The IT governance committee should ensure that policies are in place which require the listing of all software used in the organization and that this list include important information such as the level and version of the software and any patches that have been applied. Patches are bug fixes, or security enhancements, to existing software.

In addition, the IT governance committee should develop policies and assign responsibilities to ensure that hardware and software systems are tested annually and that the test results are used to continually improve the security and effectiveness of IT systems. The committee should be established prior to major changes in any IT systems and should meet monthly to review items such as investment decisions, change requests, and security policies. When changes to IT systems are proposed, the IT governance committee should already have in place a system development process that controls the initiation, approval, development, and maintenance of those changes. This process, called the system development life cycle, or SDLC, is described in detail in Chapter 6. The **system development life cycle** can be generally described as the systematic steps undertaken to plan, prioritize, authorize, oversee, test, and implement large-scale changes to the IT system.

## Physical Environment and Security

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The general controls for an IT system should include controls over the physical environment of the system and physical access controls to limit who is in contact with the system. The physical environment includes the location, operating environment, and backup systems of the IT system. Physical security is intended to limit physical access to computer hardware and software so that malicious acts or vandalism do not disrupt the system, and so that the data is protected.

Especially for large IT systems, the security of the environment in which they reside and operate is crucial. A large IT system should be physically located in an area and building that are least at risk of natural disasters such as flood, earthquake, hurricane, and fire. Natural disasters can easily destroy or disrupt IT system operations. To the extent possible, IT systems should be installed in locations that are unlikely to be affected by natural disasters.

Computer systems can also be affected by environmental extremes of temperature and humidity. Therefore, a large-scale IT system must be located in a building that properly controls dust, temperature, and humidity. The building should also have a fire protection system that does not use water sprinklers, as water can potentially damage hardware and data files. The fire prevention systems should use a gas, such as halon gas, that eliminates oxygen in the room, since a fire cannot burn without oxygen.

The computer system should also have both an uninterruptible power supply (UPS) and an emergency power supply (EPS). An **uninterruptible power supply** includes a battery to maintain power in the event of a power outage in order to keep the computer running for several minutes after a power outage. An **emergency power supply** is an alternative power supply that provides electrical power in the event that a main source is lost. An example of an EPS is a gasoline-powered generator.

As you may have found with your personal computer, loss of electrical power can result in lost or corrupted data. In the case of an electrical power failure, backup power supplies such as UPS and EPS can keep the IT system operating at least until the individual applications and data can be saved and gradually shut down.

## The Real World

On August 14, 2003, the largest power blackout in North American history affected eight U.S. states and the Canadian province of Ontario, leaving up to 50 million people with no electricity. Some of the major cities impacted were New York City, Cleveland, Toledo, Detroit, Toronto, and Ottawa. Although all electric power from utility systems was out, some telecommunications and wireless networks continued to operate. An Associated Press story explained how the networks were able to continue operating<sup>1</sup>:

Several large telecommunications providers, including the company that supports the vast

majority of Internet traffic worldwide, said they immediately switched to backup generators on the East Coast and could continue doing so for several days.

"We lost all utility power out there, but we immediately went to battery power for a few seconds, at which point all of our major generators kicked in," said Margie Backaus, chief business officer of Equinix, based in Foster City, California, which operates Internet Business Exchange centers that serve more than 90 percent of the world's Internet routes.

Battery power (UPS) and generators (EPS) served as the uninterruptible power supply and emergency power supply systems that enabled these networks to continue operations during the blackout.

The hardware and data in an IT system are also vulnerable to damage, destruction, disruption, or theft if an unauthorized person can physically access them. Large-scale IT systems should be protected by physical access controls. Such controls include the following:

1. Limited access to computer rooms through employee ID badges or card keys
2. Video surveillance equipment
3. Logs of persons entering and exiting the computer rooms
4. Locked storage of **backup data** and offsite backup data

## Business Continuity

**Business continuity planning** (BCP) is a proactive program for considering risks to the continuation of business and developing plans and procedures to reduce those risks. Since such a large number of organizations rely on IT systems to operate, the continuation of IT systems is an integral part of business continuity. BCP is a broad type of planning that focuses on key personnel, resources, and activities critical to business continuation.

## The Real World

In some organizations, loss of a key CEO could spell disaster. Unfortunately, the Internet company SurveyMonkey faced this situation when its 47-year-old CEO died from a freak accident on a treadmill in 2015. Top management of companies must

consider all types of risks that could hamper the continuation of a company, and be prepared to recover from events that can interrupt operations. While this example is unusual, it demonstrates how broad business continuity planning must be.

<sup>1</sup> Rachel Konrad, "Wireless Networks Still Work in Blackout," *Associated Press*, August 15, 2003.

BCP is a broad concept, but because of the importance of IT systems as a critical business resource, a large part of BCP includes IT continuation. Two parts of business continuity are related to IT systems:

1. A strategy for backup and restoration of IT systems, to include redundant servers, redundant data storage, daily incremental backups, a backup of weekly changes, and off-site storage of daily and weekly backups
2. A disaster recovery plan

If IT systems are to continue without interruption, it is important to have backups for both the hardware and software systems, as well as the data. One approach to a backup processing system is called **redundant servers**—two or more computer network or data servers that can run identical processes or maintain the same data. If one of the servers fails, a redundant server functions in its place. In many IT systems, redundant data storage is accomplished by the use of **redundant arrays of independent disks** (RAIDs), often set up such that two or more disks are exact mirror images. If one disk drive fails, the mirror image on a second drive can serve in its place. In addition to the backup files on a RAID, the organization should maintain daily and weekly incremental backups. This backup protection is improved by **off-site backup**, an additional copy of the backup files stored in an off-site location. In some cases, on-site backups may be destroyed and the off-site backup files would be necessary.

The plan for the continuance of IT systems after a disaster is called a **disaster recovery plan (DRP)**. Whereas BCP is proactive planning, DRP is a more reactive plan to restore business operations to normal after a disaster occurs. Disaster recovery plans should include all plans necessary to continue IT operation after a disaster. Although disaster recovery planning has been an important concept in IT systems for many years, there was much more activity regarding disaster recovery planning after the New York City terrorist attacks in September 2001. Those events reminded companies that catastrophes happen very unexpectedly and can cause IT systems to be damaged or destroyed.

Since disasters can destroy systems and data, it is important that organizations maintain backup systems and backup data. Organizations must have regular processes to back up data and to store at least one copy of the backup off site. The off-site backup is necessary in case all data is destroyed at the on-site location.

## General Controls from an AICPA Trust Services Principles Perspective (Study Objective 3)

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A reference list for the general controls described in the previous section appears at the end of this chapter as Exhibit 4-11. Each of the general controls is intended to prevent, detect, or correct risks and exposures in IT systems. A company may choose not to use all of the controls described previously. Each organization should decide which combination of IT controls is most suitable for its IT systems, making sure that the benefits of each control outweigh its costs. As an example, you probably would not spend money to install an extensive car burglar alarm system in your 1988 Honda Civic. The cost of the burglar alarm would outweigh the benefits.

When considering IT risks, organizations should implement those IT controls which are cost beneficial. As a framework to discuss these IT risks, the AICPA Trust Services Principles categorizes IT controls and risks into five categories<sup>2</sup>:

- a. **Security.** The system is protected against unauthorized (physical and logical) access.
- b. **Availability.** The system is available for operation and use as committed or agreed.
- c. **Processing integrity.** System processing is complete, accurate, timely, and authorized.
- d. **Online privacy.** Personal information obtained as a result of e-commerce is collected, used, disclosed, and retained as committed or agreed.
- e. **Confidentiality.** Information designated as confidential is protected as committed or agreed.

The fourth category, online privacy, applies only to e-business (discussed in a later chapter on e-business). The other four risk categories are used in this section to describe the concepts of controls and risks in IT systems. For each of these four categories, this section describes some of the risks and the corresponding controls, which are summarized in Exhibit 4-5. This is not a comprehensive list of risks, but a summary of some common risks along the four categories of security, availability, processing integrity, and confidentiality.

Perhaps the best way to understand these risks and the corresponding need for IT controls is to consider the absence of any IT controls. As an analogy, consider the likely negative consequences that could occur if your car doors did not have locks. Car door locks exist to prevent the specific risks of break-in and theft. Car door locks lessen these risks, but do not completely eliminate them. The sections that follow describe some of the potential risks in IT systems and controls that can reduce them. Much like car door locks, controls reduce risks; but it is impossible to completely eliminate risks.

## Risks in Not Limiting Unauthorized Users

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The top section of Exhibit 4-5 lists eight IT controls related to authentication of users. These were described in the previous section as controls that can lessen the risk of unauthorized users gaining access to the IT system: user ID, password, security token, biometric devices, log-in procedures, access levels, computer logs, and authority tables. Consider the likely results if these controls were completely missing from an IT system: An unauthorized user could easily access data and programs he should not have access to, change data, record transactions, and perhaps even have a company check written directly to himself. Unauthorized users could be from inside or outside the organization. In addition, the lack of a user ID and password would mean that the company would be unable to determine which users accomplish which tasks. There would be no computer log of tasks accomplished by individual users.

There are several *security risks* resulting from unauthorized access. However, it is important first to understand the nature of unauthorized access. While the most popular type of unauthorized access is probably by a person unknown to the organization, employees of the organization also may try to access data to which they do not need access to perform their job duties. For example, a person who works in an

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<sup>2</sup>Trust Services Principles, Criteria and Illustrations, American Institute of Certified Public Accountants, Inc. and Canadian Institute of Chartered Accountants, 2009 and 2014 ([www.aicpa.org](http://www.aicpa.org)).

**EXHIBIT 4-5**
**Control and Risk Matrix in IT Systems**

<b>Control Category</b>	<b>Security Risks</b>	<b>Availability Risks</b>	<b>Processing Integrity Risks</b>	<b>Confidentiality Risks</b>
Authentication of users	<i>Unauthorized user can</i>	<i>Unauthorized user can</i>	<i>Unauthorized user can</i>	<i>Unauthorized user can</i>
User ID	Browse data Alter data Destroy data Steal data Record nonexistent or unauthorized transactions	Shut down systems Shut down programs Sabotage systems Alter programs	Alter data Alter programs Record nonexistent or unauthorized transactions	Browse data Destroy data Steal data Reputate transactions
Password				
Security token or smart card				
Biometric devices				
Login procedures				
Access levels				
Computer logs				
Authority tables				
Hacking and other network break-ins	<i>Person breaking in can</i>	<i>Person breaking in can</i>	<i>Person breaking in can</i>	<i>Person breaking in can</i>
Firewall	Browse data Alter data Destroy data Steal data Record nonexistent or unauthorized transactions	Shut down systems Shut down programs Sabotage systems Alter programs Insert virus or worm that alters or destroys data	Alter data Alter programs Record nonexistent or unauthorized transactions Insert virus or worm that alters or slows operations	Browse data Destroy data Steal data
Encryption				
Security policies				
Security breach resolution				
Secure socket layers (SSL)				
Virtual private network (VPN)				
Wired equivalency privacy (WEP)				
Service set identifier (SSID)				
Antivirus software				
Vulnerability assessment				
Penetration testing				
Intrusion detection				
Environmental			<i>Environmental problems can</i>	<i>Environmental problems can</i>
Temperature, humidity controls		Shut down systems	Cause errors or glitches	
Fire, flood, earthquake controls		Shut down programs	Cause loss or corruption of data due to power loss	
Uninterruptible power supplies				
Emergency power supplies				
Physical access	<i>Unauthorized intruder can</i>	<i>Unauthorized intruder can</i>	<i>Unauthorized intruder can</i>	<i>Unauthorized intruder can</i>
Card key	Change user access levels	Shut down systems Sabotage or destroy systems Insert virus or worm	Shut down programs Sabotage programs Insert virus or worm	Browse data Destroy data Steal data
Operating system configuration tables				
Hardware configuration tables				
Business continuity	<i>Improper handling of backup data can</i>	<i>System interruptions can</i>	<i>System interruptions can</i>	<i>Improper handling of backup data can</i>
Disaster recovery plan	Cause unintended access to data	Shut down systems	Cause errors or glitches Result in incomplete data	Cause unintended access to data
Backup data				
Offsite backup				

accounts receivable department has no need to access payroll data. Data within the organization should be protected from internal unauthorized access as well as from external access. Unauthorized access to the IT system can allow persons to browse through data that is beyond the scope of their job duties, alter data in an unauthorized manner, destroy data, copy the data with the intent to steal and perhaps sell to competitors, or record unauthorized transactions. Establishing log-in procedures that include user IDs, passwords, security tokens, access levels, biometric devices, and authority logs can help prevent or lessen these security risks. These are preventive controls. The computer log of attempted log-ins can be periodically reviewed to determine whether unauthorized access or any attempt to gain unauthorized access has occurred. The organization can then change policies or practices if necessary to prevent further unauthorized access. The computer log serves as a detective control to assist in the discovery of unusual log-in attempts.

*Availability risks* must be assessed and controlled by authentication of user controls. Once a person gains unauthorized access, it is conceivable that he may tamper with the IT system in a manner that may shut down systems and/or programs. These interruptions would obviously make the system or program temporarily unavailable for its intended use. An unauthorized user could also sabotage an IT system by inserting malicious program code to be triggered later. For example, suppose Company XYZ fires a disgruntled programmer, but fails to revoke the user ID and password immediately. Before that programmer cleans out his office and leaves, he may insert into the system some malicious instructions that erase the accounts receivable files during its next regularly scheduled run. Many years ago, this happened to a company; It was unable to recover the files and eventually filed for bankruptcy. This type of malicious code can be triggered by a particular date, a scheduled run, or another set of system circumstances. In addition, the unauthorized user may simply change the program itself. Lessening the chance of unauthorized access through authentication controls can help prevent these availability risks. The computer log would assist in tracing the person responsible for shutting down systems and programs, sabotaging systems, or altering programs.

*Processing integrity* can be compromised without adequate authentication controls. Processing integrity refers to the accuracy, completeness, and timeliness of the processing in IT systems. If unauthorized users access the IT system, they could alter data to change the results of processing. This could occur prior to the transaction being processed, during processing, or after the processing is complete. In all three cases, the accuracy or completeness of processing would be affected. For example, after a sale has been processed, an unauthorized user could delete the amount due to the company in the accounts receivable record. The unauthorized user could also alter programs to affect the results of processing. An unauthorized user might change program instructions to automatically double the hours worked for a particular person every time a payroll check is written for that person. Unauthorized users are sometimes able to circumvent other controls and insert transactions that are fictitious or unauthorized.

Another processing integrity risk is repudiation of real transactions. After a sales transaction has been processed, it may be possible for an unauthorized user to erase traces of the transaction and claim that they do not owe money to the company. Attempting to limit unauthorized users through log-in and authentication controls helps reduce the chances of these risks occurring. Computer logs may facilitate tracing of the alteration of data or unauthorized transactions to the responsible person.

*Confidentiality* risk, or the risk of confidential data being available to unauthorized users, can occur if authentication controls are weak. An unauthorized user who gains access can browse, steal, or destroy confidential data. Improving authentication and

log-in controls helps limit the chances of confidentiality risks. Computer logs can assist in detecting such compromises of data and in tracing them to the responsible person.

Proper use of authentication controls and computer logs can help limit all four categories of these risks. As is always true, these risks cannot be eliminated, but they can be reduced by the use of appropriate controls. Each organization should assess the level of these risks and apply the controls that are cost beneficial for their system.

## Risks from Hacking or Other Network Break-Ins

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Hackers or others who break into computer networks are usually thought of as being outside the company. While this is often true, a hacker could be an employee of the organization who hacks in from home or at work. In fact, employees can sometimes be more dangerous because of their knowledge of company operations and potential access to company information or assets. Whether the threat is from an insider or outsider, efforts should be made to reduce the risk of hacking or network break-ins and to limit the harm that can result. The controls that may be applied are firewalls, encryption of data, security policies, security breach resolution, secure socket layers (SSL), virtual private network (VPN), wired equivalency privacy (WEP), wireless protected access (WPA), service set identifier (SSID), antivirus software, vulnerability assessment, penetration testing, and intrusion detection. Intrusion detection is a detective control, while the others are preventive.

The *security risks* related to hacking and network break-ins are the same as those identified in the previous section on unauthorized users. Those who break into a computer network have obviously breached security and could browse, alter, or destroy data. The use of the controls listed in the previous paragraph and in the second group in Exhibit 4-5 can help reduce the security risks of network break-ins, as well as reduce the potential damage if break-ins do occur.

The *availability risks* are that the network break-in can allow systems or programs to be shut down, altered, or sabotaged. The person who breaks in may also plant a virus or worm into the system. The *processing integrity risks* are that the person breaking in can alter the data or programs to compromise the accuracy or completeness of the data. Recording nonexistent or unauthorized transactions will also compromise data accuracy or completeness, as could planting a virus or worm. Again, there is a *confidentiality risk*, since the person breaking in may access, browse, steal, or change confidential data.

## Risks from Environmental Factors

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IT systems can be negatively affected by the environment in which they operate. Extremes of temperature or humidity can cause operating problems, especially to large mainframe computers, which are sensitive to heat and high humidity and therefore must be placed in rooms in which the climate is tightly controlled. Interruptions to the electrical power can cause systems to go down. It is not possible to prevent power outages caused by thunderstorms, fire, flood, or earthquake, but building location and construction can reduce the effects of these natural disasters. For example, a computer system should not be located in an area that frequently floods. Uninterruptible and emergency power supplies can be used to continue operations during power outages caused by natural events, because, for example, a thunderstorm can cause a lengthy power outage without actually being as disastrous as people commonly think, in terms of death and destruction.

Any environmental changes that affect the IT system can cause *availability risks* and *processing integrity risks*—the risks that systems can be shut down or errors and glitches in processing can occur which cause lost or corrupted data. Backup power supply systems allow IT systems to be gradually shut down without the loss or corruption of data.

## Physical Access Risks

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Physical access to computer systems and computer rooms should be limited to those who must have access in order to carry out their job assignments. Others who gain access (intruders) pose risks to the IT systems. The *security risk* is that an intruder who gains physical access may change user access levels so that she can later access data or systems through any network attached system. The *availability risks* are that unauthorized physical access would allow an intruder to physically shut down, sabotage, or destroy hardware or software. In addition, physical access may make it possible for an intruder to insert viruses or worms from diskette, CD, or other media. An intruder may interrupt processing and thereby affect the accuracy or completeness of processing. Thus, *processing integrity risks* are that systems or programs may be shut down or sabotaged. Viruses and worms can also affect the accuracy and completeness of processing. An intruder poses *confidentiality risks* in that she may be able to gain access to confidential data to browse, alter, or steal.

## Business Continuity Risks

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Many things can interrupt business continuity, including natural disasters. Due to the critical importance of IT systems to business continuity, there must be controls to limit IT risks related to business continuity and natural disasters. However, as part of continuity planning, an organization must still keep backup copies of data on-site and off-site. The existence of backup data poses a risk in that it affords another opportunity for unauthorized access. The *security risk* is that an unauthorized person may gain access to the backup data. Without proper business continuity planning, disaster recovery planning, and backup data, adverse events can interrupt IT system operation. The *availability risk* is that as events interrupt operations, the system becomes unavailable for regular processing. The *processing integrity risk* is that business interruptions can lead to incomplete or inaccurate data. The *confidentiality risk* is that unauthorized persons may gain access to confidential data if they access backup data. A coordinated effort regarding business continuity planning, disaster recovery planning, control over backup data, and correct use of these procedures can limit the risks.

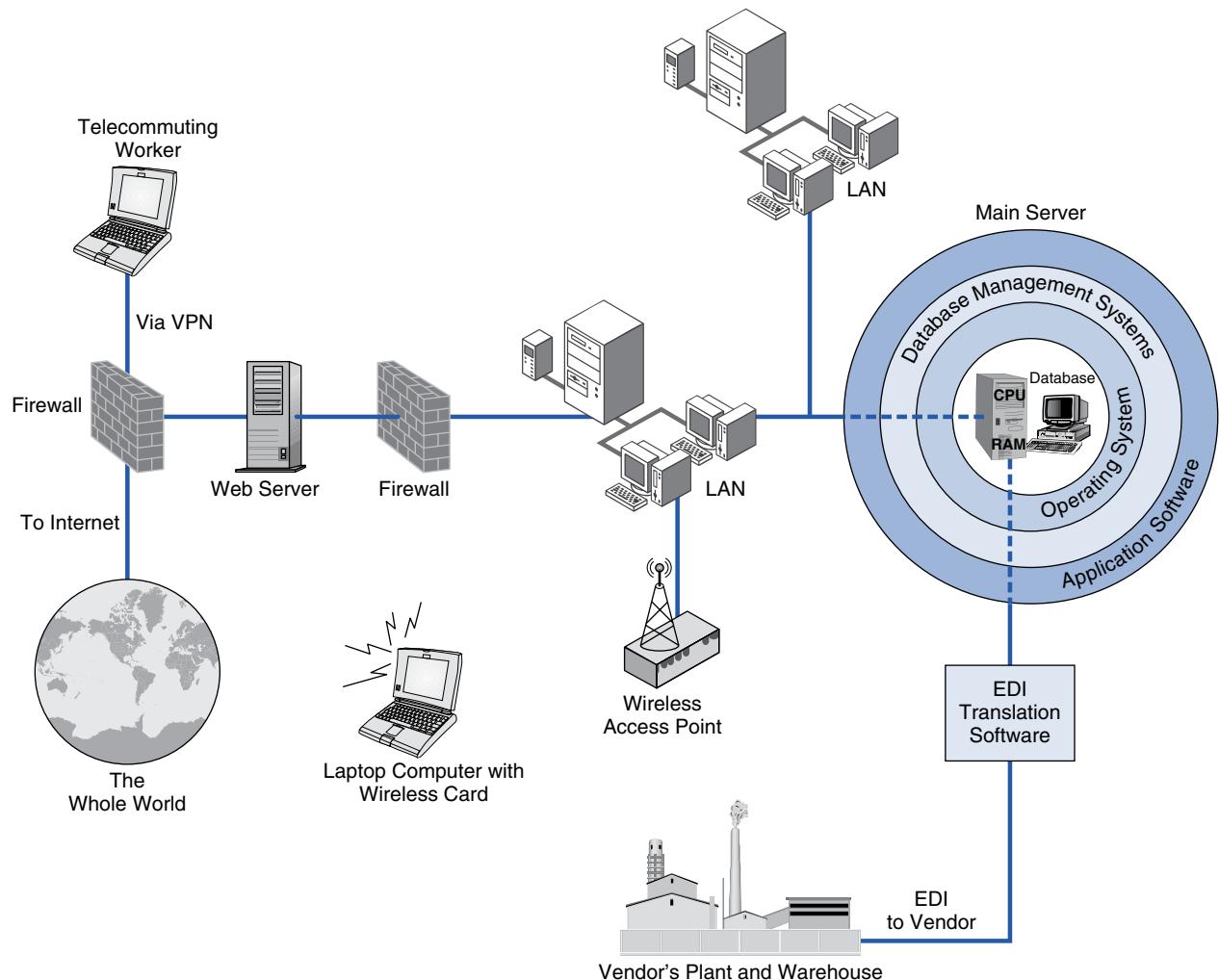
## Hardware and Software Exposures in IT Systems (Study Objective 4)

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The previous sections described and linked risk areas to corresponding controls. To properly understand these risks, we must also understand their possible sources. Consider a burglar alarm analogy. One risk in owning a building is the possibility of break-in and theft of assets from the building. A control to help prevent that risk is a burglar alarm. But to know how to install the sensors for a burglar alarm, the installer must know the potential points of entry, which would be any door or window in the building. Doors and windows serve useful purposes and make the

building more efficient, but each one is a risk area and the sensors for the burglar alarm must be placed at each of the windows and doors. In a similar manner, components of an IT system can be thought of as areas that open risks for an organization, or “entry points.” In an IT system, there are security, availability, processing integrity, and confidentiality risks. General controls (described earlier) can help limit those risks, but the “entry points” over which these controls should be placed must be identified. This section describes the typical IT system components that represent “entry points” where the risks must be controlled.

There are so many different types of hardware and software that can be used in an IT-based accounting system that no two organizations are likely to have identical hardware and software configurations. Each organization selects and implements hardware and software according to its specific needs. Since this chapter cannot possibly cover all possible hardware and software configurations, it describes typical components in generic terms. The exhibits depicting IT systems are not intended to be literal pictures of exact systems, but are simplified depictions of those systems. Exhibit 4-6 depicts several of the hardware and software components described in this chapter.



**EXHIBIT 4-6** Exposure Areas in an IT System

The components illustrated in Exhibit 4-6 can increase the efficiency, effectiveness, and economy of conducting business. They can improve sales, performance, and customer service and reduce costs. The existence of each of these components represents an exposure that should be controlled. These IT system exposures are entry points that make the organization susceptible to the IT risks described earlier. The exposure areas shown in Exhibit 4-6 are as follows:

1. The operating system
2. The database
3. The database management system (DBMS)
4. Local area networks (LANs)
5. Wireless networks
6. E-business conducted via the Internet
7. Telecommuting workers and mobile workers
8. Electronic data interchange (EDI)
9. Application software

The first eight of these exposure areas can be controlled by the use of appropriate general controls such as those described in previous sections. The next eight sections give a brief description of each of the eight exposure areas. Some of these hardware or software components are described in more detail in other chapters. The ninth exposure area, application software, requires application controls. The description of application controls within application software is presented in the last section of this chapter. The purpose of the descriptions in this chapter is to provide only enough detail to allow an understanding of these exposures.

## The Operating System

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The **operating system** is the software that controls the basic input and output activities of the computer. The operating system provides the instructions that enable the CPU to read and write to disk, read keyboard input, control output to the monitor, manage computer memory, and communicate between the CPU, memory, and disk storage. In large computer systems, the operating system manages memory and CPU functions so that multiple users or multiple applications do not interfere with each other. The operating system handles computer data in binary form, which means that data is in sets of 0 or 1 data bits. That is, data such as dollar balances or passwords is being transmitted or stored in the operating system in binary form—sets of 0 and 1 values. Any knowledgeable person who understands binary data and who gains access to the operating system may be able to scan memory for things such as passwords, employee data, and other sensitive data. Such a person could also manipulate or destroy data. The operating system can be an entry point for unauthorized users or hackers.

Operating system access allows a user access to all the important aspects of the IT system. Since all application and database software works through the operating system, access to the operating system also allows access to applications and the database. In addition, all read/write data functions are controlled by the operating system, and any person who has access to the operating system can have full access to data. Essentially, access to the operating system opens access to any data or program in the IT system. Therefore, controlling access to the operating system is critical. If a knowledgeable person is able to access and manipulate the operating system, that person potentially has access to all data passing through the operating system, all processes, and all programs. Thus, the operating system poses *security risks*, *availability risks*, *processing integrity risks*, and *confidentiality risks*.

## The Real World

As an example of the dangers of threats to operating system software, on October 14, 2015, Microsoft issued a software patch for a critical security flaw in all versions of Windows operating systems. The security flaw could allow a hacker to take control of a user's computer through Internet Explorer.

Companies that provide operating system software must always be vigilant against these

types of threats. Hackers are always searching for ways to exploit operating systems because any successful breach of the operating system can potentially give complete control of the computer to the hacker. The hacker can then view, download data, or manipulate that computer in any desired manner.

The operating system software is much different from application software. Application software, such as accounting software, usually has programmed controls that limit the types of data a person can see or manipulate. For example, employees in the purchasing department who log in to the accounting system will be able to access vendor information, but not payroll information. Application accounting software is written to limit data access and also accept only a limited type of data to be input. For example, if an employee is entering pay rates, it is not likely that the payroll software would allow her to enter letters in that blank box, or enter a pay rate of \$500 per hour. Although software is written to limit data access and input, any knowledgeable person who has access to an operating system can manipulate data without being hindered by these types of input or data limitations.

The risks to the operating system related to accounting data include security, availability, processing integrity, and confidentiality risks. Unauthorized access to the operating system would allow the unauthorized user to do the following:

1. Browse disk files or memory for sensitive data or passwords
2. Alter data through the operating system
3. Alter access tables to change access levels of users
4. Alter application programs
5. Destroy data or programs

As summarized in Exhibit 4-5, these risks are present in all four categories. Many of the general controls mentioned earlier and shown in Exhibit 4-5 should be in place to help reduce these risks. Since an organization must determine which controls are most cost-beneficial, it is not possible to list a complete, inclusive set of general controls recommended for every operating system. At the least, an organization should use user IDs, passwords, log-in procedures, computer logs, and authority tables.

## The Database

In an IT system, all or most accounting records and data are stored in electronic form in the database. There are many different types of databases, but for the purpose of examining the risks to a database, we can assume that the database is a large disk storage for accounting and operating data. The existence of a database offers many operational advantages such as the increased efficiency of IT and easy retrieval of the data. However, the database also is an exposure area. It is a part of the IT system that is susceptible to security, availability, processing integrity, and confidentiality

risks. This is true because any unauthorized access to the data can compromise their security and confidentiality and potentially interfere with the availability and normal processing of the IT system. Two examples illustrate these risk areas. An unauthorized user who gains access to the database can browse through the data, compromising the security and confidentiality of the data in the database. The unauthorized user could also destroy or erase data, thereby affecting the accuracy of processing and perhaps making processing unavailable, since some data has been erased.

The exposure of the database may be easier to understand if you compare an IT system with a paper-based system of some 50 years ago. If a person wanted to browse through payroll records back then, he would have to go to the filing cabinet, where the paper payroll records were kept, and use a key to open the file drawer. This means that the only possible unauthorized use of the data could have been by someone with physical access to the file cabinet and the key. However, a sophisticated IT system has data stored in a large database and usually has many computers networked to that database. Hence, it may be possible for someone, including a hacker who might be 3,000 miles from the office, to read payroll data from any computer connected to the network. Therefore, the database may be more open to unauthorized access than the physical, paper records, because the database has so many more access points.

General controls such as those outlined in Exhibit 4-5 can help limit the exposure of the database. The use of these controls to authenticate users and limit hacking and network break-ins can reduce the chance of unauthorized access to the data. Again, the organization must determine which specific general controls are best suited to its IT system and may decide not to employ all of the general controls listed in Exhibit 4-5. Controls such as user IDs, passwords, authority tables, firewalls, and encryption are examples of controls that can limit exposures of the database.

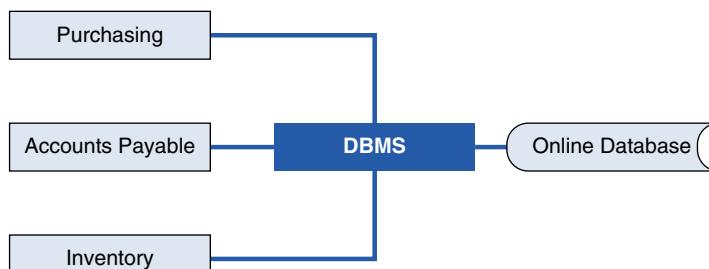
Big Data results in much larger scale databases with much more data that can be compromised. Thus, Big Data increases the risk of hackers desiring to hack into or access Big Data. If an organization uses Big Data and the tools that accompany it, it must be even more focused on IT controls that protect the Big Data.

## The Database Management System

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The **database management system (DBMS)** is a software system that manages the interface between many users and the database. Exhibit 4-7 shows a diagram of multiple user groups accessing and sharing the database through the DBMS.

Users in all three application areas—purchasing, inventory, and accounts payable—must be able to access records of inventory items, cost, and other data related to inventory. The inventory data can be stored in the database and shared by all three user groups. Each individual user group may have a different level of access.



**EXHIBIT 4-7** The Database Management System

For example, a purchasing user might need to add a new record when a purchase is placed. However, accounts payable users should not be able to add purchases, but should be able to read the records to determine which items should be paid. In addition, there are other users, such as accounts receivable users, who need access to customer and sales data, but have no need to access purchase records. The database management system manages this interface between users and data. It is the controller of access levels for different users.

As is true of the data, the DBMS poses security, confidentiality, availability, and processing integrity risk exposures. Since the database management system reads from and writes to the database, unauthorized access to the DBMS is another exposure area. An unauthorized user who is able to access the DBMS may browse, alter, or steal data. Authentication controls and controls over hacking and network break-ins can limit the chance of unauthorized access to the DBMS.

Both the data and the database management system are critical components that must be adequately guarded to protect business continuity. Loss of the data or alteration to the DBMS can halt operations. Therefore, the physical access, environmental, and business continuity controls are very important for these two components.

## LANs and WANs

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A **local area network**, or **LAN**, is a computer network covering a small geographic area. In most cases, LANs are within a single building or a local group of buildings. Most LANs are sets of personal computers or workstations that are connected in order to share data and devices such as printers. Typically, the LAN is connected to a larger computer, the server, where data and some programs reside and are shared over the LAN. A group of LANs connected to each other to cover a wider geographic area is called a **wide area network**, or **WAN**.

Since LANs and WANs are connected into the larger network of servers and computers within a company, the LANs represent risk exposure areas. Anyone with access to a workstation on the LAN can access data and devices on the entire network within the organization. LANs represent an entry point where an unauthorized user may gain access to the network. LANs pose security, confidentiality, availability, and processing integrity risks. An unauthorized user on the LAN may browse, alter, or steal data and thereby compromise the security and confidentiality of data. Any unauthorized manipulation of data or programs through the LAN can affect the availability and processing integrity of the IT system.

In addition to the workstations, the network cabling also poses risks. Any of the network cables or connections represents a spot where an intruder could tap into the network for unauthorized access. The workstations on the LAN and all network connections should be protected by general controls that limit unauthorized users. Firewalls, encryption, and virtual private networks are important controls when the local area network is connected to networks outside the organization, such as the World Wide Web.

## Wireless Networks

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Wireless networks have become very popular in organizations because they allow workers to connect to the network without being tethered to a network cable. A wireless network can save much time, cost, and effort in running network cables. In addition, it allows workers to roam and continue working via the network.

## The Real World

Boeing Co. uses wireless networks on the floor of the large shop where it manufactures airplanes. This wireless network with notebook computers allows Boeing workers to move around the plane while they are working and view engineering drawings or parts availability

during the manufacturing processes. The employees do not have to walk to a desk or workstation, away from the manufacturing flow, to access these things. Wireless networks can make employees more efficient by allowing them to roam.

The wireless network represents another potential entry point of unauthorized access and therefore poses the four risk exposures of security, confidentiality, availability, and processing integrity. The wireless network has the same kind of exposures as described in the previous section about local area networks. In fact, a wireless network is simply a special case of a LAN. In the wireless network, signals are transmitted through the air rather than over cables. These network signals are similar to radio signals; therefore, anyone who can receive those radio signals may gain access to the network. In fact, there are those who specifically take notebook computers and travel around or near company buildings, hoping to gain access to the company's wireless network. If they can intercept the network signals, they may be able to use the network to gain free Internet access at the least and hack into the company's network at worst. A popular activity is to find a company whose network signal bleeds outside the building to the sidewalk around it. Potential abusers of this network make identifiable chalk marks on the sidewalks so that others can find the network access. This activity has become known as "warchalking." A double curve symbol on the sidewalk indicates that you can access an open wireless network at that point. The legality and ethics of warchalking are debatable, but a company might avoid it by instituting proper controls, such as wired equivalency privacy (WEP) or wireless protected access (WPA), station set identifiers (SSID), and encrypted data.

## The Internet and World Wide Web

Many companies use the Internet to buy or sell via a website or to better serve customers and/or employees. A later chapter on e-business will focus on the specifics of Web-based commerce. This section provides only basics about business use of the Internet so that risk exposures and controls can be examined. While there are many advantages for companies, using the Internet poses security, confidentiality, availability, and processing integrity risks. In addition, the existence of e-commerce in an organization poses online privacy risks, which are described in a later chapter.

The Internet connection required to conduct Web-based business can open the company network to unauthorized users, hackers, and other network break-in artists. The sheer volume of users of the World Wide Web dramatically increases the potential number of hackers or unauthorized users who may attempt to access an organization's network of computers. An unauthorized user can compromise security and confidentiality, and affect availability and processing integrity by altering data or software or by inserting virus or worm programs.

A typical network configuration for Internet connection to a company's network was presented in Exhibit 4-6. Notice in the figure that there is a separate computer serving as the Web server. This computer Web server is isolated from the company network via a firewall. The exhibit shows a dual firewall system, with a firewall

between the Internet and the Web server, and a firewall between the Web server and the organization's network. The use of dual firewalls can help prevent hackers or unauthorized users from accessing the organization's internal network of computers.

## Telecommuting Workers and Mobile Workers

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A significant number of employees in the United States work from home, using some type of network connection to the office. This work arrangement is commonly called **telecommuting** or teleworking. GlobalWorkplaceAnalytics.com reports that telecommuting increased by 6.5 percent in 2014. In 2015, 2.5 percent of the U.S. workforce worked at home at least half the time. Telecommuting can offer benefits to both employer and employee. The employee gains flexibility and other advantages of being at home, while the employer may save office space and overhead expenses for the worker. The potential disadvantages of telecommuting are that the teleworker loses daily face-to-face interaction and may miss meetings with other employees or supervisors.

Telecommuting workers cause two sources of risk exposures for their organizations. First, the necessary network equipment and cabling can be an entry point for hackers and unauthorized users. Second, the teleworker's computer is also an entry point for potential unauthorized users; it is not under the direct control of the organization, because it is located in the teleworker's home. Therefore, the organization must rely on the teleworker to maintain appropriate security over that computer and to correctly use firewalls and virus software updates to keep security current. These two entry points pose security, confidentiality, availability, and processing integrity risks. The organization's security policy should address the security expectations of workers who telecommute, and such workers should connect to the company network via a virtual private network.

In addition to working in fixed locations, many employees access company networks and systems using mobile devices such as smart phones and tablets. Examples of smart phones are iPhones and Android phones; tablets include iPads and Android tablets. Using e-mail servers and applications that access company systems, employees may read and process or change company data. They also tend to use these mobile devices at lunchtime, while traveling, while visiting customers or vendors, and from home during off hours. These mobile devices cause the same types of security, availability, processing integrity, and confidentiality risks. Therefore, companies have developed unique methods to protect security and confidentiality. For example, companies that provide mobile devices for employees establish "remote wipe" capability. A remote wipe allows the company's IT professionals to remove company data and applications from the device. If an employee's smart phone or tablet is lost or stolen, it can be remotely wiped of data and applications.

## Electronic Data Interchange

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**Electronic data interchange (EDI)** is the company-to-company transfer of standard business documents in electronic form. EDI is widely used by businesses to buy and sell goods and materials. Rather than mailing copies of purchase orders and invoices, companies send these kinds of standard business documents back and forth electronically. To conduct EDI with business partners, a company must use a dedicated network, a value added network, or the Internet. The specific details and advantages of EDI are explained in a later chapter on e-business.

Regardless of the type of network used, the EDI network entails security, confidentiality, availability, and processing integrity risks, as it is another “entry point” for unauthorized users or hackers. EDI transactions must be properly guarded and controlled by general controls including authentication, computer logs, and network break-in controls. Exhibit 4-5 lists these controls and the corresponding risks.

## Cloud Computing

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As introduced in Chapter 2, many companies use a **public cloud** computing model for software, data storage, or both. The advantages of public cloud computing, as described in the following list, are repeated from Chapter 2:

1. **Scalability.** As a company grows, it can easily purchase new capacity from the cloud provider. It need not buy servers or new data storage as the cloud provider already has the capacity. This scalability is also a tremendous advantage for spikes in business activity. If a company has a large increase in business volume during certain seasons, it can easily scale up the capacity purchased from the cloud provider. When the seasonal volume declines, it then easily scales down the services it buys from the cloud provider.
2. **Expanded access.** Once the software and data are stored in the cloud, it can be accessed by multiple devices from many different locations. This gives the company much more flexibility for those who use or enter the accounting data. It also makes it easier for users to startup new computing capabilities.
3. **Infrastructure is reduced.** The company has a reduced need for servers and data storage since most of these resources are provided by the cloud provider. This also means that the cloud provider handles data security and backup of data.
4. **Cost savings.** Because of the advantages mentioned earlier, there are usually significant cost savings recognized from cloud computing. Cloud computing is usually a pay-for-service model. In other words, a company pays the cloud provider only for the level of services it actually uses. The scalability of the cloud means that the company no longer needs to maintain an IT system large enough for the peak demand periods. Cloud computing also allows a company to reduce its investment in IT hardware and the personnel needed to support IT hardware. This eliminates the financial risk because the user company avoids making a significant up-front financial investment in technology-related resources that may have uncertain returns.

A company must recognize the risks associated with cloud computing. When examined from its simplest perspective, cloud computing is the outsourcing of IT infrastructure (the hardware), data, and software to a third party. Although the advantages are noteworthy, control of the company’s data and software is transferred to the third-party cloud provider, thus introducing additional security, availability, processing integrity, and confidentiality risks. The user company must trust that the provider will keep the data secure and confidential. Similarly, the user must also trust that the provider will not have interruptions in service (downtime or breakdowns). A brief summary of the risks follows:

1. **Security.** All processing, storing data, and reading data occur over the Internet; therefore, the third-party provider must have good user authentication, firewalls, encryption, and virtual private network connections. If a company had its own IT, software, and data storage, it would design and maintain

- these controls. Under the cloud computing model, it depends on the third-party provider to maintain security controls.
- 2. **Availability.** Any interruptions in service cause the software and data to be unavailable. Again, a company is placing full control of availability in a third-party provider. The third-party cloud provider must have backup facilities, backup servers, data backups, and proper business continuity plans and disaster recovery plans. Most service level agreements indicate that a high level of uptime, even 100 percent, is guaranteed. However, these agreements also provide for credit or reduced payments if service is interrupted. It can be difficult to successfully recover funds paid to the provider or get concessions in future payments when interruptions occur. Even if the third-party provider has no downtime, an interruption in the company's Internet access can prevent it from accessing cloud services. Therefore, Internet access must be available at all times for the company and the third-party provider.
  - 3. **Processing integrity.** All control of software installation, testing, and upgrading is transferred to the third-party provider of cloud computing services. Thus a company has less control over ensuring that processing is accurate and complete. A company that outsources via cloud computing is trusting the third-party provider to maintain processing integrity.
  - 4. **Confidentiality.** As is true of the previous three items, the control of maintaining confidentiality is transferred to the third-party provider. This includes an extra risk that employees of the third-party provider can possibly browse and misuse company data.

## The Real World

SalesForce.com®, a cloud provider of customer relationship management software, experienced a sudden outage of service around noon on January 6, 2009. For about one hour, the service interruption prevented 900,000 subscribers from accessing or using the service. This outage prevented sales people and managers of the client companies from gaining any access to customer data. They were unable to engage in normal sales and promotional activities during the outage.

A more severe availability problem occurred at Coghead, a cloud computing vendor that offered database services in the cloud to paying customers. Coghead stored client databases and database applications on its servers. In February 2009, Coghead announced it was to be purchased by SAP, and customers would have to find alternative places to store data. Customers were given about two months to move their data off the servers at Coghead. This illustrates the potential loss of control of data if you store your

data and applications in the cloud. You have less control over the data and applications, and if the provider happens to cease operations (such as going out of business), there is a significant risk of losing data and applications.

To avoid these extra risks inherent in a public cloud, many companies establish their own computing cloud structure. This is called a private cloud. The **private cloud** is developed, owned, maintained, and used by the user company. There is no involvement of a third-party provider. This private cloud offers many, but not all, of the advantages of a public cloud. A private cloud provides the majority of benefits in the areas of scalability and expanded access; however, it does not reduce infrastructure or reduce costs. The greatest advantage of a private cloud is that it does not transfer control of data and software to a third-party provider. Thus, the company maintains the ability to control the security, availability, processing integrity, and confidentiality risks.

## The Real World

Starbucks uses a combination of public clouds, private clouds, and traditional corporate IT systems. In its stores, Starbucks uses Office 365 for e-mail and productivity applications such as Microsoft Word. Office 365 is the public cloud version of the Microsoft Office Suite. For e-mail and productivity applications at the corporate offices, Starbucks uses its

own traditional IT systems on premises. For its customer relationship management software, Starbucks uses SalesForce.com, a public cloud application. For other accounting and Oracle ERP applications, Starbucks uses a private cloud based on virtualized servers that they maintain. This example of using various IT approaches is quite common.

In each of these risk areas, a company places its trust in the third-party provider to have proper IT controls as described in the earlier parts of this chapter. A company must carefully examine and review cloud providers before entering into a cloud computing service agreement. A provider must be trustworthy, reliable, and large enough to scale up operations if necessary. User companies must continually monitor and assess whether the cloud provider is appropriately meeting their needs.

## Application Software and Application Controls (Study Objective 5)

Application software accomplishes end user tasks such as word processing, spreadsheets, database maintenance, and accounting functions. All application software runs on top of the operating system software and uses the basic input, output, and data storage functions of the operating system. Any accounting software is considered application software. Application software represents another entry point through which unauthorized users or hackers could gain access. As is true of the eight exposure areas described so far, the application software has security, confidentiality, availability, and processing integrity risks. Many of the general controls listed in Exhibit 4-5 can help minimize those risks. For example, authentication of the user through user IDs and passwords can reduce the chance of unauthorized access. Application software processes inputs into accounting information and therefore carries specific processing integrity risks not inherent in the eight previous IT components described. The specific processing risks are inaccurate, incomplete, or unsecure data as it is input, is processed, or becomes output. Another risk of application software is the addition and processing of unauthorized transactions. For these specific risks, application controls should be part of accounting applications.

Many of the general controls in Exhibit 4-5 can help limit access to application software; specific application controls should also be incorporated. **Application controls** are internal controls over the input, processing, and output of accounting applications. Exhibit 4-1 illustrated that application controls apply to specific accounting applications such as payroll, sales processing, or accounts receivable processing. In any of these accounting applications, data is entered through some method of input, the data is processed, and outputs such as reports or checks are produced. Application controls intended to improve the accuracy, completeness, and security of input, processing, and output are described as follows:

1. **Input controls** are intended to ensure the accuracy and completeness of data input procedures and the resulting data.

2. **Processing controls** are intended to ensure the accuracy and completeness of processing that occurs in accounting applications.
3. **Output controls** are intended to help ensure the accuracy, completeness, and security of outputs that result from application processing.

## Input Controls

In IT systems, data must be converted from human-readable form to computer-readable form. This process is called data input. Data can be input into a computer application in many different ways. For example, data can be keyed into blank fields on a computer screen from a keyboard; data can be read from bar codes; or data can be received electronically via EDI or the Web. No matter the manner of input, controls should be in place to ensure that the data entered is accurate and complete. You probably know the old computer acronym GIGO, which stands for “Garbage in, garbage out”—a short-hand method of saying that if you enter incorrect data, you will obviously get incorrect results. Input controls are intended to prevent or detect the “garbage in” so as to avoid incorrect output, or “garbage out.”

To illustrate some input controls, Exhibit 4-8 presents a Microsoft Dynamics GP input screen to add a new employee to the payroll records.

The screenshot shows the Microsoft Dynamics GP Employee Maintenance window. The title bar reads "Employee Maintenance - TWO15 (sa)". The menu bar includes "Actions", "Go To", "File", "Tools", "Help". The main area contains the following data entry fields:

Employee ID	BARB0001	Class ID	INST	Inactive
Last Name	Barbariol	Address ID	PRIMARY	
First	Angela	Address	456 Cedar Ave	
Middle		City	Fort Wayne	
Suffix		State	IN	
Soc Sec Number	986-22-5953	ZIP Code	46001	County
Hire Date	5/15/2013	Country	USA	
Adjusted Hire Date	5/15/2013	Phone 1	(219) 555-0176 Ext. 0000	
Last Day Worked		Phone 2	(219) 555-0178 Ext. 0000	
Date Inactivated	0/0/0000	Phone 3	(000) 000-0000 Ext. 0000	
Reason		Department	INST	
Secondary Status		Position	TEC	
SUTA State	IN	Location	Primary	
Workers' Comp	INWC01	Supervisor	TECMGR	
Employment Type:	Full Time Regular	Address	Additional Information	Vac/Sick

At the bottom, there are navigation icons (back, forward, search, etc.) and a dropdown menu "by Employee ID".

**EXHIBIT 4-8** Employee Maintenance Screen in Microsoft Dynamics GP

As the data input person prepares to enter data for a new employee, input controls should be in place to ensure the authorization, accuracy, and completeness of that data input. These input controls are of four types:

1. Source document controls
2. Standard procedures for data preparation and error handling
3. Programmed edit checks
4. Control totals and reconciliation

**Source Document Controls** In many IT systems and applications, data is keyed in to input screens similar to the Microsoft Dynamics GP example in Exhibit 4-8. Before this data can be keyed in, the data must be captured and recorded on a source document. A **source document** is the paper form used to capture and record the original data of an accounting transaction. For example, before filling in the blank fields in Exhibit 4-8, the data entry person needs to know the new employee's name, address, hire date, and many other pieces of information. For new employees, the source document would be a personnel action form, a sample of which appears in Exhibit 4-9.

The data entry person often refers to a copy of the source document to enter the data into the blank fields on the screen. It should also be noted that many IT systems do not use source documents. In cases where the input is automatic, such as Web-based sales, no source documents are generated. Where no source documents are used, the general controls described earlier, such as computer logging of transactions and making and keeping backup files, become more important. Where source documents are used, to minimize the potential for errors, incomplete data, or unauthorized transactions as data is entered from source documents, several source document controls should be used.

**Form design:** Both the source document and the input screen should be well designed so that they are easy to understand and use, logically organized into groups of related data. For example, notice that employee name and address blanks, or fields, are located very close to each other, since they are logically related. Source documents should have clear and direct instructions embedded into the form. The personnel action form in Exhibit 4-9 has the following instruction line: "Please check the status of the employee." Finally, the source document design and input screen design should match each other. Ideally, the fields on both forms should be the same and the fields should be in the same order. The closer the source document matches the input screen, the easier it is for the data entry person to complete the input screen without uncertainty and errors.

In many applications, it is not possible to fit all necessary data on a single input screen. This problem is solved by having several related input screens to enter all data. Exhibit 4-10 illustrates a second screen for new employees that allows the input of pay rate data on a pay code screen.

**Form authorization and control:** The source document should contain an area for authorization by the appropriate manager, such as the bottom left of the form in Exhibit 4-9. The source document forms should be prenumbered and used in sequence. Prenumbering allows for ongoing monitoring and control over blank source documents. If the source document sequence is monitored to ensure that there are no missing numbers in the sequence, most likely no transactions will be lost. Finally, blank source documents should be controlled by being kept in a secure area so as to prevent them from being misused to initiate an unauthorized transaction.

FORM DATE 6/12/2003

**PERSONNEL ACTION FORM**

<b>Part A-Employee</b>		<b>Date of Hire</b>	
Employee Name		Birth Date	
Address		Sex	
		SS#	
Telephone			
In Case of Emergency Notify			
Name			
Address			
Home Phone	Work Phone		
Relationship	Cell		
<b>Part B-Employer</b>			
<b>Change</b>	<b>From</b>	<b>To</b>	<b>STATUS</b>
Job Title			Please check the status of the employee:  <b>OVERTIME STATUS</b> <input type="checkbox"/> Exempt <input type="checkbox"/> Non Exempt  <input type="checkbox"/> Administrative <input type="checkbox"/> Direct with benefits <input type="checkbox"/> Indirect with no benefits
Pay Rate			
Hourly			
Billing Rate			
Salary			
Status (FT/PT)			
Project Assigned			
Reasons for Change			
_____	New Hire	Effective _____	
_____	Merit Increase	Effective Date _____	
_____	Project Transfer to _____	Effective Date _____	
_____	Termination _____	(Date) _____	
_____	Other (please explain below)		
Comments: _____			
		<b>SAFETY REQUIREMENTS:</b>	
		<b>VIEWED SAFETY FILMS:</b>	
*NOTE-2 SIGNATURES REQUIRED		TEST SCORE	
Payroll change requested by: _____		HAZCOM	_____
Date: _____		CONFINED SPACE	_____
Reviewed and authorized by: _____		PERSONAL PROTECTIVE EQUIPMENT	_____
Date: _____		BLOODBORNE PATHOGENS	_____
		SCAFFOLD	_____
		THIS FORM WILL NOT PROCESS WITHOUT SCORES:	

EXHIBIT 4-10 Related Input Screens for a New Employee

**Retention of source documents:** After data from source documents has been keyed into the computer, the source documents should be retained and filed in a manner that allows for easy retrieval. Filed source documents serve as the historical, original records of transactions and can be used to reconstruct transactions if necessary, or can be used to answer questions that arise about transaction processing. These source documents are part of the audit trail. The audit trail, defined in Chapter 3, is defined here also as a reminder. The audit trail re-creates the details of individual transactions at each stage of the business process in order to establish whether proper accounting procedures for the transaction were performed.

### Standard Procedures for Data Input

**Data preparation:** The procedures to collect and prepare source documents are called **data preparation** procedures. Without well-defined source data preparation procedures, employees would be unsure of which forms to use, as well as when to use them, how to use them, and where to route them. For example, when a new

employee is hired, the human resources department must know which form to use to document the hiring, how to complete the form, and which department to send the form to after it is completed. The standard data collection procedures reduce the chance of lost, misdirected, or incorrect data collection from source documents. Employees who complete source documents must understand these data preparation procedures. If employees are not well trained in these procedures, errors in data collection are likely to result.

**Error handling:** As data is collected on source documents or entered on screens, errors may occur. It is not possible to eliminate all errors. Therefore, an organization should have error handling procedures. As errors are discovered, they should be logged, investigated, corrected, and resubmitted for processing. The error log should be regularly reviewed by an appropriate manager so that corrective action can be taken on a timely basis. Corrective action might require more training for employees, better form design, or better data collection procedures.

**Programmed Input Validation Checks** Data should be validated and edited as close as possible to the time of obtaining the data from its original source. In many IT systems that process transactions in real time, editing can take place during data entry. Real-time systems must have access to data in master files, such as balances and employee pay rates. Since this data is online and available in real time, editing can be completed by checking data input against data in master files. For example, when the data entry person enters an employee number in the corresponding field, a real-time system would find the employee record and fill in the appropriate fields with the employee data such as name, address, and pay rate. If an invalid employee number is entered, the real-time system can alert the user that the entry is invalid. In addition to real-time data editing, the application software can include input validation checks to prevent or detect input errors. These checks are pre-programmed into accounting application software and are intended to check a field, or fields, for errors. Exhibit 4-2 illustrated an example of an input validation called a validity check. Input validation checks include the following:

1. Field check
2. Validity check
3. Limit check
4. Range check
5. Reasonableness check
6. Completeness check
7. Sign check
8. Sequence check
9. Self-checking digit

Any particular field may require only numbers, only letters, or a combination of numbers and letters. A pay rate field should accept only numbers, while the last name field should be only letters. A **field check** examines a field to determine whether the appropriate type (alpha or numeric) of data was entered. If the wrong data type is entered, the application should reject that data and alert the user with an error message. There are some fields, such as inventory part numbers, that might be a combination of alpha and numeric data. For those fields, a field check would not be an appropriate input validation. A **validity check** examines a field to ensure that the data entry in the field is valid compared with a preexisting list of acceptable values. For example, there may be only two choices for acceptable values for a field named Pay Type: "hourly" and "salary." The application can be preprogrammed to

check input into that field to make sure it is either “h” or “s.” Any other values should be rejected as not valid, and the user should see an error message on the screen if the data is not valid. Exhibit 4-2 shows such a message. Limit checks and range checks are very similar. Both check field input against a preestablished limit or limits. A **limit check** has only an upper limit; for example, hours worked cannot exceed a value of 70 hours per week. Hours worked would never be negative, and it is conceivable that it could be zero in some cases. Therefore, there is no need for a lower limit in that field, and a limit check would be appropriate. A **range check** has both an upper and a lower limit. Some fields, such as quantity requested, may logically suggest that the entry cannot be less than 1. Therefore, a range check could be preprogrammed into the application to accept values between one and some upper limit. A **reasonableness check** compares the value in a field with those fields to which it is related to determine whether the value is reasonable. For example, pay rate could be compared with a job category code. A **completeness check** assesses the critical fields in an input screen to make sure that a value is in those fields. For example, when a new employee is processed, a Social Security number must be entered. The completeness check scans only to make sure that a value has been entered; it cannot ensure that the *correct* value was entered. A **sign check** examines a field to determine that it has the appropriate sign, positive or negative. All of these checks examine a field or fields against some preestablished expected values.

Programmed input checks can be used not only for data input that is keyed in but also for some forms of electronic input such as EDI transactions or Web-based sales. In the case of Web sales, the customer enters data into fields, where programmed input validations can ensure proper input. In EDI transactions, data is imported into the application software through the EDI translation software. These programmed checks can help confirm the accuracy and completeness of imported data.

The programmed input checks just described are appropriate for real-time or batch systems. The final two programmed input validation checks discussed next are more appropriate for transactions that are processed in batches. In batch systems with legacy software and hardware, the master files are not necessarily always online and/or available in real time. Transactions are entered and edited as a batch and run against a master file as a batch. Therefore, the batch of transactions must be in the same order as the master file. For payroll, both transaction and master files are probably sorted by employee number. A **sequence check** ensures that the batch of transactions is sorted in order, but does not help find missing transactions because it checks only sequence, not completeness. In any particular pay period, there may be employees who will not be paid, perhaps because they are on a monthly, rather than bi-weekly, pay period, or because they are on unpaid leave. The sequence check just skips over the missing employee number and verifies only that the remaining employees in the batch are sorted in the correct order. A **self-checking digit** is an extra digit added to a coded identification number, determined by a mathematical algorithm. For example, if a vendor number is to be 6453, then an extra digit is added to the end to make it 64532, where the “2” is generated by a mathematical formula. For any data entry tasks, the vendor number 64532 is always used. During an edit run, the computer recomputes the same formula to ensure that the self-checking digit still equals 2. If the data entry person accidentally typed 65432 rather than 64532, the self-checking digit would not match and the input could be flagged as erroneous.

**Control Totals and Reconciliation** Control totals are useful in any IT system in which transactions are processed in batches. **Control totals** are subtotals of selected

fields for an entire batch of transactions. For a batch of similar transactions, such as payroll transactions for a pay period, control totals can be calculated before the data is processed. For example, the total number of hours worked on all time cards can be summed. After the time card data is keyed into the application software, a printed report can provide the computer-generated subtotal of hours worked. This reconciliation of manually generated subtotals to computer-generated subtotals should result in the same total from both sources. If they do not agree, this indicates that an error has occurred, such as adding extra transactions, skipping transactions, or entering the wrong hours for one or more transactions. Control totals are of three types: record counts, batch totals, and hash totals. **Record counts** are a simple count of the number of records processed. The records can be counted prior to and after input, and the totals should agree. **Batch totals** are totals of financial data, such as total gross pay or total federal tax deducted. **Hash totals** are totals of fields that have no apparent logical reason to be added. For example, the summation of all Social Security numbers in a batch of payroll transactions would provide a control total for comparison, but the total would have no other practical use. Both batch and hash totals are subtotals of certain fields.

## Processing Controls

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Processing controls are intended to prevent, detect, or correct errors that occur during the processing in an application. First and foremost, it is important to ensure that the application software has no errors. Software that incorrectly processes data can be dangerous, because it can consistently make the same errors and thus cause many errors in the data. To verify the accuracy of application software, the company should be sure the software is tested prior to implementation; and it must be regularly tested thereafter. Application software can be tested by reprocessing actual data with known results or by processing test data. Whether actual or test data is used, the results of processing the data are compared with known results to make sure that there are no errors in processing.

Many input controls also serve as processing controls. Control totals, limit and range tests, and reasonableness and sign tests can prevent or detect processing errors. Control totals such as record counts, batch totals, and hash totals can be reconciled during stages of processing to verify the accuracy and completeness of processing. This reconciliation of control totals at various stages of the processing is called **run-to-run control totals**. During processing, some calculations such as addition or multiplication must occur. Limit, range, and reasonableness checks can be used to ensure that the results of these mathematical manipulations are within expected ranges or limits.

Computer logs of transactions processed, production run logs, and error listings can be regularly examined to prevent, detect, and correct other errors. These logs allow management to find patterns of errors and take action to correct erroneous procedures or application software.

## Output Controls

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Many outputs in an IT system are reports from the various applications. An example of an output report is a payroll check register. There are two primary objectives of output controls: to ensure the accuracy and completeness of the output, and to properly manage the safekeeping of output reports to ascertain that security and

confidentiality of the information is maintained. To ensure accuracy and completeness, the output can be reconciled to control totals. In addition, it is extremely important that users of the reports examine the reports for completeness and reasonableness. Users of the reports are the most familiar with the nature of the output reports and are therefore most likely to notice if there are errors. Any errors detected must be logged and corrected. Management should watch for patterns of errors and follow up with corrective action.

Output reports contain data that should not fall into the wrong hands, as much of the information is confidential or proprietary. Therefore, an organization must maintain procedures to protect output from unauthorized access, in the form of written guidelines and procedures for output distribution. In the case of sensitive data, the procedures might include a requirement that users sign off on the receipt of outputs. Under this procedure, users must sign a log to indicate that they received the output, and the output is not released without the signature. The organization should also establish procedures to guide the retention and disposal of output, such as how output reports are to be stored and the length of time they are to be retained. Outputs scheduled for disposal should be properly removed, depending on the nature of the output. Sensitive output reports should be shredded.

In many cases, the output from IT systems is viewed on a screen rather than examined from a printed copy. In the case of screen outputs, the authentication of user controls described earlier help protect the security and confidentiality of output. Authentication controls help assure that only authorized users have access to such output.

## Ethical Issues in IT Systems (Study Objective 6)

A strong set of internal controls can assist in discouraging unethical behavior such as fraud and abuse. Management has a duty to maintain internal controls over IT systems for several reasons. Mainly, managers have a stewardship responsibility to safeguard assets and funds entrusted to them by the owners of the organization, and meeting this responsibility requires that controls be in place to safeguard assets. IT systems themselves, such as computer hardware and software, are assets that must be protected from theft, abuse, or misuse. Without proper controls on IT systems, the computer systems can be easily misused by outsiders or employees.

### The Real World

An unusual case of computer abuse occurred at a federal agency that regulates financial aspects of companies. The Securities and Exchange Commission (SEC) detected senior managers spending excessive hours viewing pornography during regular working hours. One SEC attorney spent as much as eight hours a day viewing pornography on his office computer.

A congressional investigation revealed that 33 high-level SEC staffers in Washington, D.C., were involved in such abuse of computers. Ironically, this misconduct was occurring during the same time that this agency should have been monitoring and reviewing banking institutions and other companies involved in the country's financial meltdown.

While such cases are interesting, they expose a serious misuse of government funds. The U.S. taxpayers paid for computers that were being diverted from their intended use. The managers of the SEC have a duty to enforce policies that protect the computers and the IT systems. Similarly, a company has a duty to its owners to enforce policies and controls to prevent misuse.

In addition, a company can be held liable if employees use computers in a way that harasses others. For example, an employee who sends e-mails that are sexually suggestive or lewd can cause legal problems for the company. In the United States, 27 percent of Fortune 500 companies have had to engage in legal defense proceedings regarding accusations that employees have sent e-mails of a sexual harassment nature. Companies must try to detect and prevent such misuse of computers.

In addition to computer assets being misused, access to IT systems may give unauthorized users access to other assets. Management must try to prevent theft conducted through the IT system, such as theft accomplished by fraudulent-transaction data entries. Both misuse of computers and theft through the computer systems are unethical behaviors that management must discourage through proper internal controls.

Besides fraud, there are many kinds of unethical behaviors related to computers, such as the following:

- Misuse of confidential customer information stored in an IT system
- Theft of data, such as credit card information, by hackers
- Employee use of IT system hardware and software for personal use or personal gain
- Using company e-mail to send offensive, threatening, or sexually explicit material

The controls described in this chapter can help set an environment in which many of these unethical behaviors are discouraged. Authentication controls, network break-in controls, and computer logging of use can help prevent or detect such behaviors.

## Summary of Study Objectives

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**An overview of internal controls for IT systems.** Threats and risks that interrupt or stop computer operations can be severely damaging to the organization. Not only can they disrupt or shut down normal operations, but they also can lead to incorrect or incomplete accounting information. There are three important areas of knowledge regarding threats and risks to IT systems: The first is the description of the general controls and application controls that should exist in IT systems. The second is the type and nature of risks in IT systems. Third, and most important, is the recognition of how these controls can be used to reduce the risks to IT systems.

**General controls for IT systems.** These are controls on the overall IT system and can be categorized by the following risk areas they are intended to lessen: unauthorized access, hacking and other network break-ins, exposures in organizational structure, threats in the physical environment and physical security of the system, and disruption to business continuity.

**General controls from a Trust Services Principles perspective.** The AICPA Trust Services Principles define five objectives for IT controls: security, availability, processing integrity, confidentiality, and online privacy. Security means that the system

is protected against unauthorized (physical and logical) access. Availability means the system is available for operation and use as committed or agreed. Processing integrity means that the system processing is complete, accurate, timely, and authorized. Online privacy means that personal information obtained as a result of e-commerce is collected, used, disclosed, and retained as committed or agreed. Confidentiality means that information designated as confidential is protected as committed or agreed.

**Hardware and software exposures in IT systems.** The various hardware and software parts of IT systems are sources of risk or exposure. Examples of these risks are altered, deleted, or stolen data; systems that are shut down or rendered unusable; and virus or worm infections. The parts of the IT system that have these potential exposures are the operating system, the database, the database management system (DBMS), a local area network (LAN), a wireless network, e-business systems, telecommuting workers, electronic data interchange (EDI) systems, and application software. Public cloud computing is a newer computing model that increases the risk categories outlined in the Trust Services Principles.

**Application software and application controls.** These are input controls, processing controls, and output controls. Input controls are intended to prevent, detect, or correct errors during data input; thus, they should help ensure the accuracy and completeness of any data that is input. Processing controls are intended to ensure accurate and complete processing. Output controls are intended to ensure that output is properly distributed and disposed of, and that it is accurate and complete.

**Ethical issues in IT systems.** IT systems and computers within IT systems can be used unethically. Examples of unethical behavior with IT systems are misuse of confidential customer information, theft of customer or company data, employee use of IT systems for personal use, and misuse of company e-mail systems to send offensive, threatening, or sexually explicit material.

## Key Terms

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Antivirus software	Database management system (DBMS)	Log in	Record counts
Application controls	Disaster recovery plan	Nonrepudiation	Redundant array of independent disks (RAID)
Authentication of users	Electronic data interchange (EDI)	Off-site backup	Redundant servers
Authority table	Emergency power supplies (EPS)	Online privacy	Run-to-run control totals
Availability	Encryption	Operating system	Secure sockets layer (SSL)
Backup data	Field check	Operations personnel	Security
Batch total	Firewall	Output controls	Security token
Biometric device	General controls	Password	Self-checking digit
Business continuity planning	Hash totals	Penetration testing	Sequence check
Completeness check	Input controls	Private cloud	Service set identifier (SSID)
Computer log	Intrusion detection	Processing controls	Sign check
Confidentiality risks	IT governance committee	Processing integrity	Smart card
Control totals	Limit check	Programmers	Source document
Data preparation procedures	Local area network (LAN)	Public cloud	Symmetric encryption
Database administrator		Public key encryption	
		Range check	
		Reasonableness check	

System development life cycle (SDLC)	Uninterruptible power supplies (UPS)
Systems analyst	User ID
Telecommuting	User profile
Two-factor authentication	Validity check

Virtual private network (VPN)	Wired equivalency privacy (WEP)
Virus	Wireless protected access (WPA)
Vulnerability assessment	
Wide area network (WAN)	

## End of Chapter Material

### Concept Check



- 1 Internal controls that apply overall to the IT system are called
  - a. overall controls
  - b. technology controls
  - c. application controls
  - d. general controls
- 2 In entering client contact information in the computerized database of a telemarketing business, a clerk erroneously entered nonexistent area codes for a block of new clients. This error rendered the block of contacts useless to the company. Which of the following would most likely have led to discovery of this error at the time of entry into the company's computerized system?
  - a. Limit check
  - b. Validity check
  - c. Sequence check
  - d. Record count
- 3 Which of the following is not a control intended to authenticate users?
  - a. User log-in
  - b. Security token
  - c. Encryption
  - d. Biometric devices
- 4 Management of an Internet retail company is concerned about the possibility of computer data eavesdropping and wiretapping, and wants to maintain the confidentiality of its information as it is transmitted. The company should make use of
  - a. data encryption
  - b. redundant servers
  - c. input controls
  - d. password codes
- 5 An IT governance committee has several responsibilities. Which of the following is least likely to be a responsibility of the IT governance committee?
  - a. Develop and maintain the database and ensure adequate controls over the database.
  - b. Develop, monitor, and review security policies.
  - c. Oversee and prioritize changes to IT systems.
  - d. Align IT investments to business strategy.
- 6 AICPA Trust services Principles describe five categories of IT risks and controls. Which of these five categories would best be described by the statement, "The system is protected against unauthorized access"?
  - a. Security
  - b. Confidentiality
  - c. Processing integrity
  - d. Availability
- 7 The risk that an unauthorized user would shut down systems within the IT system is a(n)
  - a. security risk
  - b. availability risk
  - c. processing integrity risk
  - d. confidentiality risk
- 8 The risk of an unauthorized user gaining access is likely to be a risk for which of the following areas?
  - a. Telecommuting workers
  - b. Internet
  - c. Wireless networks
  - d. All of the above
- 9 Which programmed input validation check compares the value in a field with related fields to determine whether the value is appropriate?
  - a. Completeness check
  - b. Validity check
  - c. Reasonableness check
  - d. Completeness check
- 10 Which programmed input validation check determines whether the appropriate type of data, either alphabetic or numeric, was entered?
  - a. Completeness check
  - b. Validity check
  - c. Reasonableness check
  - d. Field check

- 11 Which programmed input validation makes sure that a value was entered in all of the critical fields?
- Completeness check
  - Validity check
  - Reasonableness check
  - Field check
- 12 Which control total is the total of field values that are added for control purposes, but not added for any other purpose?
- Record count
  - Hash total
  - Batch total
  - Field total
- 13 A company has the following invoices in a batch:
- | <b>Invoice no.</b> | <b>Product I.D.</b> | <b>Quantity</b> | <b>Unit price</b> |
|--------------------|---------------------|-----------------|-------------------|
| 401                | H42                 | 150             | \$30.00           |
| 402                | K56                 | 200             | \$25.00           |
| 403                | H42                 | 250             | \$10.00           |
| 404                | L27                 | 300             | \$5.00            |
- Which of the following numbers represents a valid record count?
- 1
  - 4
  - 70
  - 900
- 21 (SO 2) How does encryption assist in limiting unauthorized access to data?
- 22 (SO 2) What kinds of risks exist in wireless networks that can be limited by WEP, WPA, and proper use of SSID?
- 23 (SO 2) Describe some recent news stories you have seen or heard regarding computer viruses.
- 24 (SO 2) What is the difference between business continuity planning and disaster recovery planning? How are these two concepts related?
- 25 (SO 2) How can a redundant array of independent disks (RAID) help protect the data of an organization?
- 26 (SO 2) What kinds of duties should be segregated in IT systems?
- 27 (SO 2) Why do you think the uppermost managers should serve on the IT governance committee?
- 28 (SO 4) Why should accountants be concerned about risks inherent in a complex software system such as the operating system?
- 29 (SO 4) Why is it true that increasing the number of LANs or wireless networks within an organization increases risks?
- 30 (SO 4) What kinds of risks are inherent when an organization stores its data in a database and database management system?
- 31 (SO 4) How do telecommunicating workers pose IT system risks?
- 32 (SO 4) What kinds of risks are inherent when an organization begins conducting business over the Internet?
- 33 (SO 4) How does the use of public cloud computing reduce costs?
- 34 (SO 4) Why is a private cloud less risky than a public cloud?
- 35 (SO 4) Why is it true that the use of EDI means that trading partners may need to grant access to each other's files?
- 36 (SO 5) Why is it critical that source documents be easy to use and complete?
- 37 (SO 5) Explain some examples of input validation checks that you have noticed when filling out forms on websites you have visited.
- 38 (SO 5) How can control totals serve as input, processing, and output controls?
- 39 (SO 5) What dangers exist related to computer output such as reports?

### Discussion Questions

- 14 (SO 1) What is the difference between general controls and application controls?
- 15 (SO 1) Is it necessary to have both general controls and application controls to have a strong system of internal controls?
- 16 (SO 2) What kinds of risks or problems can occur if an organization does not authenticate users of its IT systems?
- 17 (SO 2) Explain the general controls that can be used to authenticate users.
- 18 (SO 2) What is two-factor authentication with regard to smart cards or security tokens?
- 19 (SO 2) Why should an organization be concerned about repudiation of sales transactions by the customer?
- 20 (SO 2) A firewall should inspect incoming and outgoing data to limit the passage of unauthorized data flow. Is it possible for a firewall to restrict too much data flow?

### Brief Exercises

- 40 (SO 2, SO 5) Categorize each of the following as either a general control or an application control:
- Validity check
  - Encryption
  - Security token
  - Batch total
  - Output distribution
  - Vulnerability assessment
  - Firewall
  - Antivirus software
- 41 (SO 5) Each of the given situations is independent of the other. For each, list the programmed input validation check that would prevent or detect the error.
- The ZIP code field was left blank on an input screen requesting a mailing address.
  - A state abbreviation of “NX” was entered in the state field.
  - A number was accidentally entered in the last name field.
  - For a weekly payroll, the hours entry in the “hours worked” field was 400.
  - A pay rate of \$50.00 per hour was entered for a new employee. The job code indicates an entry-level receptionist.
- 42 (SO 3) For each AICPA Trust Services Principles category shown, list a potential risk and a corresponding control that would lessen the risk. An example is provided.

#### EXAMPLE

##### Security:

*Risk:* A hacker could alter data.

### Problems

- 48 (SO 1, SO 2) Explain why an organization should establish and enforce policies for its IT systems in the following areas regarding the use of passwords for log-in:
- Length of password
  - Use of numbers or symbols in passwords
  - Using common words or names as passwords
  - Rotating passwords
  - Writing passwords on paper or sticky notes
- 49 (SO 2) The use of smart cards or tokens is called two-factor authentication. Answer the following questions, assuming that the company you work for uses smart cards or tokens for two-factor authentication.
- Required:**
- What do you think the advantages and disadvantages would be for you as a user?
  - What do you think the advantages and disadvantages would be for the company?

*Control:* Use a firewall to limit unauthorized access.

In a similar manner, list a risk and control in each of the following categories:

- Security
- Availability
- Processing integrity
- Confidentiality

- 43 (SO 4) For each of the following parts of an IT system of a company, write a one-sentence description of how unauthorized users could use this as an entry point:
- A local area network (LAN)
  - A wireless network
  - A telecommuting worker
  - A company website to sell products
- 44 (SO 4) Explain the risk categories for cloud computing and how these risks may differ from a company that maintains its own IT hardware, software, and data.
- 45 (SO 5) Application controls include input, processing, and output controls. One type of input control is source document controls. Briefly explain the importance of each of the following source document controls:
- Form design
  - Form authorization and control
  - Retention of source documents
- 46 (SO 5) Explain how control totals such as record counts, batch totals, and hash totals serve as input controls, processing controls, and output controls.
- 47 (SO 6) Briefly explain a situation at your home, university, or job in which you think somebody used computers unethically. Be sure to include an explanation of why you think it was unethical.

- 50 (SO 4) Many IT professionals feel that wireless networks pose the highest risks in a company's network system.

**Required:**

- a. Why do you think this is true?
  - b. Which general controls can help reduce these risks?
- 51 (SO 5) Control totals include batch totals, hash totals, and record counts. Which of these totals would be useful in preventing or detecting IT system input and processing errors or fraud described as follows?
- a. A payroll clerk accidentally entered the same time card twice.
  - b. The accounts payable department overlooked an invoice and did not enter it into the system because it was stuck to another invoice.
  - c. A systems analyst was conducting payroll fraud by electronically adding to his "hours worked" field during the payroll computer run.
  - d. To create a fictitious employee, a payroll clerk removed a time card for a recently terminated employee and inserted a new time card with the same hours worked.

- 52 (SO 5) Explain how each of the following input validation checks can prevent or detect errors:

- a. Field check
- b. Validity check
- c. Limit check
- d. Range check
- e. Reasonableness check
- f. Completeness check
- g. Sign check
- h. Sequence check
- i. Self-checking digit

- 53 (SO 2) The IT governance committee should comprise top level managers. Describe why you

think that is important. What problems are likely to arise with regard to IT systems if the top level managers are not involved in IT governance committees?

- 54 (SO 2) Using the Internet or other research tool, look up the term "penetration testing." Describe the software tools you find that are intended to achieve penetration testing. Describe the types of systems that penetration testing is conducted upon.
- 55 (SO 3) Visit the AICPA website at [www.aicpa.org](http://www.aicpa.org). Search for the terms "WebTrust" and "SysTrust." Describe these services and the role of Trust Services Principles in these services.
- 56 (SO 2) Using the Internet or other research tool, look up the terms "disaster recovery," along with "9/11." The easiest way to search for both terms together is to type into the search box the following: "disaster recovery" "9/11." Find at least two examples of companies that have changed their disaster recovery planning since the terrorist attacks on the World Trade Center on September 11, 2001. Describe how these companies changed their disaster recovery plans after the terrorist attacks.
- 57 (SO 5) Go to any website that sells goods. Examples would be BestBuy, Staples, and J. Crew. Pretend that you wish to place an order on the site you choose and complete the order screens for your pretend order. **Do not** finalize the order or enter either real or fictitious credit card information; otherwise, you will have to pay for the goods. As you complete the order screens, attempt to enter incorrect data for fields or blanks that you complete. Describe the programmed input validation checks that you find that prevent or detect incorrect data input.
- 58 (SO 4) Using the Internet or other research tool, search "cloud computing" and create a list of at least 10 companies that provide cloud computing services. List the names of the companies and a brief description of the cloud computing services provided by each company.

## Cases

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- 59 The EnviroPlan Company, a small business with 100 employees, sells environmental consulting services to large companies around the United States. It employs 40 consultants who travel the United States, assisting clients with environmental compliance. To conduct business, the company must maintain a website so that potential customers can learn of its services and contact its consultants. The company maintains an internal network with an extensive database of

environmental regulations and environmental data. Each of its consultants carries a laptop computer; the company has installed a wireless network so that when the consultants are in the office they can easily connect to the company's network. Consultants visit off-site clients much of the time, but while on-site consulting with clients, they must use their laptops to access the company database to look up environmental regulations and data.

**Required:**

- a. From the list of general controls shown in Exhibit 4-5, list each authentication and hacking control that you think the EnviroPlan Company should have in place.
  - b. Explain how each control that you list can prevent IT-related risks for EnviroPlan.
  - c. Are there any general controls that you think would not be cost beneficial?
- 60 Gleason, Inc., is a manufacturer of plastic knobs for lawn and garden tractors and lawn mowers. The company has always used traditional paper-based systems to conduct transactions with its customers. For example, when a customer ordered knobs, Gleason personnel filled out a sales order acknowledgement and mailed it to the customer. Gleason would like to expand its business opportunities by becoming a supplier, as management believes the company can manufacture interior parts for automotive manufacturers. Automotive manufacturing companies use EDI extensively as they transact business with suppliers and expect any suppliers that they buy from to have the appropriate systems to conduct transactions via EDI. Therefore, Gleason must buy or develop systems that would allow it to use Internet EDI.
- Required:**
- a. Describe the extra IT system risks that Gleason should consider as it evaluates whether to buy or develop an Internet EDI system.
  - b. Describe the IT internal controls that should be incorporated into an Internet EDI system.
- 61 In the early days of computers, Chris Schuler was a very enterprising young man who, while attending UCLA, was also conducting a major fraud against

Continental Telephone and Telegraph Company (CT&T). At the height of his fraud in 2015, he was collecting approximately \$30,000 a day from CT&T. In total, it was estimated that he stole as much as \$900,000 from CT&T. Chris's fraud was fairly simple in concept, but he did work very hard at it. In 1990, he began a legitimate company refurbishing phone equipment for CT&T. As a supplier to CT&T, he became familiar with some of their operations. He also spent much time digging through dumpsters at CT&T and was able to salvage many reports that helped him understand the inventory and ordering systems. He purchased a telephone truck at an auction, and since he was a valid supplier to CT&T, he had keys to the loading dock. He began tapping into CT&T's touch-tone ordering system, ordering equipment to be dropped off at certain locations. Using his truck, he would pick up the equipment and sell it, either to CT&T or to other companies, as refurbished equipment. His knowledge of computers and CT&T systems allowed him to alter their programs to erase any traces of his illicit activity. His operation became so large that he needed employees to assist him. One of his employees became disgruntled and tipped off police to Chris's illegal activities in 2016. Chris was convicted of grand theft, burglary, and receiving stolen property and served 40 days in jail, with a three-year probation. He eventually became a computer security consultant.

**Required:**

List and describe internal controls from this chapter that may have helped prevent or detect Chris Schuler's fraud. Keep in mind that this case occurred before there was an Internet and large company computer networks.

## Solutions to Concept Check

- 1 (SO 1) Internal controls that apply overall to the IT system are called **d. general controls**. There are two categories of IT internal controls. General controls apply overall to the IT system, such as passwords, encryption of data, and physical security controls. Application controls are input, processing, and output controls applied to each specific IT application system.
- 2 (CMA Adapted) (SO 1) In entering client contact information in the computerized database of a telemarketing business, a clerk erroneously entered nonexistent area codes for a block of new clients. This error rendered the block of contacts useless to the company. The control that would most likely have led to the discovery of this error at the time of entry into the company's computerized system is a **b. validity check**. A validity check can examine the data entered and alert the user to an invalid entry.
- 3 (SO 2) **c. Encryption** is not a control intended to authenticate users. Encryption can render data unreadable and useless to those without the encryption key, but it does not prevent unauthorized users from accessing the IT system. User logins, security tokens, and biometric devices do authenticate users and are intended to prevent unauthorized access.
- 4 (CMA Adapted, CIA Adapted) (SO 2) Management of an Internet retail company is concerned about the possibility of computer data eavesdropping and wiretapping, and wants to maintain the confidentiality of information as it is transmitted. The company should make use of **a. data encryption**. Since

- encryption renders data unreadable, it prevents eavesdropping and makes wiretapping useless.
- 5 (SO 2) An IT governance committee has several responsibilities. The option least likely to be a responsibility of the IT governance committee is to **a. develop and maintain the database and ensure adequate controls over the database**. This is a description of the responsibilities of the database administrator, not the IT governance committee.
- 6 (SO 3) AICPA Trust Services Principles describe five categories of IT risks and controls. Of the five given categories, the one best described by the statement "The system is protected against unauthorized access" is **a. security**. Availability means that the system is available for operation and use as committed or agreed. Processing integrity means that system processing is complete, accurate, timely, and authorized. Confidentiality means that information designated as confidential is protected as committed or agreed.
- 7 (SO 3) The risk that an unauthorized user would shut down systems within the IT system is an **b. availability risk**. The shutdown of all or part of the IT system would make the IT system unavailable for use as intended, and it is therefore an availability risk.
- 8 (SO 4) The risk of an unauthorized user gaining access is likely to be a risk for **d. all of the above**. Each of these areas of an IT system is a potential entry point for unauthorized users.
- 9 (SO 5) **c. A reasonableness check** is the programmed input validation check that compares the value in a field with related fields to determine whether the value is appropriate. An example would be that pay rate could be compared with job category code to make sure that the pay rate is reasonable.
- 10 (SO 5) The programmed input validation check that determines whether the appropriate type of data, either alphabetic or numeric, was entered is a **d. field check**. A field check is intended to ensure that only numeric data is entered in numeric fields and only alphabetic data is entered in alphabetic fields.
- 11 (SO 5) The programmed input validation which verifies that a value was entered in all of the critical fields is a **a. completeness check**. When a user is completing an input screen, a completeness check would not allow the user to finish the input and move to the next screen or step until all critical fields contain a value.
- 12 (SO 5) The control total which is the total of field values added for control purposes, but not added for any other purpose, is a **b. hash total**. As an example, a hash total might be the total of all Social Security numbers, a field that would not be summed for any purpose other than control.
- 13 (CPA Adapted) (SO 5) A company has the following invoices in a batch:
- | <b>Invoice no.</b> | <b>Product I.D.</b> | <b>Quantity</b> | <b>Unit price</b> |
|--------------------|---------------------|-----------------|-------------------|
| 401                | H42                 | 150             | \$30.00           |
| 402                | K56                 | 200             | \$25.00           |
| 403                | H42                 | 250             | \$10.00           |
| 404                | L27                 | 300             | \$ 5.00           |

Of the numbers presented, the one that represents a valid record count is **b. 4**. This represents the number of records (invoices) included for processing in the batch.

	Term	Reference Location	
General Controls	Access	S 1.2; S 3.1; A 1.2; A 3.4; P 1.2	
	Access levels	S 1.2; S 3.1; A 1.2; P 3.5	
	Antivirus	S 3.4; A 3.7; P 3.8; O 3.10; C 3.7	
	Authentication of users	S 1.2; S 3.1	
	Backup data	S 3.1; A 3.2; A 3.3; P 3.18; P 3.19; C 3.4	
	Business continuity	A 1.2; A 3.2; P 3.18	
	Card key	S 3.2; A 3.5; P 3.6; O 3.8; C 3.5	
	Disaster recovery	A 3.2; A 3.3; A 3.11; P 3.18	
	Encryption	S 3.5; A 3.8; P 3.1; P 3.8	
	Environmental factors	A 3.1; P 3.17; P 4.3	
	Firewall	S 3.2; S 3.3; A 3.6; P 3.7; O 3.8; O 3.9; C 3.6	
	Intrusion detection	S 3.3; S 3.6; A 3.6; A 3.9; P 3.7; P 3.10; C 3.6; C 3.9	
	IT steering committee	S 3.10; A 2.5; P 2.5; O 3.16; C 2.3	
	Log-in attempts	S 3.3; A 3.4; A 3.6; P 3.5; C 3.4; C 3.6	
	Logs	S 3.2; S 3.6; A 3.4; A 3.5; A 3.6; A 3.9; P 3.10; P 4.2; C 3.5	
	New users	S 1.2; S 3.1; A 1.2; A 3.4; P 1.2; P 3.5	
	Offsite backup	S 3.2; A 3.3; P 3.6	
	Operating system	S 3.8; A 3.4; P 3.5; O 3.7; C 3.4	
	Output distribution	S 3.1; P 3.3; P 3.5; O 3.7; C 3.4	
	Passwords	S 3.1; A 3.4; P 3.5; O 3.7; C 3.4	
	Physical access	S 3.2; A 3.1; A 3.5; P 3.6	
	Router	S 3.2	
	SDLC	S 3.8; S 3.10; A 3.11; P 3.2; P 3.12; O 3.14; C 3.11	
	Security breach resolution	S 1.2; S 3.6; A 2.4; A 3.5; O 3.8; C 3.10	
	Security policy	S 1.1; S 1.2; S 1.3; S 3.7; A 4.1	
	Segregation of duties	S 3.11; A 3.4; P 3.5; O 3.11	
	Server	S 3.2	
	SSL	S 3.5; A 3.8; P 3.1; P 3.9; O 3.11; C 3.8	
	Terminated employees	S 3.1; A 3.4	
	Testing systems	S 1.2; S 3.10; S 3.11; A 1.2; A 3.11; A 3.13; P 1.2	
	User profiles	S 3.1; A 3.4; P 3.5; C 3.4	
	Utility programs	A 3.4; P 3.5	
	Virus	S 3.4; A 3.7; P 3.8	
	VPN	S 3.3; A 3.6; P 3.1; P 3.7; O 3.9; C 3.6	
	Vulnerability assessment	S 3.3; A 3.6	
Application Controls	Input	Control totals	P 3.1; P 3.3
		Data entry	P 3.1
		Data preparation procedures	P 3.1
		Error handling procedures	P 3.1
		Field edits	P 3.1
		Hash totals	P 3.1
		Input form design	P 3.1
		Range checks	P 3.1
		Record counts	P 3.2
		Source documents authorized	P 3.1
	Processing	Source documents maintained (imaged)	P 3.1
		Validity checks	P 3.1
	Output	Error handling procedures	P 3.2
		Processing	P 3.2
		Production run logs	P 3.10
		Record counts	P 3.2
		Standard review procedures	P 3.11

Reference (S = Security; A = Availability; P = Processing Integrity; C = Confidentiality; and O = Online Privacy)

**EXHIBIT 4-11** AICPA Trust Services Principles Reference List for IT Control Terms

# IT Governance

## STUDY OBJECTIVES

This chapter will help you gain an understanding of the following concepts:

- 1.** An introduction to IT governance and its role in strategic management
- 2.** An overview of the system development life cycle (SDLC)
- 3.** The elements of the systems planning phase of the SDLC
- 4.** The elements of the systems analysis phase of the SDLC
- 5.** The elements of the systems design phase of the SDLC
- 6.** The elements of the systems implementation phase of the SDLC
- 7.** The elements of the operation and maintenance phase of the SDLC
- 8.** The critical importance of IT governance in an organization
- 9.** Ethical considerations related to IT governance

## Introduction to IT Governance (Study Objective 1)

The Real World example on the next page will help you understand the context of many concepts in this chapter. Please read that Real World example to begin effective reading and studying of this chapter. The Real World example provides an example of a company, United Parcel Service Inc. (UPS), that has established strong IT governance within its organization which has resulted in its IT organization consistently aligning with the company's core business strategy. In the business environment of today, IT systems are critical to the success of the organizations that use them. IT systems can improve efficiency and effectiveness, and reduce costs. Companies that fail to take proper advantage of the potential benefits of IT systems can lose market share to competitors or in some cases, become bankrupt. To ensure that a company is using IT to its competitive advantage, it must continually investigate and assess the viability of using newer information technologies. The company must ensure that its long-term strategies, and its ongoing operations, properly utilize appropriate IT systems. But how does a company decide which IT systems are appropriate to its operations? Moreover, how does a company decide, for example,

- which accounting software package to buy?
- when the company has outgrown its accounting software or when to upgrade that accounting software?
- whether to use IT systems to sell products on the Web?
- whether to establish a data warehouse for analyzing data such as sales trends?
- whether to use an ERP system or customer relationship management (CRM) software?

Each of these decisions is likely to have a long-run strategic impact on the company. Decisions the company makes about the IT systems it will use will affect the

## The Real World



© Sean Locke/Stockphoto

Keeping technology initiatives aligned with business direction is a challenge facing every company, but the larger the company, the bigger the challenge will be. As a global corporation with multiple subsidiaries, United Parcel Service Inc. (UPS) has faced the challenge and fashioned an award-winning IT organization consistently aligned with the company's core business strategy.

UPS formed an Information and Technology Strategy Committee (ITSC) composed of senior managers from all functional areas within the company. The ITSC was chartered with the tasks of studying the impacts and application

of new technologies and possible business opportunities. The group's ongoing role is to consider where technology is going next and how UPS's current generation of technology can be improved upon.

Another cross-functional committee has approval and oversight authority on all IT projects and programs, while a senior executive heads them and an IT owner helps prioritize needs and resource requirements across functions. Projects are prioritized on the basis of the strength of their business cases (e.g., service to UPS customers) and financial metrics (e.g., return on investment and net present value), but nonfinancial metrics are also considered so that noncore projects can be given adequate resources.

UPS also formed an IT governance committee to oversee day-to-day IT operations. In addition to formalizing the project prioritization and budgeting processes, the IT governance committee established standards and designed the architecture, policing itself to ensure that all work was in tune with business requirements and direction. Composed of the chief information officer and senior IT managers, the IT governance committee more closely aligns IT to the business, establishing stringent management processes and enforcing technology standards and processes. The committee has oversight into all key IT decisions and provides a forum to raise critical issues.<sup>1</sup>

efficiency and effectiveness of the organization in achieving strategic goals. IT systems must be chosen that support management's strategic goals and the daily operational management. IT systems must be strategically managed. **Strategic management** is the process of determining the strategic vision for the organization, developing the long-term objectives, creating the strategies that will achieve the vision and objectives, and implementing those strategies. Strategic management requires continuous evaluation of, and refinements to, the vision, objectives, strategy, and implementation. To achieve the purposes of strategic management, an organization must also properly manage, control, and use IT systems that enable the organization to achieve its strategies and objectives. The proper management, control, and use of IT systems is IT governance. The IT Governance Institute defines **IT governance** as follows:

[A] structure of relationships and processes to direct and control the enterprise in order to achieve the enterprise's goals by adding value while balancing risk versus

<sup>1</sup> Excerpts from a United Parcel Service press release, "Redefining IT's Value to the Enterprise" (<http://www.pressroom.ups.com/>).

return over IT and its processes. IT governance provides the structure that links IT processes, IT resources, and information to enterprise strategies and objectives.<sup>2</sup>

A summary of this definition is that the board of directors and top-level executive managers must take responsibility to ensure that the organization has processes that align IT systems to the strategies and objectives of the organization. IT systems should be chosen and implemented that support attainment of strategies and objectives. To fulfill the management obligations that are inherent in IT governance, management must focus on the following activities:

- Aligning IT strategy with the business strategy
- Cascading strategy and goals down into the enterprise
- Providing organizational structures that facilitate the implementation of strategy and goals
- Insisting that an IT control framework be adopted and implemented
- Measuring IT's performance

There is no single method of achieving each of these management obligations. Different companies may choose different approaches. There are, however, three popular models of an IT control framework:

1. Information Systems Audit and Control Association (ISACA) control objectives for IT (COBIT)
2. The International Organization for Standardization (ISO) 27002, Code of Practice for Information Security Management
3. The Information Technology Infrastructure Library (ITIL)

These three are very comprehensive models of an IT control framework, and their details are beyond the scope of this book. The major focus of this chapter is to highlight the first three of the preceding objectives: aligning IT strategy with business strategy; cascading strategy down into the enterprise; and providing organizational structures to facilitate implementation. Therefore, this chapter will focus only on three selected aspects of IT governance: the definition of IT governance, the role of the IT governance committee, and the system development life cycle.

IT governance must be an important issue for all management levels, from the board of directors to lower level managers. To meet its obligation of corporate governance, the board must oversee IT. IT systems are critical to the long-term success of the organization, and board involvement in IT oversight is therefore necessary. The board should do the following:

- Articulate and communicate the business direction to which IT should be aligned. The board should set and communicate long-term company strategy and objectives.
- Make sure it is aware of the latest developments in IT, from a business perspective.
- Insist that IT be a regular item on the agenda of the board and that it be addressed in a structured manner.
- Be informed about how and how much the enterprise invests in IT compared with its competitors' investments.
- Ensure that the reporting level of the most senior information technology manager is commensurate with the importance of IT. For example, the chief information officer (CIO) may need to report directly to the CEO.
- Ensure that it has a clear view of the major IT investments, from a risk-and-return perspective. Each IT investment will have risks—for example,

<sup>2</sup> Adapted from Control Objectives for information and Related Technology (COBIT) 4.1, Framework, IT Governance Institute, Rolling Meadows, IL, 2007 ([www.itgi.org](http://www.itgi.org)).

increased security risks. However, each IT investment will also generate return in the form of cost savings, such as increased efficiency. The board members should be informed about the risks and returns.

- Receive regular progress reports on major IT projects.
- Receive IT performance reports illustrating the value of IT.
- Ensure that suitable IT resources, infrastructures, and skills are available to meet the required enterprise strategic objectives.<sup>3</sup>

To ensure that IT systems support long-term strategic objectives as well as daily operations, management must constantly assess its current situation, where it plans to go, and which IT systems will help it get there. To be effective, this assessment should be part of an ongoing process to evaluate organizational direction and the fit of IT to that direction. The board and top management must ensure that the organization has processes to accomplish the following tasks:

1. Continually evaluate the match of strategic goals to the IT systems in use.
2. Identify changes or improvements to the IT system that will enhance the ability to meet strategic organizational objectives.
3. Prioritize the necessary changes to IT systems.
4. Develop the plan to design and implement those IT changes that are of high priority.
5. Implement and maintain the IT systems.
6. Continually loop back to Step 1.

The managerial obligation to evaluate strategic match and to implement IT systems begins with the board of directors and must cascade down into the organization. This means that the board, top executive management, and lower-level managers all must work toward the same goal of ensuring IT systems and strategy align with the organization's strategic goals. To match company strategy to IT systems, the company should have an IT governance committee and a formal process to select, design, and implement IT systems. The **IT governance committee** is a group of senior managers selected to oversee the strategic management of IT. The formal process that many organizations use to select, design, and implement IT systems is the **system development life cycle**, or **SDLC**. Both of these management tools, the IT governance committee and the SDLC, are necessary in the strategic management of IT systems.

By analyzing similar management situations, we may find it easier to see the importance of the IT governance committee and the SDLC. Professional sports teams can be used as an analogy to IT management. For a professional football team to be a consistent winner over many seasons, two kinds of important management processes must occur. First, the general manager, scouts, and coaches must draft and trade for players who fit into the organization. When drafting and trading players, these team managers must be considering their long-term strategy. They must assess the strengths and weaknesses of the team, the style of offense and defense they will play in the future, and the types of players that will best fit those playing styles and the coaching structure. In addition to this long-term management of team strategy and player choices, the coaches must make shorter-term decisions to develop and use the players of the team. Coaches must decide which players are starters and which serve as backup players. They must decide which players play which positions and which types of offensive and defensive plays most effectively use the skills of their players. In other words, to consistently be successful in winning games, team managers must not only have a proper long-term strategy, but, within

<sup>3</sup> Adapted from "Board Briefing on IT Governance," 2nd Ed., IT Governance Institute, Rolling Meadows, IL, 2003 ([www.itgi.org](http://www.itgi.org)).

any sports season, must manage the players in a way that takes best advantage of team strengths and weaknesses. They must fit all the pieces of the team together in a way that maximizes team success. That is, they must implement the best mix of players and plays to maximize the effectiveness of the team in achieving the objective: winning games. The managers and coaches have systematic, regular steps that they consistently apply to manage the long-term and short-term success of the team. Without these systematic, regular steps, the team would not be successful when playing against other well-managed teams. The team play would be too chaotic and unorganized to play successfully. For example, a playground, pick-up basketball team could never hope to succeed against a professional NBA basketball team.

These two processes of long-term development and short-term management are similar to the functions of the IT governance committee and the SDLC. The IT governance committee should constantly assess the long-term strategy of the company and determine the type of IT systems to purchase, develop, and use that will help the organization achieve its objectives. Once the IT governance committee has determined the priority it places on various IT systems, the SDLC is the process that manages the development, implementation, and use of those IT systems. Much like players on a team, the various parts of the IT system must fit together in a way that maximizes the overall effectiveness and efficiency of the company operations. In addition, much like the salary caps in professional sports, there is a limit to the funds that a company can spend to purchase, develop, and implement IT systems. With limited funds available, the proper long-term and short-term management of IT systems becomes very critical. The organization must strategically manage IT systems to achieve maximum effectiveness of the systems at a cost that matches the IT budget. Similar to the sports team example, the lack of systematic, regular steps to strategically manage the IT systems leads to chaotic and unorganized IT systems. In such an unorganized environment, the company is less likely to be successful in competing against other companies and may struggle to survive.

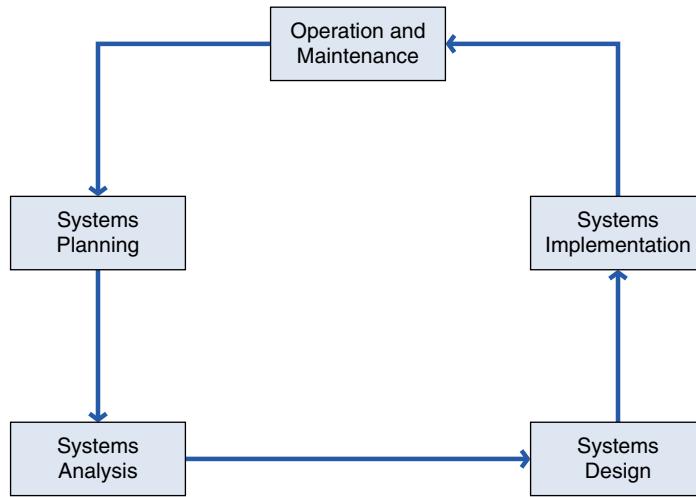
## An Overview of the SDLC (Study Objective 2)

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The systems development life cycle (SDLC) is a systematic process to manage the acquisition, design, implementation, and use of IT systems. The oversight and management of the SDLC is normally the responsibility of the IT governance committee. The IT governance committee is usually made up of the top managers of the organization, including the chief executive officer (CEO), the chief financial officer (CFO), the chief information officer (CIO), top managers from user departments, and top management from internal audit. In addition to developing a long-term vision and objectives for IT systems, the IT governance committee oversees the SDLC.

In the early days of computers, most organizations had to develop, program, and implement accounting software in-house. It was not feasible to buy accounting software, nor was it available at a reasonable price. During that time, the SDLC was a systematic set of regular steps to accomplish the IT systems selection, design, programming, and implementation. The phases of the SDLC are depicted in Exhibit 5-1 and are briefly defined as follows:

1. **Systems planning** is the evaluation of long-term, strategic objectives and the prioritization of IT systems in order to assist the organization in achieving its objectives. Systems planning also involves the planning and continuous oversight of the design, implementation, and use of those IT systems.



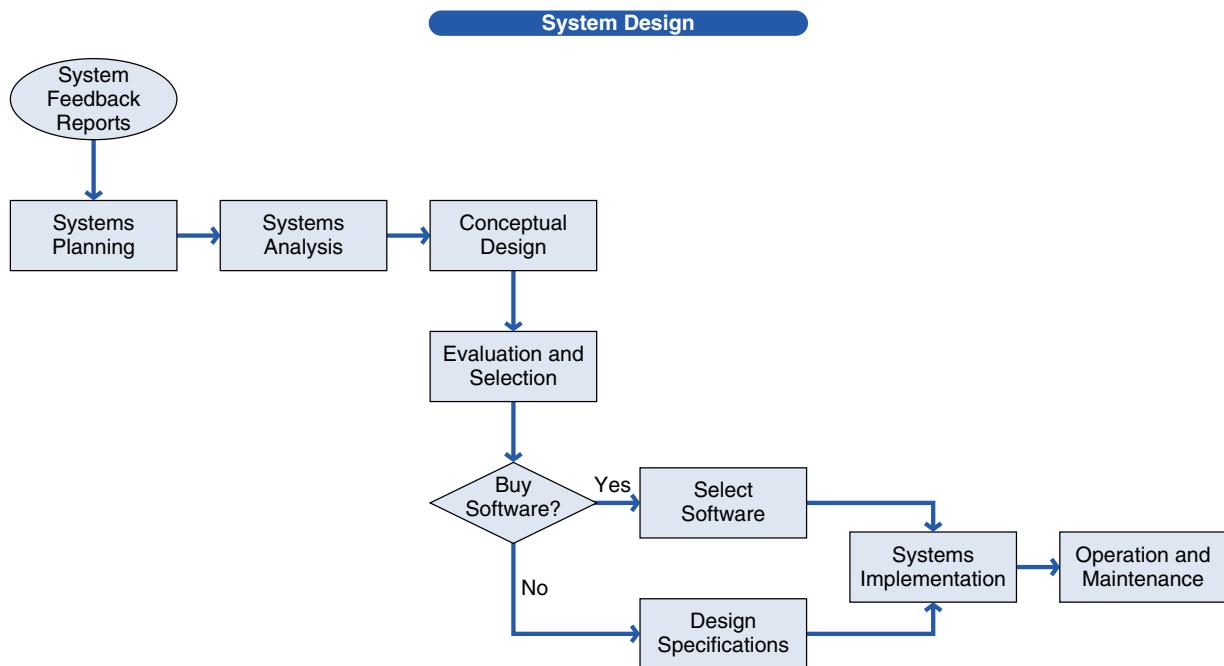
**EXHIBIT 5-1** An Overview of the Systems Development Life Cycle

2. **Systems analysis** is a study of the current system to determine the strengths and weaknesses and the user needs of that system. Analysis requires the collection of data about the system and the careful scrutiny of that data to determine areas of the system that can be improved.
3. **Systems design** is the creation of the system that meets user needs and that incorporates the improvements identified by the systems analysis phase.
4. **Systems implementation** is the set of steps undertaken to program, test, and activate the IT system as designed in the system design phase.
5. **Operation and maintenance** is the regular, ongoing functioning of the IT system and the processes to fix smaller problems, or “bugs,” in the IT system. During operation, management should request and receive ongoing reports about the performance of the IT system.

Notice that the SDLC is a cycle that eventually loops back to systems planning. This is true because the IT governance committee must continually evaluate how well the current IT systems match the company's strategic objectives. At some point, the IT governance committee will most likely find it necessary to go back through the phases of the SDLC to design new and improved IT systems.

As computers and IT systems have become more complex, more comprehensive, and more common, some steps in the phases in the SDLC have evolved to be slightly different. The major difference now, compared with earlier days of computers, is that the majority of companies purchase the accounting software they use rather than designing and programming the software in-house. However, even when accounting software is purchased, it may require extensive modification to make it fit the organization's needs. Therefore, even when purchasing accounting software, it is important to use a systematic, regular set of steps to evaluate, purchase, modify, and implement the software. The SDLC phases may be slightly different, but still comprise necessary steps for the proper strategic management of IT systems.

The remaining sections of this chapter describe the phases and steps of the SDLC in the modern IT environment. A process map overview of a typical SDLC appears in Exhibit 5-2. Not every organization follows each of these steps in the exact sequence shown; the SDLC phases can vary from organization to organization. The more important factor is that an organization follows a set of logical, systematic steps when modifying or adopting new systems. The exact steps and their sequence are not as critical as the need to formalize and conduct those steps completely and



**EXHIBIT 5-2** Process Map of the System Development Life Cycle (SDLC)

consistently. As a corollary, think about how companies conduct their budgeting procedures. Different companies may go about building their budgets in different ways. Some may use a bottom-up approach where lower level managers build budgets for their area and those budgets are submitted up the chain of management where they are consolidated into one overall budget. Other companies may budget from the top down. In either case, the method chosen should fit the company. The important factor is that the company has a working budgeting process, not whether it uses a particular method. Likewise, it is important that the SDLC have a logical sequence of phases, but those phases may vary slightly from company to company.

The process map shows the same phases as the SDLC overview in Exhibit 5-1, but with an expanded set of processes within the system design phase. These expanded processes are necessary because there is usually more than one software or system type that meets the needs of the organization. For example, if a company wishes to modify the payroll processes and systems in use, there are several ways to approach the modification. First, the company could do time-keeping in-house, but outsource the actual payroll processing to a payroll processing firm. Second, the company could buy or write a stand-alone payroll processing program. As a third alternative, the company could buy or write an integrated payroll system as part of a more comprehensive human-resource-management software system. To guide this process of designing a new payroll system, the company should have defined steps that identify the alternative system approaches, evaluate the fit of each alternative to the company's needs, select the best fit, and design or buy that system.

The process map in Exhibit 5-2 shows these various phases of the SDLC. **Conceptual design** is the process of matching alternative system models with the needs identified in the system analysis phase. **Evaluation and selection** is the process of assessing the feasibility and fit of each of these alternative conceptual approaches and selecting the one that best meets the organization's needs. The best system may be either software that can be purchased, or a system designed and developed

in-house. If software is to be purchased, the company must undergo a set of steps called **software selection** to select the best software for its needs. When systems are to be developed in-house, the company must undertake steps to design the details of that system. **Detailed design** is the process of designing the outputs, inputs, user interfaces, databases, manual procedures, security and controls, and documentation of the new system.

## The Phases of the SDLC

The sections that follow build upon the overview of the SDLC phases, examining each phase in detail. As mentioned previously, it is important to remember that the descriptions presented here are for a typical set of phases and steps within the SDLC and are not intended to imply that every organization must follow these exact steps.

## Elements of the Systems Planning Phase of the SDLC (Study Objective 3)

Systems planning is a managerial function of the IT governance committee. The IT governance committee must constantly monitor the IT system through feedback about network utilization, security breaches, and reports on the operation of the system. This constant monitoring allows the IT governance committee to determine whether the current system meets organizational needs. When the committee determines that a part or parts of the IT system are not meeting organizational needs, it should begin the process to study and evaluate the feasibility of modifying or updating those parts of the system. The IT governance committee will also receive specific requests from those who use the IT systems to modify or upgrade parts of the system. This means that at any one time the IT governance committee may be considering not only modifications or upgrades that they have noted need attention, but also upgrades or modifications requested by users. Usually, it is not possible to simultaneously modify or upgrade all of these areas. The IT governance committee must have procedures to follow that will assist it in prioritizing the most important needs of the IT system for immediate modification or upgrade.

### The Real World

Before Allstate Insurance Co. formed a capital spending committee with IT governance responsibilities, the process of prioritizing IT projects typically was decided by “whoever spoke the loudest or whoever had the biggest checkbook,” said Chief Technology Officer Cathy Brune.<sup>4</sup>

Now Brune and some top Allstate executives, including the chairman and CEO and the chief

financial officer, collectively decide how to prioritize IT initiatives based on business needs. “They help me decide where to spend our money,” Brune said, noting that their approach to IT governance gives the business executives a better understanding of the IT spending process.<sup>5</sup>

<sup>4</sup> Thomas Hoffman, “IT Governance Is on the Hot Seat,” *ComputerWorld*, July 12, 2004, pp. 6–8.

<sup>5</sup> *Ibid.*

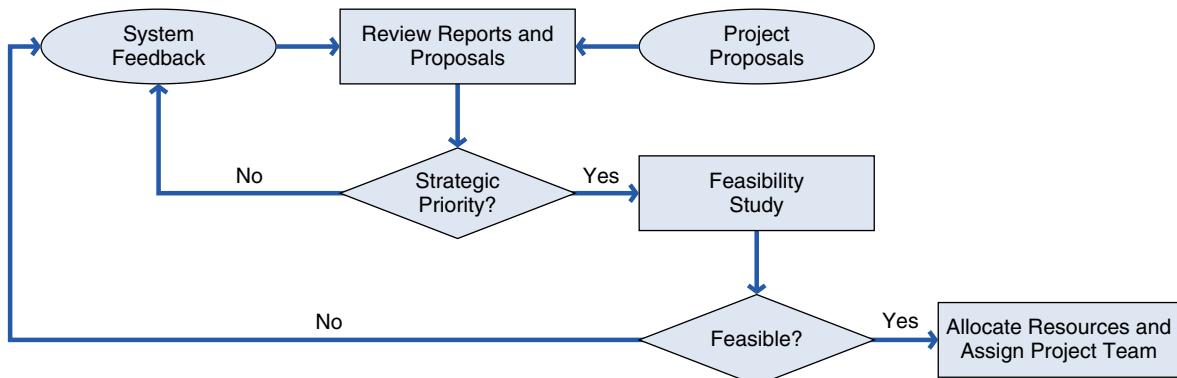


EXHIBIT 5-3 Systems Planning Process Map

The old approach at Allstate did not lead to selecting the IT systems that best empowered the company to achieve its strategic objectives. A better approach is to follow a system for prioritizing IT changes. To prioritize these projects, the IT governance committee should consider two broad aspects: (1) the assessment of IT systems and their match to strategic organizational objectives, and (2) the feasibility of each of the requested modifications or upgrades. In addition, the IT governance committee must plan and manage the design, implementation, and use of those IT systems. Exhibit 5-3 details the systems planning process.

## The Match of IT Systems to Strategic Objectives

The IT governance committee must evaluate proposed changes to IT systems in terms of their usefulness in assisting the organization to achieve its objectives. Evaluating the match of proposed IT changes to strategic objectives will allow the IT governance committee to begin prioritizing the desired changes. For example, suppose that a company has decided that a main strategic objective is to improve customer satisfaction. If the IT governance committee has received requests to begin modifications of the customer order entry system and the payroll system, they are likely to place a higher priority on the customer order entry system, since it will affect the service and satisfaction of customers. The payroll system modifications may be of a lower priority because such a change does not match as well with the strategic objective of improved customer satisfaction.

This need to match IT systems to organizational objectives also highlights the need for the IT governance committee to include as its members top management such as the CEO, CFO, CIO, and other high-level managers. Since these managers establish strategic objectives, they are in the best position to assess the fit of IT systems to those objectives. In addition, top management has the authority to allocate resources and time to these projects that will modify or upgrade IT systems. Lower-level managers would not have the authority or gravitas within the organization to push through IT changes.

## Feasibility Study

In addition to examining the match of IT systems to strategic objectives, the IT governance committee should evaluate the feasibility of each competing proposal. Feasibility refers to the realistic possibility of affording, implementing, and using

## The Real World

Top management at Anheuser-Busch Companies, Inc., has been very determined to use IT to improve beer sales. Significant investments of time, effort, and money are necessary to achieve the goal.

"The beer industry was historically a technological laggard. Distributors and sales reps returned from their daily routes with stacks of invoices and sales orders, which they would type into a PC and dial in to breweries. They, in turn, would compile them into monthly reports to see which brands were the hottest. But Anheuser changed the rules in 1997, when chairman August Busch III vowed to make his

company a leader in mining its customers' buying patterns.<sup>6</sup>

This data-mining example is discussed in more detail in Chapter 10 but is included here to emphasize that the use of sophisticated IT systems to do data mining was a strategic objective of the company championed by the chairman, August Busch III. Such initiatives cannot be successful without the support of high-level managers, who control the resources necessary to successfully implement IT systems. Top-level managers must become strong supporters of improved IT systems if problem-solving systems are to be successfully integrated into the organization.

the IT systems being considered. There are four feasibility aspects that should be considered—remember them by the acronym TOES:

1. **Technical feasibility**—assessment of the realistic possibility that technology exists to meet the needs identified in the proposed change to the IT system.
2. **Operational feasibility**—assessment of the realistic possibility that current employees will be able to operate the proposed IT system. If the operation will require new training of employees, this assessment should evaluate the feasibility of providing training to existing employees.
3. **Economic feasibility**—assessment of the costs and benefits associated with the proposed IT system. Is it realistic to conclude that the benefits of the proposed IT system outweigh the costs?
4. **Schedule feasibility**—assessment of the realistic possibility that the proposed IT system can be implemented within a reasonable time.

As the IT governance committee studies and assesses each of these aspects of feasibility, it can better understand which proposed changes should have higher priorities. As an analogy to this process, think about how you chose your major in college. There are several majors that might have been possible for you. Perhaps you were considering an accounting major, a marketing major, and future law school as potential choices. To narrow your alternatives, you had to think about which major best fit your skills, talents, knowledge, and abilities. You had to assess the realistic possibilities of each major. It was probably true that you could rule out some majors as not at all feasible. But there may have been three or four that were realistically possible for you. You had to assess each of those potential majors from several aspects and decide which single major was best for you. Likewise, the IT governance

<sup>6</sup> Kevin Kelleher, "66,207,896 Bottles of Beer on the Wall," *Business 2.0*, February 25, 2004 (<http://www.cnn.com/2004/TECH/ptech/02/25/bus2.feat.beer.network/>).

committee may rule out some proposed changes to the IT system as not feasible at all. Among those that remain, some IT changes are more feasible than others. The studies of technical, operational, economic, and schedule feasibility allow the IT governance committee to decide which proposed IT changes should have the highest priority.

Using both the strategic objective match and the feasibility study, the IT governance committee can prioritize the various proposed changes to the IT system.

## Planning and Oversight of the Proposed Changes

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After the IT governance committee has prioritized the proposed changes, it must decide which changes can be undertaken at the current time. Basing its decisions on the budget, resources, and time available, the IT governance committee may find that there are only one or two proposed changes that can be undertaken. Those proposed changes that must be delayed may be reviewed again in the future when the IT governance committee reassesses the strategic match of IT and feasibility. These processes are ongoing.

For the sake of further analysis, let us assume that the IT governance committee has decided that only one proposed IT system change can be undertaken at this time. The committee should do several things to initiate the next phases of the SDLC:

1. Formally announce the project they have chosen to undertake.
2. Assign the project team that will begin the next phase, the systems analysis.
3. Budget the funds necessary to complete the SDLC.
4. Continue oversight and management of the project team and proposed IT changes as the remaining SDLC phases occur.

## Elements of the Systems Analysis Phase of the SDLC (Study Objective 4)

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Exhibit 5-4 illustrates typical steps within the systems analysis phase of the SDLC: a preliminary investigation, a survey of the current system, a determination of user information needs, analysis, and business process reengineering. At the end of this phase, the project team will prepare and deliver a systems analysis report.

### Preliminary Investigation

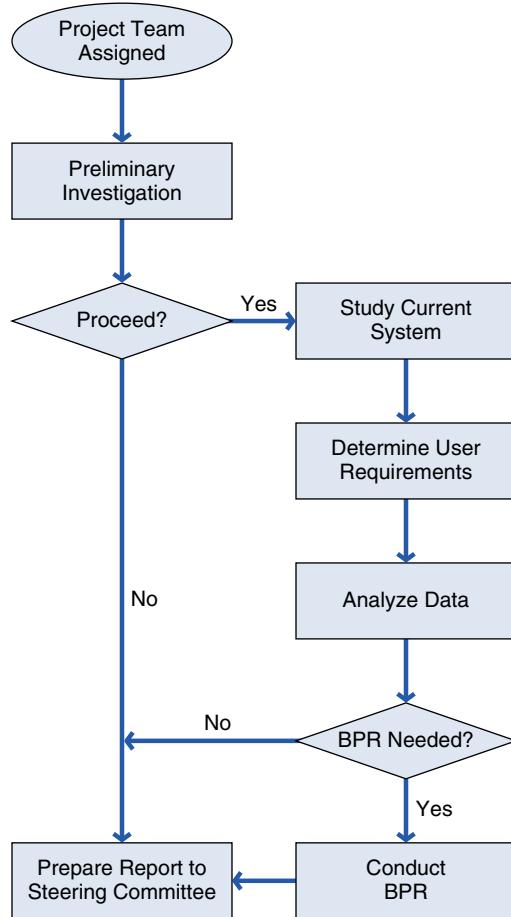
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The preliminary investigation occurs within a short period ranging from a few hours to a few days and should not exceed two to three days. The purpose of the preliminary investigation is to determine whether the problem or deficiency in the current system really exists. The project team may reexamine some of the feasibility aspects of the project. At this point, the purpose is to make a “go” or “no-go” decision. The end result is a decision to proceed further or to abandon the project.

### System Survey: The Study of the Current System

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In most cases, it is easier to improve something only when you have a good understanding of it. For example, it would be difficult for you to improve on the fuel efficiency of a car if you did not know details about how gas is used in the car, what



**EXHIBIT 5-4** Systems Analysis Process Map

quantities of gas the car uses, and which characteristics of the car affect fuel efficiency. Likewise, we cannot improve the efficiency and effectiveness of the IT system in use without first knowing such details about the system as transaction volumes, processes within the system, and controls within the system. All of these factors and others affect the throughput of an accounting system. **Throughput** is a measure of transactions per period. The **systems survey** is a detailed study of the current system to identify weaknesses to improve upon and strengths to be maintained. A systems survey requires collecting data about the current system, including the following:

- Inputs—sources of data
- Outputs—the uses of information from processing and outputs such as checks, reports, or forms
- Processes—the individual steps undertaken to process transactions, including both manual and computerized processes
- Controls—the internal controls within the processing system
- Data storage—how and where data is stored, and the size of the data storage
- Transaction volumes—number of transactions per day or per hour
- Errors—number of transaction processing errors

The exact data collected in a systems survey may vary from project to project or company to company, and the foregoing list shows the usual data collected. As noted in this list, different kinds of data must be collected from several different sources.

Some data collection may involve asking employees or managers questions, while other data collection may require examining documents such as operating manuals or flowcharts. The data collection in a systems survey requires several different methods of collecting data from different sources. Data collection involves observation, documentation review, interviews, and questionnaires. A project team would use each of these methods to collect the necessary data. The first two methods are described in this section, and the final two are described in the section that follows.

**Observation** is watching the steps that employees take as they process transactions in the system. The purpose of the observation is to enable the project team to gain an understanding of the processing steps within the system. **Documentation review** is the detailed examination of documentation that exists about the system to gain an understanding of the system under study. The project team would examine any relevant documentation about the system, such as flowcharts, run manuals, operating manuals, input forms, reports, and outputs.

## Determination of User Requirements

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While observation and documentation review are important methods of data collection, neither method actually seeks the views or thoughts of users of the system. By these methods, the project team members capture only those strengths and weaknesses within the system that they notice. To gain a complete understanding of the system under study, the project team should not only observe and review documentation, but also seek the opinions and thoughts of those who use the system.

Interviews and questionnaires are data collection methods that solicit feedback from users of the system. These are critical parts of the data collection, because it is of utmost importance that users have input into the development of a new or revised system. Since users are the people who input data or use output reports on a daily basis, the system must satisfy the needs of these users. The user perspective and perception about the current system are an important part of the information that the project team needs to collect in order to benefit from a system survey. Interviews are a data collection method that help the project team in determining user needs.

**Interviews** are the face-to-face, verbal questioning of users to determine facts or beliefs about the system. The questions asked can be structured, unstructured, or some mixture of the two. A structured question is designed such that the format and range of the answer is known ahead of time. An unstructured question is completely open-ended, and the respondent is free to answer in any way that he feels addresses the question. The difference between structured and unstructured questions is similar to the difference between multiple choice and essay questions. The multiple choice question has predetermined answers in a certain format, whereas the format and content of an essay answer are much more flexible for the person answering the question. Both types of questions can be used in interviews to solicit feedback from users about how they use the system and about strengths and weaknesses in the current system. The face-to-face nature of interviews provides advantages. The interviewer can clarify any misunderstandings about the question and can follow up with more questions, depending on the response of the interviewee. Both the interviewer and interviewee are more likely to understand each other when communication is verbal and face-to-face.

Questionnaires are also used to solicit feedback from users. However, **questionnaires** are a written, rather than an oral, form of questioning users to determine facts or beliefs about the system. Questionnaires can also include both structured and unstructured questions. There are advantages to the use of questionnaires. Questionnaires can be answered anonymously, which allows the respondent to be

more truthful without fear of negative consequences. Similar to the anonymous instructor-evaluation forms used in college classes—wherein the student can be completely frank in his or her evaluation of a professor, since responses are anonymous—a respondent to a systems questionnaire can answer the questionnaire fully and truthfully. The other advantage to questionnaires is efficiency; that is, it is much easier and less time-consuming to process 100 questionnaires than it is to personally interview 100 users.

## Analysis of the System Survey

The analysis phase is the critical-thinking stage of the systems analysis. The purpose is to question the current approaches used in the system and to think about better ways to carry out the steps and processes in the system. The project team studies the information collected in the system survey phase and attempts to create improvements to the system.

In many cases, the analysis phase and the attempt to create improvements may lead to **business process reengineering (BPR)**. BPR has been defined as “*fundamental rethinking and radical redesign of business processes to bring about dramatic improvements*” in performance.<sup>7</sup> Business processes are the many sets of activities within the organization performed to accomplish the functions necessary to continue the daily operations. For example, every organization has a process to collect and record the revenue earned. In a smaller company, the revenue collection process may simply be a single person who mails bills, receives customer checks in the mail, totals the checks, records them in the accounting records, and deposits the funds. Through rethinking and redesigning this process, the company may be able to improve the process and thereby speed up the collection of revenue. This rethinking and redesign is especially aided by the use of IT. When technology or computers are introduced, the processes can be radically redesigned to take advantage of the speed and efficiency of computers to improve processing efficiency. IT and BPR have a mutually enhancing relationship. IT capabilities should support the business processes, and any business process should be designed to match the capabilities that the IT system can provide. BPR should leverage the capabilities of IT to improve the efficiency of processes. As discussed earlier, Anheuser Busch uses extensive IT systems to improve the forecasting of customer buying patterns. This IT system and the processes that match it enable Anheuser Busch to keep customer store shelves stocked with the right amount of its various beer brands.

BPR will probably begin at this stage of the SDLC, but it may continue through several phases of the SDLC. As the project proceeds through the phases of the SDLC and the team begins to design and implement improvements to the system, more BPR may be necessary to match the processes to the system.

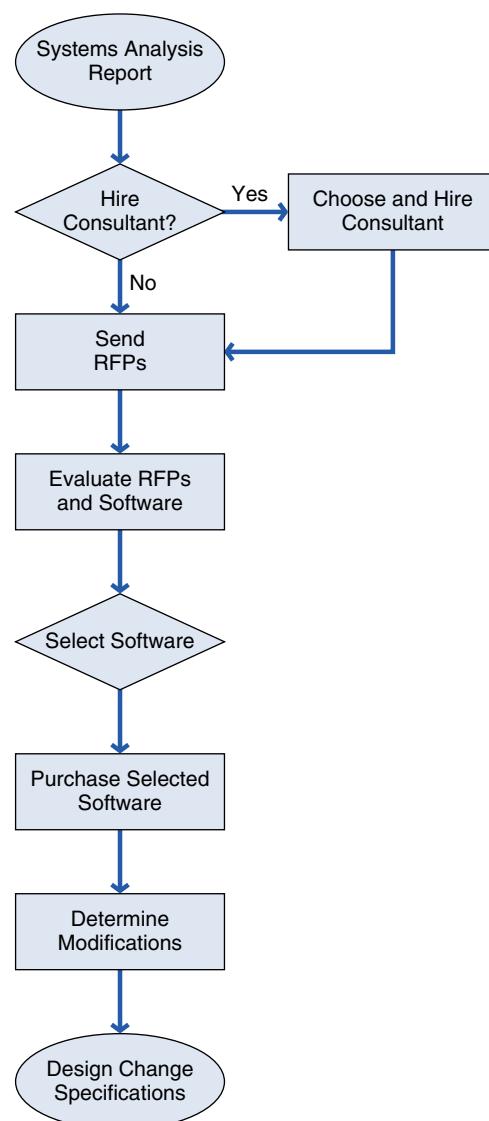
## Systems Analysis Report

The last step in the systems analysis phase is to prepare a systems analysis report for delivery to the IT governance committee, which will inform the IT governance committee of the results of the systems survey, user needs determination, and BPR. The report will make recommendations to the IT governance committee regarding the continuation of the project.

<sup>7</sup> Michael Hammer and James Champy, *Reengineering the Corporation, Revised Edition*, New York: HarperCollins Publishers, Inc., 1993, p. 32.

## Elements of the Systems Design Phase of the SDLC (Study Objective 5)

The nature of the steps within the design phase of the SDLC is different, depending on whether the organization intends to purchase software or design the software in-house. Much of the software used by organizations today is purchased. However, even when software is purchased, it is likely to be modified or customized to suit the specific needs of the organization. Therefore, there are similarities in the steps of the system design phase when software is purchased and when it is designed and written in-house. Exhibit 5-5 shows the typical steps undertaken when software is purchased.



**EXHIBIT 5-5** System Design Process Map for Purchased Software

## The Purchase of Software

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When the project team has reached the design phase, user needs and system requirements have previously been determined in the systems analysis phase. Therefore, the project team is ready to solicit proposals from different software vendors for accounting systems that satisfy the identified user needs and meet the system requirements.

Often, an organization hires a consultant to assist in the selection, design, and implementation of purchased software. If the organization intends to hire a consulting firm, such hiring may take place at this point. However, it is important to understand that a consultant could be hired for any part or parts of the SDLC. The hiring of the consultant is mentioned at this point (see Exhibit 5-5) to show how consulting firms may be used throughout the SDLC.

The process to solicit proposals is called a **request for proposal**, or **RFP**. A RFP may be sent to each software vendor offering a software package that meets the system and user needs. When the vendor returns the RFP, it will include details such as a description of the software that it intends to sell, the technical support that it intends to provide, and the related prices.

Once all RFPs have been received, the project team and IT governance committee should evaluate the proposals in order to select the best software package. There are many things that the project team and IT governance committee should consider when evaluating each proposal, such as the following:

1. The price of the software or software modules
2. The match of system and user needs to the features of the software
3. The technical, operational, economic, and schedule feasibility
4. Technical support provided by the vendor
5. Reputation and reliability of the vendor
6. Usability and user friendliness of the software
7. Testimonials from other customers who use the software.

The project team or IT governance committee must choose one of the several competing software products. The technical feasibility is an assessment of whether or not the existing computer hardware, or hardware to be purchased, represents adequate computing power to run the software. The operational feasibility refers to the capability of the existing staff of employees and any planned new hires to use the software as it is intended. The economic feasibility refers to the cost–benefit analysis of each software package. The cost–benefit analysis is a comparison of costs with benefits. The schedule feasibility is an analysis of the time to install and implement each software package. From the evaluation of these factors, the software system that best fits the organization’s needs will be selected and purchased.

In general, purchased software is less costly and more reliable and has a shorter implementation time than software designed in-house. Purchased software has these advantages because it is written by the software vendor, its cost is spread over several clients, and the coding and testing are already complete when a customer buys the software. However, nearly every organization has unique needs or circumstances that may not match the software exactly. There is often a need to customize the software or the reports within it. The project team should develop design specifications for any modifications to the software or the reports. In the case of major modifications to purchased software or in the case of in-house design, the system design phase would include specific steps to design the outputs, inputs, processes, controls, and data storage of the revised system. The next section describes the steps of the in-house design phase.

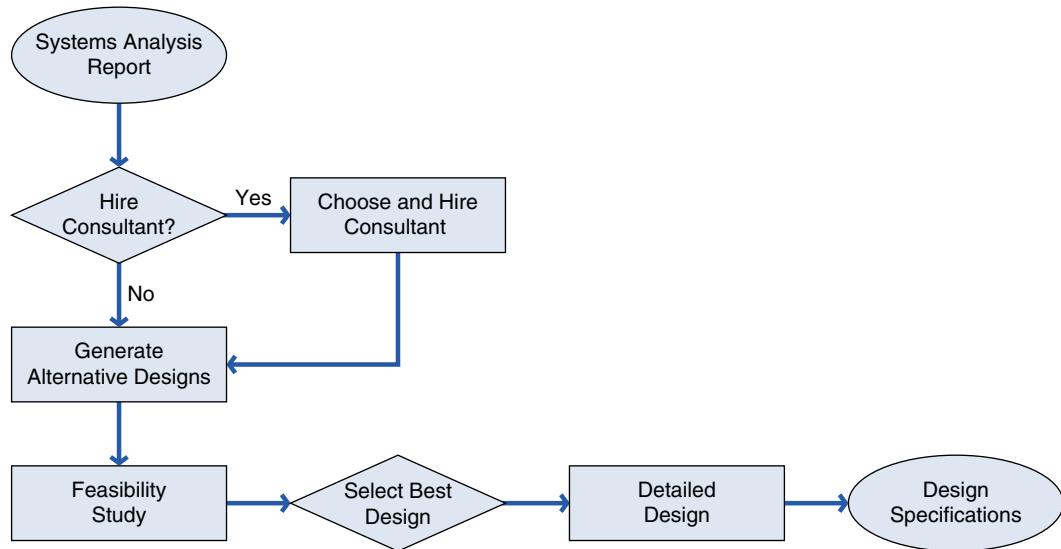


EXHIBIT 5-6 System Design Process Map for In-House Design

## In-House Design

As discussed in the previous section, the systems analysis report identifies user needs and system requirements. Exhibit 5-6 shows a process map for the in-house design of accounting system software, with the systems analysis report containing the input information to begin this phase.

**Hiring a Consultant** As discussed, while it is not necessary to hire a consulting firm, many organizations find that the special expertise of consulting firms is most beneficial in the design and implementation of accounting system software. Such firms have a broad range of expertise, assisting many different types of organizations with many different types of software systems. The choice of whether to use a consultant and the point at which to hire one are fully dependent on the extent of in-house expertise available within the organization.

## Conceptual Design

Whether or not a consulting firm is hired, the next step is the **conceptual design** phase, which involves identifying the alternative conceptual design approaches to systems that will meet the needs identified in the system analysis phase. This step could be viewed as a sort of “brainstorming” to generate the different conceptual approaches in a system design that will meet the identified needs. In the case of purchased software, this step is taken by sending RFPs to several software vendors. In the case of in-house design, the project team must identify different conceptual design approaches. For example, there are different types of payment processing available to organizations to receive and pay invoices. The different approaches range from a traditional system that matches the purchase order, receiving, and invoice documents and involves relatively little complex technology to a Web-based electronic invoice presentment and payment (EIPP) system. The EIPP system is a “matchless” system in which invoices are paid as soon as they are electronically delivered; there is no matching of documents prior to the approval and payment of the

invoice. While both of these systems accomplish the payment of invoices, they each rely on technology differently. The EIPP system requires more complex and advanced technology and fewer manual steps. The traditional document matching requires simpler technology and involves more manual tasks. These are examples of different conceptual design approaches. The project team should identify the different conceptual designs that meet the identified needs.

## Evaluation and Selection

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When the conceptual designs are identified, the project team must evaluate the alternatives and choose the best design. **Evaluation and selection** is the process of assessing the feasibility and fit of each of the alternative conceptual approaches and selecting the one that best fits the organization's needs. The evaluation process includes a more detailed feasibility study, with the same set of feasibility assessments identified earlier examined in detail for each of the conceptual designs. The feasibility assessments in the study include the following:

1. Technical feasibility
2. Operational feasibility
3. Economic feasibility
4. Schedule feasibility

In this phase, the assessment of each feasibility aspect is more detailed and the scope of the study is much different from the feasibility study in the systems planning phase.

As you may recall, the purpose of the feasibility study in the systems planning phase was to assist the IT governance committee in determining which of the several different systems within the organization has the highest priority. For example, the IT governance committee might have been trying to determine whether revising the order entry system is more important than revising the invoice payment system. Assume that the IT governance committee decided that the invoice payment system is the higher priority. The end result of the system planning phase would be to announce this decision and to assign resources and a project team to begin the revision of the invoice payment system. Now we move forward through the other phases. In the conceptual design phase, the project team identified a traditional invoice-matching system and a Web-based invoice payment system as the alternative conceptual designs. At the point of evaluation within the design phase, the project team must now evaluate whether the matching or Web-based system better meets organizational needs, and select the optimal system.

Since the project team has a more narrow and defined scope, the estimates of the technology needed, the operational requirements, the economic aspect, and the schedule for implementation can be more precise than in the systems planning phase. The project team may be able to attach quantifiable measurements to these feasibility assessments, such as dollars, weeks, or number of employees needed.

The project team should study each aspect of the feasibility assessment for each of the alternative conceptual designs. Examples of the type of assessments and analysis the project team would make are described in the following list:

1. *Technical feasibility.* The project team will assess the technical feasibility of each alternative conceptual design. In general, designs that require more complex technology have a lower feasibility than designs with less complex technology. The project team may place a numeric score on the technical feasibility.

For example, on a scale of 1 to 10, the invoice-matching system may be scored as a 10, because the lower technology requirements make it much easier and less risky to acquire and/or implement. The Web-based system may be scored as a 5, since the technology is more complex and thus more risky to acquire and implement.

2. *Operational feasibility.* The project team will assess the realism of the possibility of operating each of the alternative designs. During this process, the team must consider the number of employees, their capabilities and expertise, and any supporting systems necessary to operate each alternative design. The team attempts to determine whether existing staff and support systems are adequate to operate the systems. For example, with a given staff size, a highly computerized system such as a Web-based system may be more operationally feasible, because it would require fewer staff members to operate. However, the staff using the system probably needs more computer expertise. Also, to implement a Web-based system, there must be an adequate number of reliable vendors and a high degree of trust between the company and its vendors. This is true because any invoice presented will be paid, without matching supporting documents. In summary, all of the support staff and underlying supporting systems must be examined, with the intention of assessing how easily the company could operate each alternative system design. Again, the project team may assign numerical assessment on a scale to indicate the relative operational feasibility.
3. *Economic feasibility.* The project team must estimate the costs and benefits of each alternative design. The costs and benefits can be compared by a formal cost-benefit method such as net present value, internal rate of return, or payback period. The purpose of this analysis is to determine which of the alternative designs is most cost effective. The costs of the system designs might include hardware and software costs, training expenses, and increases in operating and supplies costs. These examples of systems-related costs do not represent a complete list. Benefits might include cost savings from reductions in staff, increased operating efficiency, and elimination of non-value-added steps. Cost savings should be compared with the cost of a system by a formal analysis that allows the organization to determine whether tangible benefits outweigh costs. When a company is revising systems, there are also intangible benefits that are difficult to estimate in dollars. For instance, an improved accounting system might result in better feedback to management and, therefore, improved decision making. However, it is very difficult to place a dollar value on improved decision making. Since it may not be possible to estimate the dollar amount of intangible benefits, they cannot be included in an analysis such as net present value. The project should not ignore the intangible benefits, however. The report of the project team should include a written description of the intangible benefits.
4. *Schedule feasibility.* For each alternative design, the project team must estimate the total amount of time that will be required to implement the revised system. The designs that take longer to implement are less feasible.

The project team must summarize and analyze the results of these four feasibility tests for the purpose of selecting the single best design from the alternatives available. The task of summarizing and analyzing can become difficult because there may be conflicting signals across the four feasibilities. For example, a system may have high benefits when costs are compared (economic feasibility), but it may also require a longer time to implement (schedule feasibility). The team must then

assess the trade-offs involved in a high benefit project that requires a long implementation time. In most cases, the cost-benefit analysis is the most important of the four tests. However, any one of the four feasibilities can cause the team to drop an alternative design. For example, a design that meets all other feasibilities, but cannot be operated by the company's staff (operational feasibility) would not be selected.

## Cloud Computing as a Conceptual Design

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At some point in the SDLC, managers might consider cloud computing as part of the conceptual model or approach to their IT system. You may recall from previous chapters that there are several approaches to cloud computing, including public clouds, private clouds, Software as a Service (SaaS), Database as a Service (DaaS), Infrastructure as a Service (IaaS), and Platform as a Service (PaaS). Regardless of the approach the company considers, the incorporation of cloud computing requires a careful, controlled approach to system design. This means the team conducting the SDLC must consider the risks, costs and benefits, and feasibility of the cloud computing approach. Cloud computing can entail greater security, availability, processing integrity, and confidentiality risks (as described in chapter 4), and these must be appropriately weighed against the benefits of scalability, expanded access, cost savings, and IT infrastructure changes.

In addition to the risks and benefits mentioned here, there are other considerations related to adopting or increasing cloud computing usage, such as:

1. The customer support provided by the cloud vendor. It is important to fully understand the level and reliability of support provided by a cloud vendor.
2. The service level agreement (SLA) with the cloud provider. This contract should clearly specify the vendor's responsibilities, including the billing terms and expectations about allowable downtime.
3. The manner of monitoring cloud service usage. Since cloud computing is often a pay for service model in which the client pays for the level of service used, it is important that the client is able to monitor usage and reconcile billing with the actual service usage. As a simple analogy, you probably carefully review your cell phone bill to make sure you were not charged for more services than you used. Likewise, cloud computing clients must be able to track their usage of the cloud services and reconcile their measure of services used to the billing provided by the cloud vendor.

Ideally, any intent to move toward cloud computing, or any increase in the use of cloud computing, should follow the steps within the SDLC. These steps were previously described in this chapter to include systems planning, systems analysis, and the remaining steps of the SDLC. The inclusion of a discussion about cloud computing in the conceptual design section of this chapter does not imply that it is the only phase within the SDLC to consider cloud computing.

## Detailed Design

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The end result of the evaluation and selection phase of the SDLC is that the best alternative design is selected. Once the design has been selected, the details of that selection must be designed. The purpose of the **detailed design** phase is to create the entire set of specifications necessary to build and implement the system. The various parts of the system that must be designed are the outputs, inputs, processes,

data storage, and internal controls. Each of these parts must be designed in enough detail that programmers and analysts can develop the program code necessary to build the software system. However, the actual writing of program code is not part of the design phase. The coding of software occurs in the implementation phase.

Outputs of the system are reports and documents, such as income statements, aged accounts receivable listings, inventory status reports, and sales by product. Other outputs are documents or turn-around documents. For example, checks printed by the accounts payable system and invoices printed by the billing system are outputs. Each output of the system being revised must be designed in detail. The form and format must be designed. The form may be a printed report or a report viewed on the screen. The format is the actual layout of the report or document. The details of the rows and columns of data and how it appears on the report must be crafted. Since users need these reports on an ongoing basis as part of their jobs, it is critical to have user feedback in designing the details of output reports. If output reports do not meet the needs of the intended users, they are not very useful.

The organization needs customized output reports even when software is purchased rather than designed in-house. Therefore, when software is purchased, it is often necessary for the customer company to design detailed formats of output reports.

Inputs are the forms, documents, screens, or electronic means used to put data into the accounting system. There are many ways that data can be input, ranging from the manual keying in of data on a keyboard to computerized input such as bar code scanning. The project team must design the input method to fit the system being revised. For example, if the evaluation and selection phase results in the selection of an EIPP system, then invoices will be received electronically and there is no matching of the related documents. Therefore, there is no reason to design a paper copy of a receiving report. Instead, the project team must design the systems that will receive, read, and convert the electronic invoice. There are so many different forms of input that it is not possible to describe here the details of all possible forms. The overriding concern, regardless of the form of input, is ensuring the efficiency and accuracy of input. That is, the inputs must be designed to work efficiently and with as few errors as possible. Samples of the different methods of data input are as follows:

1. Keying in data with a keyboard from data on a paper form. The person operating the keyboard must enter data from a paper form into an input screen on the computer.
2. Magnetic ink character recognition (MICR) is used on checks and turn-around documents such as the portion of your credit card bill that you return. The computer system reads the magnetic ink to determine information such as account number.
3. Electronic data interchange (EDI), in which standard business documents are transmitted electronically.
4. Internet commerce, in which the customer enters customer and order data.
5. Bar code scanning, such as in the point-of-sale systems used by grocery and department stores.

In general, the manual input from item (1) is more error-prone and much slower than the other electronic methods of input. Regardless of the method, internal controls should be incorporated to reduce input errors. Input controls were described in the application control section of Chapter 4 and include electronic data validation controls such as validity checks, limit checks, and completeness checks.

In the case of purchased software, input screens are often modified to better suit the specific needs of the organization. Before the screens are modified, the project

team should follow the process of detailed design of the input screens and solicit user involvement. Lack of user input can result in screens that are difficult to use, resulting in input errors.

All details of the processes of the system must also be designed. As you may recall from your study of processes, there are many different processes in an accounting system. Each one usually requires many detailed steps. For example, processing payroll checks requires many steps, including timekeeping, calculation of gross pay and deductions, approvals for the payroll, and printing and distribution of checks. In the detailed design phase, all of the individual steps within a process must be designed. The project team again should have user input in designing these processes. Without user input, the processes may be designed in a way that makes it difficult or undesirable for users to use the system. Any such difficulties or reluctance by users to use the system can lead to efficiency problems or errors in the process.

The internal controls within the system must be designed during the detailed design phase. Internal controls are much more effective when they are designed into the processes from the beginning. Adding internal controls after the system has been implemented is much more difficult. To understand why this is true, let's think about the global positioning systems (GPSs) that are now built into some cars. When those cars were designed, the electronics, dashboard space, and dashboard controls had to be designed simultaneously. If you buy a car without the GPS and decide to add it later, your add-on system is likely to be less effective than a built-in GPS. Likewise, internal controls that are initially designed into the system are more effective. Chapter 4 described the types of controls that should be a part of IT systems.

An IT system must also have the proper amount and type of data storage to accomplish the functions it was designed to do. The data storage method and size must match the design of the inputs, processes, and outputs. The project team must design the method, size, and format of the data storage. For example, if data is to be stored in a relational database, the team must design all the elements, including the tables, the rows and columns within the tables, and the relationships between the tables. Chapter 13 on databases includes details about the storage and use of data in a relational database.

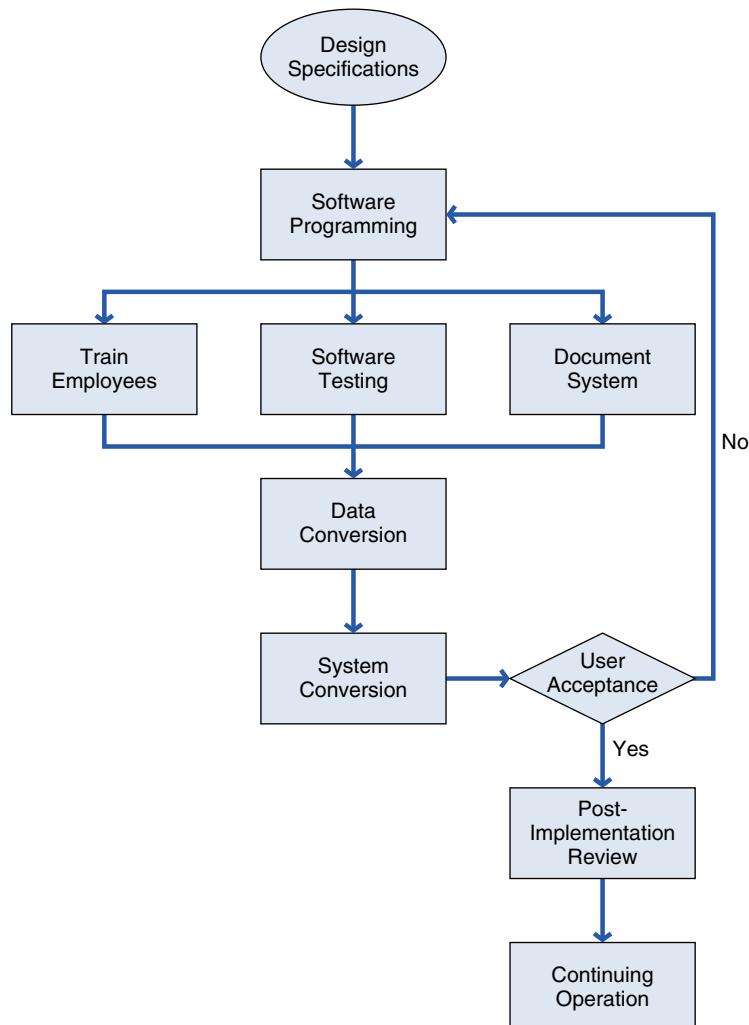
When the project team has completed the detailed design of outputs, inputs, processes, internal controls, and data storage, the implementation phase can begin.

## Elements of the Systems Implementation Phase of the SDLC (Study Objective 6)

There are many individual tasks that must be undertaken to implement a new or revised accounting system. This is true regardless of whether the software is purchased or designed in-house. Implementation time would be much shorter for purchased software, since the software has already been written and tested by the vendor. However, even purchased software is often modified, and those modifications should be coded and tested in the implementation phase. Exhibit 5-7 is a process map of the systems implementation and operation phase.

There are so many different tasks within the implementation and operation phase that it would be impossible to describe all of them in this chapter. Instead, a few of the critical steps are described.

As depicted in Exhibit 5-7, some tasks can occur simultaneously. The employee training, program testing, and documentation can all be undertaken at the same time. For example, the documentation does not need to begin after employee training.



**EXHIBIT 5-7** Implementation and Operation Process Map

## Software Programming

Using the design specifications developed in the detailed design phase, the programming staff would write the program code for the new or revised system. In the case of purchased software, the programming staff would modify the program code as necessary to meet the design specifications. While accountants may not be directly involved in programming, they would have frequent interaction with the programming staff to ensure that the programming meets the identified accounting requirements.

## Training Employees

As the programming is completed or nearing completion, employees should be trained to use the new system. Depending on the extent of changes from the old system, employees may need training in the use of new input screens, output reports, and processes.

## Software Testing

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As programmers complete the programming of the new system, the programs and the modules that make up the programs must be tested. Software should never be implemented before it is tested; otherwise, it can cause errors or problems in the accounting system and thereby result in erroneous accounting data. The most common way to test software is to use test data, which is specially created and entered into the software to ensure that the software works correctly. The test data approach is described in Chapter 7.

## Documenting the System

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Since inputs, outputs, and processes are very likely to change as systems are revised, it is important to write the documentation that matches the new inputs, outputs, and processes. There are many kinds of documentation necessary to operate and maintain an accounting system, including flowcharts, data flow diagrams, entity relationship diagrams, process maps, operator manuals, and data dictionaries. Unfortunately, many companies do not always rewrite documentation at this stage, even though they should. The lack of up-to-date documentation makes it much more difficult for new employees to understand the system and makes future revisions to the system more complicated.

## Data Conversion

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Though it is not always necessary, the implementation of a new or revised system may require that the data be converted to a new format. The file or database storage for the new system may be different from the storage format of the old system. In most instances, a conversion program can be written or acquired that will convert the data from the old to the new format. Accountants should oversee the data conversion process to make sure that all accounting data is completely and correctly converted. To check the accuracy of the conversion, accountants can reconcile control totals from the old data set to control totals from the converted data. These control totals should match for all converted data.

## System Conversion

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The system conversion is the actual changeover from the old to the new system. Often, this is called the “go-live” date. The go-live date is the day that the new system becomes fully in operation. There are several different conversion methods to choose from: parallel conversion, direct cutover conversion, phase-in conversion, and pilot conversion. Each of these methods has advantages and disadvantages, and the company should choose the method that best fits its situation.

**Parallel conversion** is a conversion method in which the old and new systems are operated simultaneously for a short time. For example, the company may run the old and new versions of a system in parallel for a one-month period. The advantage to the parallel conversion is that it is the least risky. If errors or problems become apparent in the new system, the company can continue to use the old system until the problems are resolved. However, the disadvantage is that parallel conversion is the most costly and time-consuming conversion method, since it requires that the operating staff operate two systems and input all data twice—once in each system.

**Direct cutover conversion** means that on a chosen date the old system operation is terminated and all processing begins on the new system. This method is in many ways the opposite of parallel conversion. Direct cutover is the most risky method, but the least costly and time consuming. Since systems are not run in parallel, there is no backup in the form of the old system if problems occur.

The **phase-in conversion** is a method in which the system is broken into modules, or parts, which are phased in incrementally and over a longer period. As an example, assume that a company is implementing an entirely new accounting system, using a phase-in approach. The company might first implement only the order-entry part of the system. If that is successful, it may then choose to phase in the accounts receivable module. When that is working well, it may then phase in the cash receipts module. The phase-in approach is a low-risk approach, as it does not disrupt large parts of the organization at the same time. However, it will take longer to phase in all the parts of the accounting system.

In a **pilot conversion**, the system is operated in only one or a few subunits of the organization. For example, suppose that a bank intends to implement new loan processing software at its branch offices. The bank may choose a few of its locations as pilot test sites for the software. The bank would implement the new software at the selected pilot sites and work out any problems in the system at those sites. Once the bank is satisfied with the operation at the pilot sites, the system can be implemented at the remaining sites.

## User Acceptance

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To ensure that user needs have been met, many organizations require a user acceptance at the end of the implementation of a new system. **User acceptance** means that when the manager of the primary users of the system is satisfied with the system, he will sign an acceptance agreement. The enforcement of user acceptance makes it much more likely that project teams will seek user input and that the project team will work hard to meet user needs.

## Post-Implementation Review

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A few months after implementation, the project team should review the SDLC steps for the project that was implemented. This **post-implementation review** is a review of the feasibility assessments and other estimates made during the process. The purpose of the review is to help the organization learn from any mistakes that were made. The review does not correct any errors made, but it helps the company avoid those same errors in the future.

## Elements of the Operation and Maintenance Phase of the SDLC (Study Objective 7)

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After implementation, the company will operate and maintain the system for some length of time. This part of the SDLC is the longest and most costly part, since it may last for several years. At some point, the company will need to make major revisions or updates to the system, which will trigger the SDLC to begin again to revise the system.

During the ongoing operation, management should receive regular reports regarding the performance of the IT system. The reports are necessary to monitor the performance of IT and to enable management to determine whether IT is aligned with business strategy and meets the objectives of the IT system. Some examples of these IT reports are the following:

- IT performance
  - IT load usage and excess capacity
  - Downtime of IT systems
  - Maintenance hours on IT systems
- IT security and number of security breaches or problems
- IT customer satisfaction, from both internal and external customers. Internal customers are the various users of IT systems within the organization.

These reports are an important part of IT governance, as they drive the continual monitoring of the IT system.

## The Critical Importance of IT Governance in an Organization (Study Objective 8)

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The establishment and use of an IT governance committee and an SDLC are critically important for an organization to accomplish IT governance. Three major purposes are served by the continual and proper use of the IT governance committee and the SDLC:

1. The strategic management process of the organization
2. The internal control structure of the organization
3. The fulfillment of ethical obligations

The manner in which the SDLC accomplishes these three purposes is described in the sections that follow.

### **SDLC as Part of Strategic Management**

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As discussed in the introduction of this chapter, IT systems are an extremely important resource in most organizations. IT systems improve efficiency, effectiveness, and long-term success of operations. Each organization may approach IT governance in a slightly different manner, but each organization should establish procedures for IT governance. The models presented in this chapter of an IT governance committee and a systems development life cycle are typical of IT governance. An SDLC process serves as the mechanism to continually assess the fit of IT systems to long-term strategy and short-run goals of the organization. Once the IT governance committee has identified which types of IT systems are appropriate for the organization, the SDLC becomes the mechanism to properly manage the development, acquisition, and implementation of IT systems.

### **SDLC as an Internal Control**

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Chapter 4 provided an overview of the AICPA Trust Services Principles and their role in the internal control structure of IT systems. These Trust Services Principles include many details about an IT governance committee and the SDLC and the role

Security 4.3 Environmental and technological changes are monitored and their effect on system security is assessed on a timely basis. *Senior management*, as part of its annual IT planning process, considers developments in technology and the impact of applicable laws or regulations on the entity's security policies. The entity's IT security group monitors the security impact of emerging technologies. Users are proactively invited to contribute to initiatives to improve system security through the use of new technologies.

Availability 2.5 Changes that may affect system availability and system security are communicated to management and users who will be affected. Planned changes to system components and the scheduling of those changes are reviewed as part of the monthly *IT steering committee* meetings.

Availability 3.9 Procedures exist to identify, report, and act upon system availability issues and related security breaches and other incidents. Network performance, system availability, and security incident statistics and comparisons to approved targets are accumulated and reported to the *IT steering committee* monthly.

Security 3.8 Design, acquisition, implementation, configuration, modification, and management of infrastructure and software related to system security are consistent with defined system security policies to enable authorized access and to prevent unauthorized access. The entity has adopted a formal *systems development life cycle (SDLC)* methodology that governs the development, acquisition, implementation, and maintenance of computerized information systems and related technology. The SDLC methodology includes a framework for classifying data and creating standard user profiles that are established based on an assessment of the business impact of the loss of security. Users are assigned standard profiles based on needs and functional responsibilities.

Process Integrity 3.2 The procedures related to completeness, accuracy, timeliness, and authorization of system processing, including error correction and database management, are consistent with documented system processing integrity policies. The entity's documented *systems development life cycle (SDLC)* methodology is used in the development of new applications and the maintenance of existing applications. The methodology contains required procedures for user involvement, testing, conversion, and management approvals of system processing integrity features.

**EXHIBIT 5-8** Selected Sections<sup>8</sup> of the AICPA Trust Principles<sup>9</sup>

of these two strategic management processes in the internal control structure. The Trust Services Principles illustrate that the SDLC and an IT governance committee are important parts of the IT system of an organization. Without the use of an IT governance committee and the SDLC, the process of revising or updating systems can be chaotic and uncontrolled. An organization would likely find that an uncontrolled approach results in poorly designed and documented systems. In addition, systems that result from such a chaotic process would probably not meet user needs and would not be likely to support the strategic objectives of the company.

A few excerpts from the Trust Services Principles are presented in Exhibit 5-8 as examples of the role of an IT governance committee and the SDLC in internal controls. The term steering committee is becoming less popular in the IT industry than the newer term IT governance committee.

These excerpts illustrate that an IT governance committee and the SDLC are used as internal control mechanisms to monitor and control security, availability, acquisition, implementation, and maintenance of IT systems. These internal control

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<sup>8</sup> Emphasis added.

<sup>9</sup> Trust Services Principles, Criteria and Illustrations, American Institute of Certified Public Accountants, Inc. and Canadian Institute of Chartered Accountants, 2009 ([www.aicpa.org](http://www.aicpa.org)).

mechanisms allow management to ensure that IT systems meet organizational needs and that the development and implementation of new IT systems is properly controlled.

## Ethical Considerations Related to IT Governance (Study Objective 9)



### Ethical Considerations for Management

The management of any organization has an ethical obligation to maintain processes and procedures that assure accurate and complete records and protection of assets. This obligation arises because management has a stewardship obligation to those who provide funds or invest in the company. **Stewardship** is the careful and responsible oversight and use by management of the assets entrusted to management. This requires that management maintain systems that allow it to demonstrate that it has appropriately used these funds and assets. Investors, lenders, and funding agencies must be able to examine reports that show the appropriate use of funds or assets provided to management. This is accomplished by maintaining accurate and complete accounting records and reports with full disclosure within those reports. Therefore, management should have a mechanism that assists the organization in the development of accurate and complete accounting processes and systems.

In many cases, poorly designed IT systems can allow a fraudster to perpetrate fraud. In the case of the Phar-Mor drugstore chain fraud, the vice president became concerned about the adequacy of the IT system and the resulting reports. This vice president formed a committee to address the problems, but the committee was squelched by members of senior management who were involved in the fraud. Poorly developed IT systems can be used by managers or employees to commit and hide fraud. A management team that is focused on ethics throughout the organization should consistently monitor and improve IT systems. The SDLC is the mechanism to accomplish that. Thus, by diligently adhering to SDLC processes, management is, in part, fulfilling its ethical obligations of stewardship and fraud prevention.

As systems and processes are revised, management must also consider the ethical implications regarding employees. Revising processes and systems can lead to job-related changes for employees such as changes in job functions or duties, changes in the processes that employees perform, or in some cases, job loss. If managers expect employees to be ethical, then management must be ethical in the treatment of employees. Managers must carefully consider the impact of system changes on employees and be ethical in the manner that it handles employees throughout the processes of change. Although job losses are sometimes unavoidable, management must be especially conscious of the manner that it informs, terminates, and assists employees who experience job loss due to system changes. In addition, managers should maintain confidentiality about the proprietary features and functions of the IT system.

### Ethical Considerations for Employees

As managers apply the processes within the SDLC to revise IT systems, employees should not subvert the process. A disgruntled employee may sabotage the SDLC process by not cooperating, providing false information in interviews or

questionnaires, or reverting to the old ways of doing things. If management of the organization has made an honest effort to include user feedback and participation in the SDLC processes, employees should likewise make an honest effort to participate, learn new system processes, and properly use the new processes and systems.

For employees who serve on project teams in the revision of IT systems, confidentiality can be an ethical consideration. As they participate in project teams, employees may learn things about people or processes in the organization that they would not otherwise know. These employees should not disclose things that management wishes to keep confidential. However, this can sometimes be a difficult ethical choice. For example, suppose that while serving on a project team, you learn that a friend's job will be eliminated and that management intends to announce the job cuts next week. In the days before the formal announcement, should you tell your friend of the impending job loss? In most circumstances, the project team member should keep this information confidential and allow management to handle the job cuts in a responsible and ethical manner.

## Ethical Considerations for Consultants

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When consultants are employed to assist the organization with phases of the SDLC, they have at least four ethical obligations:

1. Bid the engagement fairly, and completely disclose the terms of potential cost increases.
2. Bill time accurately to the client, and do not inflate time billed.
3. Do not oversell unnecessary services or systems to the client just to inflate earnings on the consulting engagement.
4. Do not disclose confidential or proprietary information from the company to other clients.



In the past, many CPA firms offered consulting services to assist organizations in the selection and implementation of accounting system software. The freedom of CPA firms to do such consulting was significantly decreased when Congress enacted the Sarbanes–Oxley Act of 2002, which prohibits CPA firms from providing systems consulting services to any organization for which the CPA firm serves as the auditor. An excerpt from the AICPA summary of Section 201 of the Act follows (emphasis added):

It shall be “unlawful” for a registered public accounting firm to provide any nonaudit service to an issuer contemporaneously with the audit, including: (1) bookkeeping or other services related to the accounting records or financial statements of the audit client; (2) financial information systems design and implementation; (3) appraisal or valuation services, fairness opinions, or contribution-in-kind reports; (4) actuarial services; (5) internal audit outsourcing services; (6) management functions or human resources; (7) broker or dealer, investment adviser, or investment banking services; (8) legal services and expert services unrelated to the audit; (9) any other service that the Board determines, by regulation, is impermissible.

As an example, if Pricewaterhouse Coopers (PwC) audits Anheuser-Busch, then PwC would be prohibited from providing systems consulting services to Anheuser-Busch. However, PwC could provide systems consulting services to The Boston Beer Company, Inc. (brewers of the Samuel Adams® product line), if it does not audit this company. Only CPA firms face this restriction under Sarbanes–Oxley Act, because CPA firms are the only entities that are permitted to conduct external audits of public company financial statements. Other companies, such as International

Business Machines Corp. (IBM), are not restricted in providing system consulting services to organizations.

The restrictions under the Sarbanes–Oxley Act are intended to enhance CPAs' ethical obligation to remain independent with respect to their clients. On the other hand, if CPAs were to implement new IT systems for their audit clients, the perception of objectivity and independence may be compromised.

Because of this restrictive environment for CPA firms in providing consulting services, many large CPA firms have spun off or sold their consulting divisions. There are still CPA firms that provide system consulting services, but they must be careful not to ever provide both consulting and audit services to the same organization.

## Summary of Study Objectives

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**An introduction to IT governance and its role in strategic management.** The board of directors and top-level executive managers must take responsibility to ensure that the organization has processes that align IT systems to the strategies and objectives of the organization. IT systems should be chosen and implemented that support attainment of strategies and objectives. To ensure that IT systems support long-term strategic objectives and also support daily operations, management must constantly assess its current situation, where it plans to go, and which IT systems will help it get there. To be effective, this assessment should be part of an ongoing process to evaluate organizational direction and the fit of IT to that direction. The board and management should establish ongoing processes and procedures to accomplish this IT fit. These processes would include an IT governance committee and a systematic approach to IT system change, such as a systems development life cycle approach.

**An overview of the system development life cycle (SDLC).** The SDLC is a systematic approach to the change or upgrade of an IT system. While there are many approaches to the SDLC, a popular approach has five phases: systems planning, systems analysis, systems design, systems implementation, and operation and maintenance. These five phases are a structured and systematic way to undertake changing or upgrading IT systems.

**The elements of the systems planning phase of the SDLC.** Systems planning is the evaluation of long-term strategic objectives and the prioritization of the IT systems that assist the organization in achieving its objectives. Systems planning also involves the planning and continuing oversight of the design, implementation, and use of those IT systems. The planning phase involves matching organization strategy to IT strategy and selecting IT changes that successfully meet the requirements of the feasibility study. In a feasibility study, the realism of the possibility of each proposed IT change is assessed on four dimensions: technical feasibility, operational feasibility, economic feasibility, and schedule feasibility.

**The elements of the systems analysis phase of the SDLC.** Systems analysis is a study of the current system to determine the strengths and weaknesses and the user needs of that system. Analysis requires the collection of data about the system and the careful evaluation of that data to identify areas of the system that can be improved. Data is collected through observation, documentation review, interviews, and questionnaires.

**The elements of the systems design phase of the SDLC.** Systems design is the creation of the system that meets user needs and incorporates the improvements identified by the systems analysis phase. The design phase includes generating alternative conceptual designs, evaluating those designs, selecting the best conceptual design, and designing the details of the selected conceptual design.

**The elements of the systems implementation phase of the SDLC.** Implementation consists of the steps undertaken to program, test, and activate the IT system selected in the system design phase.

**The elements of the operation and maintenance phase of the SDLC.** Operation and maintenance is the regular, ongoing functioning of the IT system and the processes to fix small problems, or “bugs,” in the IT system. During ongoing operation, management should request and receive ongoing reports about the performance of the IT system.

**The critical importance of IT governance in an organization.** The SDLC serves as the mechanism to continually assess the fit of IT systems to long-term strategy and short-run goals of the organization. As such, it is an important part of the strategic management of the organization. The SDLC process also serves as a mechanism to monitor and control security, availability, acquisition, implementation, and maintenance of IT systems. In addition, the SDLC assists management in ensuring that it maintains accurate and complete accounting records and accounting reports and that it maintains full disclosure within those reports. The SDLC is a mechanism that assists the organization in developing accurate and complete accounting processes and systems.

**Ethical considerations related to IT governance.** Managers, employees, and consultants all have obligations to act ethically while engaged in changes to IT systems. Managers must ensure that proper IT systems are functioning to meet the stewardship obligation they have for the assets entrusted to them. In addition, they must consider confidentiality and the effects of employee displacement as changes occur. Employees have obligations to provide honest feedback about IT systems and to not disclose confidential information. Consultants have ethical obligations to bid and bill time fairly, to not oversell IT system modules, and to maintain confidentiality.

## Key Terms

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Business process reengineering (BPR)	IT governance	Post-implementation review	System Development Life Cycle (SDLC)
Conceptual design	IT governance committee	Questionnaires	Systems analysis
Detailed design	IT steering committee	Request for Proposal (RFP)	Systems design
Direct cutover conversion	Observation	Schedule feasibility	Systems implementation
Documentation review	Operation and maintenance	Software selection	Systems planning
Economic feasibility	Operational feasibility	Stewardship	Systems survey
Evaluation and selection	Parallel conversion	Strategic management	Technical feasibility
Interviews	Phase-in conversion	Strategic management of IT	User acceptance
	Pilot conversion		

# End of Chapter Material

## Concept Check



- 1 IT governance includes all but which of the following responsibilities?
  - a. Aligning IT strategy with the business strategy
  - b. Writing programming code for IT systems
  - c. Insisting that an IT control framework be adopted and implemented
  - d. Measuring IT's performance
- 2 Which phase of the system development life cycle includes determining user needs of the IT system?
  - a. Systems planning
  - b. Systems analysis
  - c. Systems design
  - d. Systems implementation
- 3 Which of the following is **not** part of the system design phase of the SDLC?
  - a. Conceptual design
  - b. Evaluation and selection
  - c. Parallel operation
  - d. Detailed design
- 4 Which of the following feasibility aspects is an evaluation of whether the technology exists to meet the needs identified in the proposed change to the IT system?
  - a. Technical feasibility
  - b. Operational feasibility
  - c. Economic feasibility
  - d. Schedule feasibility
- 5 The purpose of the feasibility study is to assist in
  - a. selecting software
  - b. designing internal controls
  - c. designing reports for the IT system
  - d. prioritizing IT requested changes
- 6 Within the systems analysis phase of the SDLC, which of the following data collection methods does not involve any feedback from users of the IT system?
  - a. Documentation review
  - b. Interviews using structured questions
  - c. Interviews using unstructured questions
  - d. Questionnaires
- 7 A request for proposal (RFP) is used during the
  - a. phase-in period
  - b. purchase of software
- 8 Which of the following steps within the systems implementation phase could not occur concurrently with other steps, but would occur at the end?
  - a. Employee training
  - b. Data conversion
  - c. Software programming
  - d. Post-implementation review
- 9 Each of the following are methods for implementing a new application system except
  - a. direct cutover conversion
  - b. parallel conversion
  - c. pilot conversion
  - d. test method conversion
- 10 A retail store chain is developing a new integrated computer system for sales and inventories in its store locations. Which of the following implementation methods would involve the most risk?
  - a. Direct cutover
  - b. Phased-in implementation
  - c. Parallel running
  - d. Pilot testing
- 11 The use of the SDLC for IT system changes is important for several reasons. Which of the following is not a part of the purposes of the SDLC processes?
  - a. As part of strategic management of the organization
  - b. As part of the internal control structure of the organization
  - c. As part of the audit of an IT system
  - d. As partial fulfillment of management's ethical obligations
- 12 Confidentiality of information is an ethical consideration for which of the following party or parties?
  - a. Management
  - b. Employees
  - c. Consultants
  - d. All of the above

## Discussion Questions

- 13 (SO 3) Near the beginning of Chapter 5, the real-world example of Allstate's IT expenditure is mentioned. Prior to the implementation of its IT governance committee, "whoever spoke the loudest

- or whoever had the biggest checkbook" got to select IT projects. What do you think the problems were with this kind of approach?
- 14 (SO 1) Why is it important that IT systems be aligned with the business strategy?
  - 15 (SO 1) Why would IT governance include measuring the performance of IT systems?
  - 16 (SO 3) What is the difference between technical feasibility and operational feasibility?
  - 17 (SO 3) How does the analysis of feasibilities in the systems planning phase help to prioritize system changes?
  - 18 (SO 4) What is the advantage of studying the current system during the systems analysis phase?
  - 19 (SO 4) During the systems analysis phase, which two data collection methods help determine user requirements?
  - 20 (SO 5) What are the advantages of purchased software when compared with software developed in-house?
  - 21 (SO 5) Why might it be important to follow some or all of the SDLC phases for purchased software?
  - 22 (SO 5) How is conceptual design different from detailed design?
  - 23 (SO 5) Within the system design phase, what are the purposes of evaluation and selection?
  - 24 (SO 5) Which part of the system design phase would include designing rows and columns of output reports? Why is it important to design reports?
  - 25 (SO 6) What is the purpose of software testing?
  - 26 (SO 6) How are accountants involved in data conversion?
  - 27 (SO 6) Why is a direct cutover conversion risky?
  - 28 (SO 6) Why is parallel conversion costly?
  - 29 (SO 6) Why is user acceptance important?
  - 30 (SO 6) Why is post-implementation review undertaken?
  - 31 (SO 8) How does the SDLC serve as an internal control?
  - 32 (SO 9) What ethical obligations do employees have as IT systems are revised?

### Brief Exercises

- 33 (SO 1) Describe the role that the board of directors should play in IT governance.
- 34 (SO 3, SO 5) Two feasibility studies occur during the SDLC: one during systems planning and one during systems design. Describe the differences between these two feasibility studies.
- 35 (SO 4) There are four methods of data collection used in the study of the current system: observation, documentation review, interviews, and questionnaires. Compare and contrast these four methods.
- 36 (SO 4) Describe the purpose of business process reengineering during the system analysis phase.
- 37 (SO 6) There are four methods of system conversion: parallel, direct cutover, pilot, and phase-in. Describe these four methods and how they differ.
- 38 (SO 7) Operation and maintenance is the longest and costliest part of the SDLC. Explain why this is true.
- 39 (SO 7) Describe how IT performance reports are important in IT governance.
- 40 (SO 9) What is the underlying purpose of the restrictions on CPA firms in Section 201 of the Sarbanes–Oxley Act?

## Problems

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- 41 (SO 1) Middleton Corporation just became a public corporation when shares of its stock were sold to the public three months ago. A new board of directors has been appointed to govern the corporation. Assume that you will be giving a presentation to the board members on their responsibilities for IT systems. Write a report that could be delivered to the board.
- 42 (SO 2) Millennium Tech Stop is a regional retailer of consumer electronics, with warehouses and stores located in several large cities in California. The board and top management of Millennium are considering updating their accounting, inventory, and retail sales software and hardware. The current systems are approximately 15 years old. Assume that you have

been hired as a consultant to guide them through the process of upgrading their systems. Write a document that could be presented to the board of directors and that summarizes the SDLC.

- 43 (SO 4) Assume that you are the manager of the project team that is engaged in a systems analysis. The company is a large, national retailer with several stores and warehouses located throughout the United States. The corporate headquarters are in Atlanta, and all major accounting takes place at the corporate headquarters. Describe how you would use the various data collection techniques of observation, documentation review, interviews, and questionnaires.

- 44** (SO 5) CEEMCO Corp. is a small, privately owned manufacturing company in Cincinnati. CEEMCO manufactures custom products as well as store display products to sell to other companies such as retailers. Using an Internet search engine, do a search on the terms “CEEMCO” and “Cincinnati.” Examine the kind of manufacturing the company does. Once you have completed that, study an accounting software site such as [www.2020software.com](http://www.2020software.com) or [www.accountingsoftware411.com](http://www.accountingsoftware411.com). Complete the following:
- Describe the process CEEMCO should undertake to determine which accounting software might be the best fit for the company.
  - Although you do not know much about the company, develop a list of requirements you believe that any accounting software should have in order for CEEMCO to consider the software as a viable alternative.
  - Choose an accounting software from your Web search, and describe why you believe it is a good match for CEEMCO.
- 45** (SO 2) There are several approaches to applying an SDLC methodology to IT system change. Using an Internet search engine, search for these terms: SDLC, waterfall, JAD (joint application development), RAD (rapid application development), build and fix, and spiral model. For example, you might try entering these search terms: SDLC waterfall. From your search results, write a brief definition of these various approaches to the system development life cycle.
- 46** (SO 9) Thomas Clark is an accounting software consultant at Tann and Associates Consulting. Tann is a value-added reseller of accounting software for midsize companies, which normally have revenue between \$50 million and \$500 million. One of Clark’s responsibilities is to solicit new client companies and to meet with their management to recommend the best accounting software system for them. Midmarket accounting software typically offers several modules that the client may choose from. For example, not all clients would need an e-business module for their accounting software. Since part of Clark’s compensation is a percentage of software sales and consulting revenue that he generates, what are the ethical conflicts he faces when soliciting new clients and recommending software and software modules? Suggest some improvements that can be made to ensure that consultants with performance based compensation are acting ethically in their communication with clients.

## Cases

- 47** The ElectroShock is a retailer of electronics such as cell phones, satellite radios, mp3 players, and high-end LCD and plasma TVs. The ElectroShock is a large chain with stores in strip shopping centers throughout the United States. However, each store is small, with generally 5-6 employees and a manager. Each store sells much less volume than a large electronics retailer such as Best Buy or Circuit City.
- Top management has recently become concerned with what appears to be an excessive amount of inventory loss (shrinkage) at many of its stores. At this point, the management team is uncertain whether the excessive loss is due to weaknesses in its IT system that tracks inventory or to customer and employee theft at the stores. Top managers are concerned that the IT system may be a contributing factor to the loss and would like to study whether a new system should be implemented. Through their industry contacts, they know that large retailers such as Best Buy and Circuit City use much more sophisticated inventory management systems than The ElectroShock does.
- A systems analysis would require a cost-benefit analysis and a feasibility study. Describe steps that The ElectroShock should take to complete a cost-benefit analysis and a feasibility study for a new IT system to track inventory.
- 48** Miller International Corp. is in the process of purchasing a new accounting software system. Miller is in a very specialized industry, with an international market. The company manufactures specialized parts to sell to companies in the oil exploration and drilling industry. The corporate headquarters are in Chicago, Illinois and a significant number—approximately one-half—of their operations are U.S.-based. They also maintain production plants and a sales and support staff in most oil-producing countries. Explain the factors that Miller should consider when determining which software system will best suit its needs.
- 49** Refer to case 48. Describe which parts of the design phase Miller should undertake to ensure that the purchased software matches with the business processes that it will use.

## Solutions to Concept Check

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- 1 (SO 1) IT governance includes all the given choices, except **b. writing programming code for IT systems**. IT governance does include aligning IT strategy with business strategy, insisting that an IT control framework be adopted, and measuring IT performance.
- 2 (SO 2, SO 4) The phase of the system development life cycle that includes determining user needs of the IT system is **b. systems analysis**. The systems analysis phase includes a study of the current system to determine strengths and weaknesses of the system, and a determination of user needs.
- 3 (SO 2, SO 5) **c. Parallel operation** is not part of the system design phase of the SDLC. The system design phase can be divided into conceptual design, evaluation and selection, and detailed design. Parallel operation occurs within the systems implementation phase.
- 4 (SO 3) The feasibility aspect that is an evaluation of whether the technology exists to meet the need identified in the proposed change to the IT system is **a. technical feasibility**. The purpose of the evaluation of technical feasibility is to assess the realism of the possibility that the technology exists to meet the need identified in the proposed change to the IT system.
- 5 (SO 3) The purpose of the feasibility study is to assist in **d. prioritizing IT requested changes**. The feasibility study helps determine which proposed IT systems or changes have a realistic possibility of being achievable from the standpoint of technical, operational, economic, and schedule feasibility. Those suggested changes that are less feasible will be ranked lower and, therefore, have a lower priority.
- 6 (SO 4) Within the systems analysis phase of the SDLC, the data collection method that does not involve any feedback from users of the IT system is **a. documentation review**. Interviews and questions require that users answer either structured or unstructured questions. Therefore, these methods of data collection allow users to provide feedback. Documentation review is a review of documentation for the IT system and does not involve obtaining feedback from users.
- 7 (SO 5) A request for proposal (RFP) is used during the **b. purchase of software**. An RFP is a request to bid. Organizations use RFPs to request bids on software.
- 8 (SO 6) The following steps within the systems implementation phase that could not occur concurrently with other steps, but would occur at the end, make up the **d. post-implementation review**. A post-implementation review is a review of the SDLC process to determine whether any estimates or processes were incorrect and must occur after the other implementation processes are completed.
- 9 (CIA Adapted) (SO 6) Each are methods for implementing a new application system except **d. test**. Although all systems should be tested before implementation, there is no one specific test method for all systems implementation.
- 10 (CIA Adapted) (SO 6) A retail store chain is developing a new integrated computer system for sales and inventories in its store locations. The implementation method that would involve the most risk is **a. direct cutover**. This approach would be considered risky, because it would involve all store locations carrying out a simultaneous implementation. Accordingly, there would be no opportunity to compare results between the old and new systems, and any problems or “bugs” would adversely affect every location.
- 11 (SO 7) The use of the SDLC for IT system changes is important for several reasons, but, **c. as part of the audit of an IT system**, is not among the SDLC’s purposes. The SDLC processes are critical as part of strategic management of the organization, as part of the internal control structure of the organization, and as partial fulfillment of management’s ethical obligations. The SDLC helps ensure that IT strategy is aligned with business strategy, that system changes are properly controlled, and that management has attempted to fulfill its ethical obligation to maintain adequate IT systems. The SDLC is not an integral part of an IT audit.
- 12 (SO 9) Confidentiality of information is an ethical consideration for **d. all of the above**. Management, employees, and consultants all have an ethical obligation to keep proprietary or sensitive information confidential.

# Enterprise Resource Planning (ERP) Systems

### STUDY OBJECTIVES

This chapter will help you gain an understanding of the following concepts:

1. An overview of an ERP system
2. The history of ERP systems
3. Current ERP system characteristics
4. The modules of an ERP system
5. The market segments of ERP software systems
6. Implementation issues of ERP systems
7. The benefits and risks of ERP systems
8. ERP systems and the Sarbanes-Oxley Act

### Overview of ERP Systems (Study Objective 1)

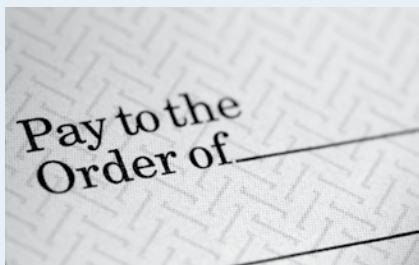
The Real World example on the next page will help you understand the context of many concepts in this chapter. Please read that Real World example to begin effective reading and studying of this chapter. The Real World example outlines how Agri-Beef Company experienced significant efficiency gains and cost savings by implementing a new ERP system.

The following chapters in the book describe business processes and the resulting data. These are processes that deal with a very high volume of transactions. For example, sales and purchase processes have a high volume of recurring transactions where a large volume of data is generated, processed, and stored. These processes also result in data that must be entered and summarized in the general ledger. Earlier chapters examined how IT systems can improve the efficiency and cost of those processes. Ideally, all of an organization's business processes should be controlled by one software system that incorporates all processes. That is, one software system that would collect, process, store, and report

the data resulting from all revenue, expenditures, conversion, and administrative processes. This is the intention of an enterprise resource planning (ERP) system. The ERP system is the IT infrastructure that facilitates e-commerce and e-business. ERP systems and e-business are mutually supporting parts of the organization.

An **enterprise resource planning (ERP)** system is a multimodule software system that integrates all business processes and functions of the entire organization into a single system. Each module is intended to collect and process data of a functional area of the organization and to integrate with related processes. For example, a module may be designed to process purchasing transactions and record all data about purchase orders. This module must integrate with accounts payable and inventory, since the vendor must be paid and inventory increased as the purchased goods arrive. Each of the software modules of an ERP system automates business activities of a functional area within an organization. Information is updated in real time in the ERP database so that employees in all business units are using the same

## The Real World



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Agri-Beef Co. is a privately held Idaho firm with annual sales in excess of \$500 million. Believing that its old accounting systems were antiquated, the management at Agri-Beef recently switched

to an ERP system. They experienced a very successful implementation that took only six weeks and they began experiencing benefits immediately. The treasurer of the company, while describing the benefits with regard to the preparation and handling of intracompany transactions, said the following:

“With the old method, we had to walk each transaction through. Now we can post transactions straight through to another division’s general ledger account.”

The improved efficiency resulted in two check runs instead of 22 runs, and a 200 man hour savings per month.<sup>1</sup>

information and all information is up to date. Since the data is stored in a single database, each functional area can easily share information with other areas of the organization. For example, when a customer order is entered into an ERP system, a customer representative can have access to information such as the customer’s order and credit history and account balance details, inventory levels, production schedules, and shipping schedules. Therefore, the employee can answer any questions that the customer may ask, such as the following:

1. Is the product in stock?
2. If not, when will it be produced or restocked?
3. How soon can it be shipped?
4. When did we place the last order for this item?

To answer these questions, the customer service representative must have access to inventory information, production planning and scheduling information, shipping scheduling information, and customer history. All of these functional areas have data stored in a single, shared database to enable the necessary integration and data retrieval.

You may think it is obvious that an ERP system that integrates all business functions and shares data across functions would be efficient. However, ERP systems did not become popular until the 1990s. Prior to that period, ERP hardware and software systems were not available or were not cost-effective. ERP systems were not possible until computer hardware and software capabilities evolved to a certain point. In the 1980s and 1990s, the increasing power of computers and the decreasing cost made it much more realistic for companies to have enough computing power to accomplish the functions of an ERP system. The first ERP systems were modified MRP II systems. Software companies such as SAP evolved their MRP II software into products that became known as ERP systems. **MRP II** is a **manufacturing resource planning** software system that focuses on the movement and use of resources needed by a manufacturing company. ERP systems expanded upon the MRP system, adding functions across the entire spectrum of processes in the enterprise. For example, marketing, distribution, human resources, and other enterprise processes became part of the ERP system.

<sup>1</sup> Bartholomew, Doug “The ABC’s of ERP,” *CFO*, Fall 2004, vol. 20, issue 12, p. 19.

ERP software operates on a relational database such as Oracle, Microsoft SQL Server, or IBM's DB2. An ERP system is generally module based and includes the following functional areas:

1. Financials
2. Human resources
3. Procurement and logistics
4. Product development and manufacturing
5. Sales and services
6. Analytics

Modules within the financials functional area may include the general ledger, cash management and fixed assets. Modules in the Sales and services functional area may include sales order processing, accounts receivable, customer service, customer relationship management and other related processes.

Data within the ERP system is stored in an operational database. In some systems, a data warehouse is also used to store data and produce data analytics.

These components are tightly integrated and affect each other. For example, the manufacturing modules and data are integrated so that sales personnel can immediately see production schedule information and therefore, give customers accurate information about product delivery dates. Exhibit 6-1 is a depiction of an ERP system.

The ERP system often utilizes two different databases: the operational database and the data warehouse. The **operational database** contains the data necessary to conduct day-to-day operations and produce management reports. The operational database contains the data that is continually updated as transactions are processed. Each time a new transaction is completed, parts of the operational data must be updated. For example, recording a sale means that sales, inventory, and accounts receivable balances must be updated.

The **data warehouse** is an integrated collection of enterprise-wide data that generally may include 5–10 years of nonvolatile data. It is used to support management in decision making, planning, and reporting. The data is enterprise-wide because it is pulled from operational databases and maintained in the data warehouse for many fiscal periods. The data in the data warehouse is pulled from sales order processing, inventory systems, receivables, and many other transaction-processing systems within the organization. In a data warehouse, data is also pulled from multiple operational databases and integrated into one reporting source. The information in a data warehouse is called nonvolatile because it does not change rapidly in the

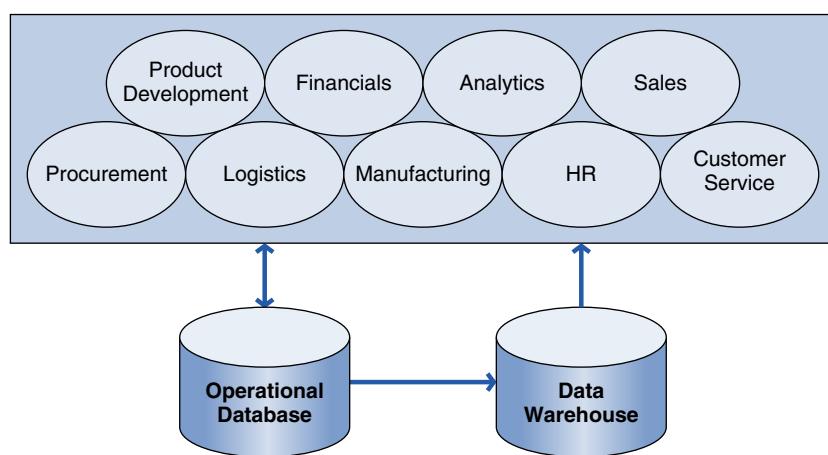


EXHIBIT 6-1 An ERP System

same way that operational data changes. Periodically, new data is uploaded to the data warehouse from the operational data, but other than this updating process, the data in the data warehouse represent historical data that will not change.

Notice the direction of the arrows touching the two databases in Exhibit 6-1. The arrow between the ERP modules and the operational database shows data flow in both directions. This indicates that the modules store data in the database as transactions are processed, and the data is read by modules to process transactions and to prepare operational reports. The arrow between the operational database and the data warehouse shows data flow in one direction only. This arrow depicts the periodic update of data in the data warehouse by the uploading of data from the operational database. Notice that data for the data warehouse is never used to update data in the operational database.

The arrow between the data warehouse and the ERP module also depicts data flow in one direction only. The data in the data warehouse is only read, manipulated, and reported. The data is generally not updated as transactions are processed.

Data warehouses are populated using an extract, transform, and load (ETL) process. For example, a company defines its ETL protocol for how the data will be extracted from the operational database, transformed so that it is meaningful in the data warehouse, and then the data is loaded into the data warehouse. The ETL function is positioned between the operational database and the data warehouse. A company determines how often data is extracted and loaded into the data warehouses. Many companies elect to update the data warehouse every evening, with some electing more or less frequent updates.

The various interactions between the modules are difficult to capture in a two-dimensional drawing. Each of the modules may have some interaction with the other modules. For example, to plan and execute the manufacturing process, the manufacturing module must interface with sales, logistics, materials management, human resources, finance, and reporting. This interface is necessary because the manufacturing process must have these resources:

1. Feedback regarding expected sales of products from the sales module
2. Status information about raw materials in stock and on order from the materials management module
3. Information about how and when materials, subassemblies, and finished goods are moved through the plant and warehouses from the logistics module
4. Staffing and payroll information from the human resources module
5. Posting to and cost tracking in the general ledger and subledgers within the finance module
6. Various operations reports to monitor and control the manufacturing process

This list provides examples of some of the interactions between modules as a process occurs. This type of interaction between modules would be necessary for most of the business processes within an organization. In order for this interaction to occur and for the necessary reports to be provided, the data must be available in the operational database that is shared by all modules.

## History of ERP Systems (Study Objective 2)

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ERP systems can be traced back to software that was developed during the 1960s and 1970s to track inventory in manufacturing companies. The first generation of this software was called **materials requirements planning (MRP)** software. MRP software of the 1970s allowed plant managers to coordinate the planning of production and raw material requirements. MRP software determined order size and timing of raw

materials on the basis of sales forecasts, factoring in lead times for order and delivery of materials.

The typical computer hardware and software of the 1970s that were used to enable an MRP system were mainframe computers, sequential file processing, and electronic data interchange (EDI). The EDI allowed up-to-date information about inventories and status of orders to be processed quickly. As mainframe computers improved in speed and power during the 1980s, MRP software evolved into manufacturing resource planning (MRP II) systems. MRP II was much broader and more encompassing than MRP software. MRP software was intended to provide for the purchase of raw materials to support manufacturing needs. The purpose of MRP II was to integrate manufacturing, engineering, marketing, and finance units to run on the same information system and to use a single database for all of these functions.

As MRP and MRP II systems became more popular in large manufacturing companies, early pioneers of ERP systems were working on a broader concept of information system software. Five former IBM systems analysts created an early version of ERP software in 1972. These five innovators formed a company that was to become Systems, Applications, and Products in Data Processing (SAP). SAP designed the first true ERP system, also called SAP. SAP was intended to integrate all business processes, not just manufacturing, and to make data available in real time. To the financial accounting system, they added modules for materials management, purchasing, inventory management, and invoice verification. SAP release 2, or SAP R/2®, was introduced in 1978. The new version took full advantage of the current mainframe computer technology, allowing for interactivity between modules and additional capabilities like order tracking.

ERP software did not become popular in the large corporation software market until the 1990s. In 1992, SAP released its third version of SAP, called SAP R/3®. Two important features led to a tremendous growth in the demand for SAP R/3. First, it used client–server hardware architecture. This setup allowed the system to run on a variety of computer platforms such as Unix® and Windows NT®. This meant that large corporations could use Windows NT based PCs as the client systems. R/3 was also designed with an open-architecture approach, allowing third-party companies to develop software that would integrate with SAP R/3. The success of SAP R/3 led other software developers to create competing products. Companies such as Oracle Corporation, PeopleSoft®, J.D. Edwards®, and Baan® produced competing ERP systems.

During the last half of the 1990s, there was a very rapid growth in the sales of ERP software to Fortune 500 companies. Three major factors contributed to this growth. One was the explosion of e-commerce and the dot-com boom that occurred in the late 1990s. To enable e-commerce and the business process acceleration necessary to meet the demands of e-commerce sales, companies needed integrated systems such as ERP.

A second factor was the significant advancement in personal computer processing capabilities and the ability to network computers in a client–server configuration. Companies no longer required mainframe or mini computers to adopt a full-scale ERP system. This made the option affordable and compelling for many organizations.

The third factor was the valid concern about Y2K compatibility of existing software systems in companies. Many companies were uncertain as to whether their legacy software would work after 1999 or would be **Y2K compatible**. The concern arose because of an artifact from the early days of programming. The amount of usable memory in the early computers was extremely small compared with computers today. To save memory space, programmers always used only two digits for the year when storing dates. For example, 1999 was stored as "99." However, when the calendar rolled to 2000, the two digits would not have been sufficient to express the new century dates. Systems professionals were concerned that older legacy

systems would process the year “00” as 1900 rather than 2000, or that the system could not even handle “00,” “01,” “02,” and so forth. There was genuine concern that the actual programming logic in those older systems would “blow up” when faced with a 2000 or later date. For example, consider the potential problem if an older computer software system was used to calculate interest due on a note payable. It would calculate this by subtracting dates to determine the number of days and then multiply number of days times interest rate. If the note were issued on December 1, 1999, and due on January 30, 2000, the number of days outstanding should be 60 days. However, an older software system might calculate this as December 1, 1999 minus January 30, 1900, and return a negative number of days.

Therefore, many companies were rapidly trying to replace legacy software in the late 1990s before the year 2000 changeover occurred. Many large companies purchased and implemented ERP systems such as SAP R/3, PeopleSoft, Oracle, and J.D. Edwards. Midmarket ERP systems also began to emerge with lower cost solutions such as Great Plains, Solomon, Navision, Macola®, Timberline®, and other products providing ERP functionality at a fraction of the cost of the Tier One solutions. Sales of ERP system software soared and continued to grow until the dot-com bust of 2001. Immediately after the Y2K rush to implement ERP systems, there was a dramatic slowdown in the sale and implementation of ERP systems. At the same time, however, there were many changes occurring in business related to the Internet and e-commerce.

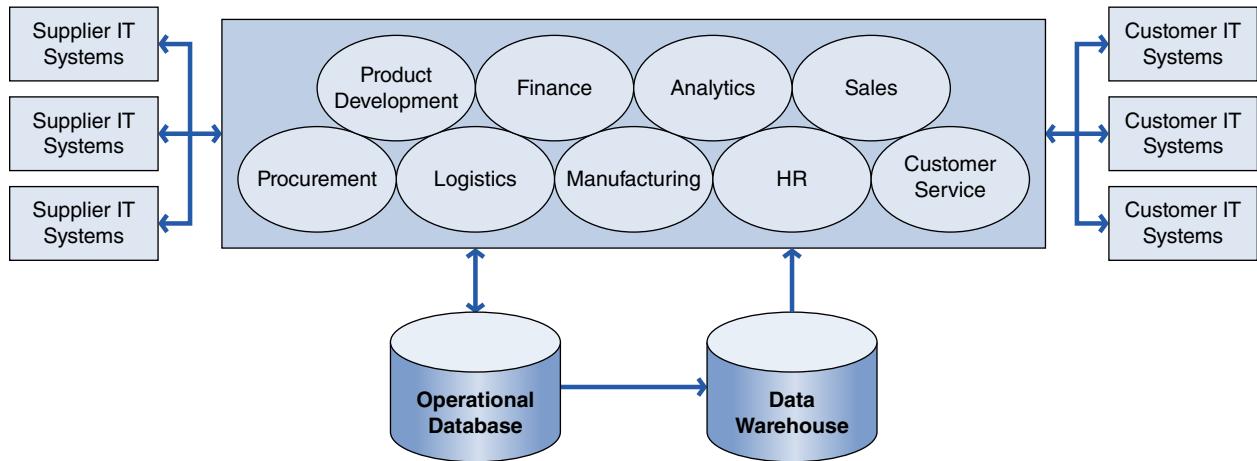
To increase the marketability of their ERP software, ERP providers began modifying their ERP software to include e-commerce capability. During this period, Gartner, Inc., a leading provider of research and analysis of the global IT industry, coined a new name for these evolving ERP systems: ERP II. A major addition to ERP II systems was the ability to support e-commerce. However, the evolution to ERP II included more than simply e-commerce. A whole range of modules to improve the processes between a company and its trading partners is part of an ERP II system. These modules include **customer relationship management (CRM)** and **supply chain management (SCM)** modules. These modules will be described in more detail in a later section of this chapter. The evolution of ERP systems into ERP II systems changed the focus of ERP systems from an internal management perspective to an interactive, internal, and external perspective of business processes.

## Current ERP System Characteristics (Study Objective 3)

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The evolution of ERP II systems has resulted in most large businesses implementing ERP systems that are connected to the IT systems of their trading partners. EDI, Internet EDI, or extranets are used to connect a company’s ERP system to the IT systems of its suppliers and customers. For example, suppliers may monitor their customers’ inventory levels and electronically trigger a shipment when items they supply reach pre-arranged reorder levels. Another example of this trading partner connection of ERP systems is that a customer could access a supplier’s production schedule to assess when its order may be filled. Exhibit 6-2 depicts a view of an ERP II system. The term “ERP II” has not yet been widely adopted, and the software systems are still generally referred to as ERP systems, even though they have expanded modules and functions compared with the original ERP systems of the 1990s.

As a result of the decline in the U.S. stock market following the tragic events of September 11, 2001, nearly all companies made drastic reductions in expenditures on IT systems and software around that time. IT spending on ERP systems was flat



**EXHIBIT 6-2** An ERP II System

between 2001 and 2003. Beginning in 2004, IT spending on ERP systems began to rise again. In the years since 2004, spending on ERP systems increased or decreased based on several factors.

1. ERP has become so important to daily operations that many companies cannot allow their ERP systems to become outdated.
2. The need to improve customer service through standardizing and combining business processes requires ERP software that can support standardized and combined processes.
3. Global companies that operate in several countries may have separate ERP systems in the different countries. Many of these companies decide to replace these various ERP systems with one centrally managed ERP system for the entire company.
4. Aging ERP systems that were installed in prior years may require replacement to meet competitive demands faced by companies today.
5. Bigger IT budgets replace leaner budgets as economic conditions improve. As companies increase overall IT spending, spending on ERP systems also increases.
6. Many companies need upgraded systems to enhance compliance with the Sarbanes–Oxley Act.
7. Many companies want to take advantage of new technologies such as cloud-based ERP systems.

In spite of these important factors, spending on ERP systems tends to decline during hard economic times. ERP spending is expected to rise over the next few years.

## The Real World

Viper Motorcycle Company, a Minneapolis-based manufacturer and seller of luxury motorcycles, began business in 2002. Within one year, Viper was looking for an accounting software system that would tie together the company's accounting with manufacturing, order processing, and other business functions,

while complying with Sarbanes–Oxley Act. Viper first selected SAP Business One® as its ERP software system, and later adopted SAP Business ByDesign®. These IT Solutions have helped Viper realize benefits in terms of operating efficiencies, financial transparency, and setting internal controls.

This section has provided a brief overview of the ERP modules, the databases, and the interactive connection between the ERP system and trading partners. The next section will describe selected ERP modules in more detail.

## ERP Modules (Study Objective 4)

Exhibits 6-1 and 6-2 depicted simple overviews of ERP systems. The ERP systems used by today's large organizations are actually more complex and encompass more of the enterprise than the systems depicted in Exhibits 6-1 and 6-2. The top-selling ERP system for large corporations and organizations is SAP. SAP describes its current ERP system as having many modules. Exhibit 6-3 is adapted from information provided on the SAP website.

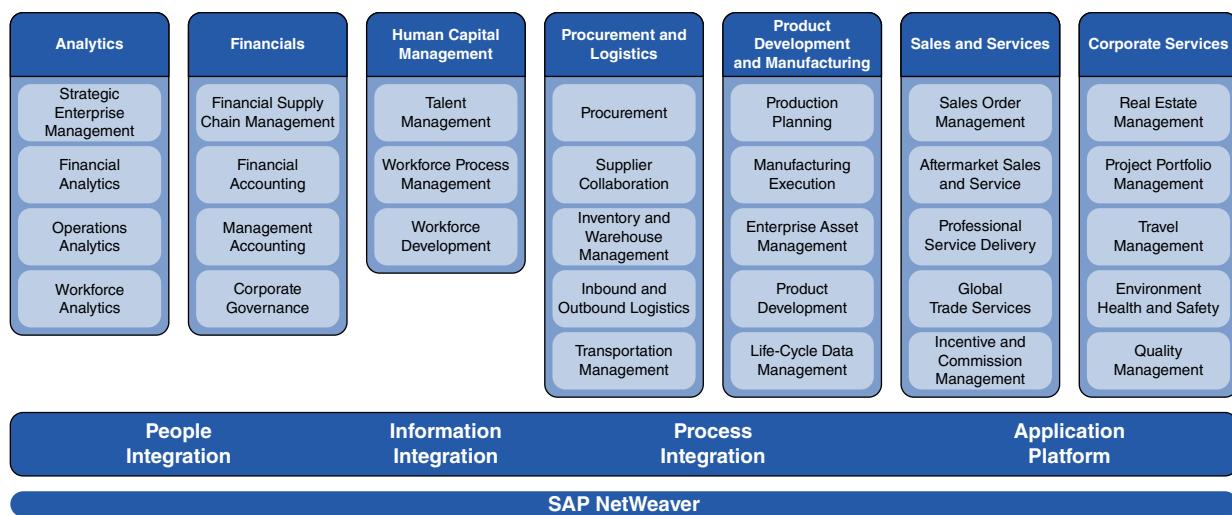
This section will not describe each of these modules in detail, but will focus on those modules most closely tied to accounting.

### Financials

The financials module contains what is normally considered the components of an accounting system. This includes the general ledger and financial reporting components. Some systems also include cash management, banking and fixed assets in the financial modules series.

The difference between a typical accounting software system and the financials module of an ERP system is that the financials module is tightly integrated to the other modules on a real-time basis. This means that as events occur in the organizations, and as soon as the transaction is entered at the source by an employee, the data is updated in records that are akin to subsidiary ledgers, special journals, and the general ledger. Management can see the financial effects of those events immediately. This real-time availability of financial data allows managers to have immediate feedback useful for making operating decisions and managing operating events.

This type of real-time integration did not exist in accounting systems before ERP systems were developed. With the type of real-time feedback available to management in an ERP system, management is in a better position to make strategic and operational decisions necessary to make the organization successful.



**EXHIBIT 6-3** SAP View of ERP Modules

## Human Resources

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This module in an ERP system incorporates all human resource and payroll processes and data. This would include all employee information on processes such as performance review, raises, and current wage and deductions.

## Procurement and Logistics

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Included in this ERP module are all processes and data related to the purchase and movement of materials and finished goods. This module incorporates the purchasing processes described in Chapter 9.

## Product Development and Manufacturing

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The planning, scheduling, and management of production are incorporated into this module. The conversion processes of Chapter 12 are included in this module.

## Sales and Services

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All processes involved in taking and filling customer orders are incorporated into this module. The revenue and cash collection processes of Chapter 8 are included in this module.

## Analytics

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Management must examine feedback from the ERP system to assist in the proper management and control of operations and financial conditions. The ERP system is designed to incorporate all enterprise processes into a single database that can be uploaded to a data warehouse. As described in Chapter 13, data mining and analytical techniques can be employed for managers to gain decision-making insights. The Analytics module in the ERP system incorporates the appropriate data mining and analytical tools to provide reports to management.

## Supply Chain Management (SCM)

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Supply chain management has become a critical aspect of many businesses. SCM is described as follows:

Supply Chain Management encompasses the planning and management of all activities involved in sourcing and procurement, conversion, and all Logistics Management activities. Importantly, it also includes coordination and collaboration with channel partners, which can be suppliers, intermediaries, third party service providers, and customers. In essence, Supply Chain Management integrates supply and demand management within and across companies.<sup>2</sup>

SCM is the management and control of all materials, funds, and related information in the logistics process, from the acquisition of raw materials to the delivery of

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<sup>2</sup> The definition of Supply Chain Management as adopted by The Council of Supply Chain Management Professionals (<http://www.cscmp.org>).

finished products to the end user (customer). Processes in the supply chain involve trading processes from a supplier to a business, as well as trading processes between the business and its customers and other intermediaries. Similar to internal processes, the efficiency of trading processes can be improved by the use of ERP systems to initiate, record, store, and report these processes.

ERP systems now include SCM modules. An SCM module represents a module that can assist an organization in supply chain management.

## **Customer Relationship Management (CRM)**

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CRM is a term for software solutions that help businesses manage customer relationships in an organized way. An example of a CRM would be a database of detailed customer information that management and salespeople can reference. This database generally includes information regarding customers' purchases, which can be used to do things such as match customer needs with products, inform customers of service requirements, and analyze customer buying behavior.

A successful CRM strategy does not depend only on installing and integrating a software package designed to support CRM processes. The organization must also train employees, modify business processes to match customers' needs, and implement relevant IT systems such as a CRM module in an ERP system.

## **Market Segments of ERP Systems (Study Objective 5)**

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There are at least two tiers of ERP systems within the market for ERP software. **Tier one** includes software often used by large, multinational corporations. **Tier two** describes software used by midsize businesses and organizations. Tier two software is also referred to as Midmarket software. As discussed in an earlier chapter, software vendors attempt to expand the market for their software products by appealing to a market segment outside their normal market. For example, tier one vendors attempt to make changes in their software that make it appealing to smaller companies in the tier two market. Likewise, tier two vendors attempt to scale up their products so that they appeal to larger companies that may be tier one companies. The typical tier market ERP systems are explained next.

### **Tier One Software**

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Tier one software is usually implemented in very large organizations and is extremely expensive. A minimum cost to purchase tier one ERP software is approximately \$1 million. Often, the cost of the software with all desired modules exceeds \$2 million, and consulting fees to implement the software can add an extra \$1–2 million or more. The average time to implement a tier one ERP system is about 24 months. The rule of thumb in the industry is that for every dollar that a company spends on software, it should expect to also spend a dollar on implementation consulting assistance. The three most popular ERP systems in tier one are SAP, Oracle®, and Microsoft Dynamics AX (Axapta)®.

**SAP** A brief history of SAP was given earlier in this chapter. The company called **SAP** was formed in 1972 by five former IBM employees. Their intent was to develop

and sell application software for real-time processing of business processes. In 1973, they released version 1 of their software, called SAP R/1. The “R” stood for real-time processing. In the 1980s, SAP incorporated multinational currency capability and other enhancements into the software release entitled SAP R/2.

In the early 1990s, SAP modified its ERP software system to be based on client-server architecture. This version, SAP R/3, became the top selling ERP system in that decade and into the early 2000s. SAP R/3 was a true ERP system that included modules for financials, human resources, logistics, sales and distribution, and other typical ERP process modules.

After 2000, the company evolved the ERP system to become Web-centric. This ERP version incorporates Web-based functionality to fully support e-business and e-commerce. SAP continues to be the top-selling tier one ERP system in the United States.

**Oracle** Oracle was founded in 1979 as a database software provider. In 1992, Oracle began offering an ERP software system for business application processing. Oracle moved this software to client-server architecture software in 1993. In 1998, Oracle incorporated a CRM module into its ERP software. Oracle ERP software is the second best selling tier one ERP software system.

The current ERP system, Oracle Applications, offers a fully Internet-enabled application. Oracle advertises this release as a version that fully integrates back office and front office applications. The **back office** modules are the ERP modules such as financials, manufacturing, supply chain management, procurement and logistics, and human resources applications. The **front office** modules, such as customer relationship management (CRM), include customer interfacing applications for sales, marketing, service, and call-center functions. Oracle suggests that the Internet business solutions aspect integrates the back office and front office processes of a company's business.

**Microsoft Dynamics AX** In 2001, Microsoft acquired an accounting software company called Great Plains Software. The accounting software was a popular accounting software for mid-size companies. Subsequent to purchasing Great Plains, Microsoft also purchased other software companies including Axapta, Solomon, and Navision and continued to enhance each of these products. As the software evolved, the name of the software product line was changed to Microsoft Dynamics. The four separate products are referred to as Microsoft Dynamics AX (Axapta), Microsoft Dynamics GP (Great Plains), Microsoft Dynamics NAV (Navision)<sup>®</sup>, and Microsoft Dynamics SL (Solomon)<sup>®</sup>. As features have been added, the Dynamics product lines have been considered ERP systems. More recently, Microsoft Dynamics AX has been categorized by the Gartner Group, as a tier one ERP system. This large-scale version of the ERP system is very configurable and adaptable. This flexibility has resulted in lower implementation costs as compared to other tier one implementations for some companies adopting Microsoft Dynamics AX.

## Tier Two Software

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Tier two ERP software is intended for organizations in the range of approximately \$25–250 million in sales. There are many ERP software systems in the tier two market. Some of the popular ERP systems are Microsoft Dynamics GP (Great Plains), Microsoft Dynamics NAV (Navision), Epicor ERP<sup>®</sup>, Sage 300<sup>®</sup>, Sage 500 ERP<sup>®</sup>, NetSuite, and Infor<sup>®</sup>. ERP software systems such as these have a price range between \$30,000 and \$250,000.

## Cloud-Based ERP

The market tiers continue to evolve as tier one vendors attempt to attract smaller companies as customers and tier two vendors attempt to scale up their software to appeal to larger companies. Therefore, the differences between tier one and tier two software are becoming less definitive. In addition to this trend, all ERP vendors have developed ERP products for cloud computing. For example, SAP offers a cloud-based ERP system for small to medium-sized entities (SMEs) called SAP Business ByDesign. Customers who use this cloud-based software need only a small IT system. The ERP system can be used through a computer with Internet access and a Web browser.

### The Real World

Skullcandy, founded in 2003, is a manufacturer and seller of headphones exclusively tailored for snowboarders, skateboarders, and other action-sports enthusiasts. It has experienced tremendous growth over the past decade. During one period, it grew 300 percent over four years. The growth became explosive when its products were

accepted by Best Buy, Circuit City, and Target. In response to this growth, Skullcandy sought a business software system that would meet its accounting and reporting needs but could also easily scale to match the company's growth. The company chose SAP Business ByDesign, a cloud-based system, as its ERP system.

Each of the ERP software vendors mentioned in this chapter, and the many additional vendors, have developed cloud-based ERP software. The example preceding mentions the SAP cloud product. Microsoft recently announced it will make its Dynamics ERP system available as a cloud-based system, making the entire functionality of Dynamics available as a cloud-based system. There are too many software vendors to give examples of each, but the point is that there are many ERP options, and companies need to determine whether some or all of its ERP system should be cloud-based.

There are many benefits, as well as risks, in cloud-based ERP systems. Those benefits and risks are discussed in Chapters 2, 4, and 7 and will not be repeated here. However, one risk is worth mentioning again. One of the largest risks of ERP systems in the cloud is the potential service outage that might cause the system to be unavailable. Even though cloud vendors work very hard to avoid outages, they can happen unexpectedly, even for mundane reasons.

### The Real World

On leap day, February 29, 2012, Microsoft's Azure cloud experienced outages that, in some cases, lasted up to 16 hours. The outages occurred in cloud data centers in Chicago, San Antonio, and Dublin, Ireland. After investigation, Microsoft determined that the outage was triggered by a security system bug related to leap day itself. The system

sets expiration dates for security certificates in the virtual machines that run software for customers. Those security certificates, by default, expire one year later. The system tried to set the security date to February 29, 2013, a nonexistent date (since 2013 was not a leap year). This was the initial cause of the crash that Microsoft had to quickly fix.

A company must weigh all the benefits and risks in determining which ERP system best fits its needs.

## Implementation of ERP Systems (Study Objective 6)

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There are many important factors and issues to bear in mind when an organization considers implementation of an ERP system. The management of an organization must consider each of these issues either before or during the ERP implementation. These issues include the following:

1. Hiring a consulting firm
2. Determining the best-fit ERP system
3. Which modules to implement
4. Best of breed versus ERP modules
5. Business process reengineering
6. Customization of the ERP system
7. The costs of hardware and software
8. Testing the ERP system
9. Data conversion
10. Training of employees
11. Method of conversion, or “going live”

Many of these issues are interrelated, but the following discussion will address these issues one at a time.

### Hiring a Consulting Firm

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Very frequently, organizations considering an ERP implementation hire a consulting firm to assist with all or part of the implementation. If a consultant is hired to assist in the entire process, the consulting firm will help with the remaining factors 2–11 described in the next subsections. For example, the consulting firm is likely to assist the organization in evaluating and selecting an ERP system, implementing the software, and training employees to use the new system. Alternatively, an organization might choose to use a consulting firm for only selected parts of the ERP implementation process.

### The Best-Fit ERP System

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An organization must choose the ERP system that best suits its needs. Chapter 5 described some of the factors involved in software selection. Those concepts apply also in selecting an ERP system; however, there are additional factors unique to ERP systems that must be considered. One such factor is the system’s area of specialization. While ERP systems encompass all business processes, each vendor’s software has special areas of strengths. For example, SAP’s ERP system evolved from manufacturing resources planning (MRP II) software and therefore has been considered particularly strong in its manufacturing related modules. Thus, a manufacturing firm might prefer SAP.

The organization must consider its business processes and how well each ERP system operates for those processes. Consulting firms are often used to assist in selecting an ERP system.

## Which Modules to Implement

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ERP systems have modules available for all typical processes and functions of an organization. However, each additional module that an organization chooses to purchase and implement adds cost, implementation time, and implementation difficulties. For some processes, a company may choose to keep a legacy system rather than purchase an ERP module. For example, a company may have an existing legacy system that records and reports fixed asset processes. Rather than purchase a fixed asset module of an ERP system, the organization may choose to continue using the legacy system.

When determining whether to purchase a particular module, the organization must recognize that there tend to be problems inherent in integrating a legacy system into an ERP system. Either approach—purchasing an ERP module or keeping a legacy system—has costs and benefits that must be weighed.

## Best of Breed versus ERP Modules

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While ERP systems usually are intended to fit all business processes of an organization, some experts believe that ERP systems do not necessarily offer the best solution for all processes. It is difficult for any single software system to offer the best possible modules in all areas of business processes. This is especially true since ERP systems are designed to have a very broad appeal across many different kinds of organizations. This broad appeal is accomplished by building ERP modules around standard, generic business processes. Therefore, some experts believe that an organization is better served by using one brand of ERP system for many processes, but to select some modules from other vendors that are “best of breed.” **Best of breed** means the best software on the market for a particular type of business process for this size of an organization.

A best of breed approach is usually applied when an organization has some processes that may be different from the generic processes. Those processes that may be unique or a little more specialized might be better handled by a best of breed rather than the ERP module.

Similar to the factors in decision making regarding legacy systems or ERP modules are the costs and benefits of using either the ERP module or the best of breed system. The ERP module is likely to be easier to integrate into the whole system, but might not offer as much functionality as the best of breed. The organization must evaluate this trade-off and determine which approach best suits the many modules it wishes to implement.

## Business Process Reengineering

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Chapter 1 introduced the concept of business process reengineering. Recall that **business process reengineering (BPR)** is the purposeful and organized changing of business processes to make them more efficient. BPR not only aligns business processes with the IT systems used to record processes, but it also improves the efficiency and effectiveness of these processes. Thus, the use of sophisticated IT systems usually leads to two kinds of efficiency improvements. First, the underlying processes are reengineered so as to be conducted more efficiently. Second, the IT systems improve the efficiency of the underlying processes through automation. By rethinking and redesigning processes, the organization may be able to improve, and thereby enhance, the process. Rethinking and redesigning are especially aided

by the use of IT. When computerized technology is introduced into processes, the processes can be radically redesigned to take advantage of the speed and efficiency of computers to improve processing efficiency. IT and BPR have a mutually enhancing relationship. IT capabilities should support the business processes, and any business process should be designed to match the capabilities that the IT system can provide. BPR should leverage the capabilities of IT to improve the efficiency of processes.

BPR is an important aspect of ERP system implementation. Since most organizations' processes do not match the processes in the ERP system for any individual module, BPR is usually undertaken to make the business processes more compatible with the ERP modules. For example, an organization's sales and delivery processes may not currently be done in the same manner as the ERP system module that was written to handle such processes. Since ERP systems have been developed through many years of working experience with many organizations, the ERP systems are usually built around effective and efficient process steps. This means that organizations are usually best served by BPR to change their processes to match those in the ERP system. As described in the preceding paragraph, BPR not only makes the individual process more efficient, but it allows the organization to improve process efficiency overall by capturing the extra efficiencies of the advanced IT processes in the ERP system.

## **Customization of the ERP System**

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As often as possible, organizations should attempt to undertake BPR to match their processes to the ERP system. However, there are cases in which it may be necessary to customize the ERP system rather than change the business processes. Most consultants and experts would recommend that the number of customizations be limited to the least amount necessary. The two primary reasons for limiting customization is cost and upgrading of the system. Any customization may require changing or writing new programming code, which can be a very expensive and time-consuming task. The cost of customization can easily exceed the cost of packaged ERP software. Second, customizations cannot be automatically incorporated when the ERP vendor provides an upgraded version of the ERP system. Therefore, upgrading to the next version may require rewriting the customization to work with the new version of the software.

In practice, many organizations do wish to have some customization. However, customization should be limited, and the organization should fully understand the extra costs and problems inherent in customization.

## **The Costs of Hardware and Software**

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Implementation of ERP systems usually requires the purchase of new computer hardware, systems software, network equipment, and security software. The cost of hardware is dependent on the size of the organization, its current hardware and software, and the scope of implementation of the ERP system. The decision whether to adopt cloud-based ERP systems will also have a tremendous impact on the computer hardware and IT infrastructure needed. A cloud-base system will require less IT structure at the company. Companies should factor in all costs and calculate the total cost of ownership (TCO) for the ERP system they are evaluating. TCO includes the purchase cost of the software, the annual maintenance costs for the software, implementation and training costs, potential costs to upgrade, and hardware costs.

The cost of an ERP software system varies depending on the size of the organization, the number of modules to implement, and whether any best of breed modules are to be purchased. As discussed earlier, a minimum cost of tier one ERP systems is approximately \$1 million, and in the largest corporations, the total cost can be as much as \$100–200 million.

## Testing of the ERP System

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As you consider the previous paragraphs, notice the potential complexity of an ERP system implementation. It can involve integrating ERP modules, legacy systems, and best of breed modules. The primary measure of success for ERP implementation is ERP integration. Because an ERP implementation may involve integration of legacy systems and various modules from different vendors, it is imperative that these systems undergo extensive testing prior to implementation.

## Data Conversion

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The implementation of an ERP system will involve converting data from legacy systems. Second generation ERP systems use relational database management systems (RDBMS) to store enterprise data. Conversion from data in legacy systems to RDBMS can be error prone and time consuming. Often, the data must be cleansed and errors must be corrected prior to conversion. An ERP system is intended to bring many data sources into a single database. The various operational databases of the legacy systems might have incompatible data in several different formats. An appropriate amount of time, effort, and dollars must be devoted to the proper cleansing and conversion of data.

## Training of Employees

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Since ERP system implementation usually requires BPR, many processes that employees are involved with will change. Thus, training is necessary because workers will often have to learn a new set of processes. As is true of data conversion, it is expensive and time-consuming to train employees. However, this is a step that organizations should not take lightly. Poorly trained employees may prevent the organization from fully realizing the benefits of the ERP system and can cause errors and problems in the processes. Such errors can disrupt business processes and introduce incorrect data into the system.

## The Methods of Conversion to the ERP System

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Near the end of the implementation process, the organization must “go live” with the new ERP system. That is, after data conversion, training, software installation, and related tasks, a shift to the new ERP system must take place. There are several methods of making this switch-over. The usual approaches are big bang, location-wise, and modular implementation. These approaches are described in the sections that follow.

**Big Bang** In the **big bang** approach to implementation, the company implements all modules and all functional areas of the ERP system at once. There is a particular

date established as the “go live” date, and the ERP system is turned on fully on that date. Therefore, the installation of ERP systems of all modules happens across the entire company (including any subsidiaries) at once. The big bang approach requires that all functional areas of the company are ready to make the change at the same time. This approach demands a tremendous amount of planning and coordination across the entire company. If well planned and executed, the big bang approach has the potential to reduce the time and cost of implementation. However, it is extremely difficult to execute a big bang conversion well. Such a tremendous effort in planning and coordination is needed that most companies are not able to pull it off.

The underlying premise of a big bang method is that the ERP implementation is simply the implementation of a big information system, which typically follows an SDLC (systems development life cycle) model. But ERP implementation requires a great deal of business process reengineering and is not like IT system changes from years ago. As processes are changed through BPR, implementation becomes more difficult and time consuming. Some have said that an ERP implementation is 60 percent about changing attitudes and only 40 percent about changing systems. Although the big bang method dominated early ERP implementations, it partially contributed the higher rate of failure in early ERP implementations.

## The Real World

The City of Tacoma, Washington, attempted a \$50 million implementation of SAP R/3 to handle all aspects of business processes within the city. The software was intended to incorporate the city’s budgeting, accounting, human resources and payroll, police, fire, and city utilities. The city decided to implement the software in a big bang fashion with the assistance of a consulting firm. The communications supervisor of the city said of the implementation that “they threw the switch at one time, and a lot of failures happened.” These failures included problems with payroll checks, utility bills to city residents, and the budget module. An industry expert indicated that the city “tried to do too much at one time.” These failures in implementation caused the city to spend much more money to fix the problems. For example, the new system workflow required customer service representatives to examine five different screens of customer data to access customer data and answer inquiries. The city had to spend an extra

\$405,000 to have the consulting firm modify the ERP system so that important customer data were collapsed into one screen. The problems that occurred in this implementation are examples of the type of problems encountered in implementing an ERP system by a big bang approach.<sup>3</sup>

However, problems can also be encountered in even less complex projects and less aggressive ERP implementations. Marin County, California, chose SAP as the ERP system to replace its legacy accounting systems. Deloitte was chosen as the consultant. After spending several million dollars and two years in trying to implement SAP, Marin County scrapped the entire SAP project in 2010, intending to start over with another ERP vendor. The SAP ERP system was so poorly implemented that management felt it was a lower-cost alternative to replace it rather than continue the implementation. In 2011, Marin County sued two SAP subsidiaries and Deloitte for \$35 million.

<sup>3</sup> Marc L. Songini, “\$50 Million SAP Rollout Runs Into Trouble in Tacoma,” *Computerworld*, November 22, 2004, vol. 38, no. 47, p. 52.

More than half of the ERP implementations by the big bang approach experienced significant failures or problems in the 1990s, with nearly one-third of these implementations abandoned in progress. As described in the Marin County example there continue to be failures in ERP implementations when they are not well managed. However, there have also been successful big bang implementations of ERP systems.

## The Real World

Marathon Oil Company has been a leader in worldwide energy innovations since 1887. In late 2000, the company began a big bang implementation of SAP R/3 in late 2000. Since Marathon is in a specialized industry, many of its business processes are different from most companies and have unique information needs. Despite the size and uniqueness of Marathon, it was able to fully implement the ERP system and “go live” after 13 months. The team at Marathon undertook several steps to ensure a successful implementation. First,

Marathon selected a cross-functional team to manage the implementation. The company also studied the ERP market and selected the ERP software that best suited its needs. The team also studied the reasons for the failures in implementation that other companies had experienced. ERP systems often require underlying changes to business processes. Marathon had an effective plan to manage change in the organization. All of these factors contributed to the success of the implementation at Marathon.<sup>4</sup>

If a company plans a big bang approach to implementation, it must consider the many risks and potential problems. To avoid the risk inherent in a big bang approach, other approaches can be used for the implementation of an ERP system, described in the sections that follow.

**Location-Wise Implementation** In a **location-wise** implementation of an ERP system, the organization chooses a specific location or subunit of the organization and implements the ERP system in that place only. This approach can be considered a “pilot” approach in which the ERP is first carried out in a subunit of the larger organization. This means that any resulting problems will be isolated within the pilot unit so that the entire organization is not impacted. This location-wise approach allows

## The Real World

Even when a company uses a low risk ERP conversion method such as location-wise, there can still be major problems. In 2013, Avon announced that it was abandoning a roll-out of SAP in the United States. In 2009, Avon began implementing SAP in Canada, and hoped to expand it to the United States. However, the Canadian implementation caused a large number of problems for

Avon sales representatives and disrupted operations.

This meant Avon was abandoning a four year effort to implement SAP. This abandonment also caused Avon to write down balance sheet values between \$100 and \$125 million. This example illustrates that ERP implementations always have the risk of causing problems if not properly managed.

<sup>4</sup> Gregg Stapleton and Catherine J. Rezak, “Change Management Underpins a Successful ERP Implementation at Marathon Oil,” *Journal of Organizational Excellence*, Autumn 2004, pp. 15–22.

the implementation team to work out many of the implementation and operational issues of the ERP system while its impact is minimized within a single location. Once the pilot implementation has been completed and any related issues have been addressed, the ERP implementation can be continued across the entire organization.

**Modular Implementation** In a **modular implementation**, the ERP system is implemented one module at a time. The implementation team will normally focus on the most critical module first and complete the implementation of modules in descending order. This allows the organization to take advantage of the new features of the module in the ERP system without affecting all processes in the organization.

A modular implementation normally limits the scope of implementation to one functional department. The implementation team can choose to implement the module in a single location, or organization-wide. A modular implementation reduces the risks associated with installation and operation of ERP systems because it reduces the scope of the implementation. A modular approach will mean that the organization cannot take advantage of all modules in the ERP system until all intended modules have been phased in. This means that the interaction of many of the ERP modules cannot be fully realized until all selected modules are implemented.

## Benefits and Risks of ERP Systems (Study Objective 7)

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As is true of any IT system, there are both benefits and disadvantages to ERP systems. The next several sections describe some of the benefits and disadvantages.

### Benefits of ERP Systems

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ERP systems have characteristics that allow an organization to experience many benefits. However, to gain any benefits from an ERP system, the organization must successfully implement and operate the ERP system. The characteristics that allow organizations to benefit are the following:

1. The interactive nature of the modules allows processes to interact with each other. For example, the ordering and receiving processes can automatically trigger payment processes.
2. The real-time nature of processing decreases the total processing time and allows more immediate feedback to management.
3. The “best practices” nature of the processes in ERP systems—ERP systems have evolved from many years of software experience with various companies, and the software reflects tried and true practices.
4. The single database enhances sharing of information between the business’s functional areas and between processes.
5. There is the capability to analyze large amounts of data in a single database. Analytical tools that enable detailed analysis of the data are incorporated into ERP systems.
6. The capability to enhance e-commerce and e-business—the ERP systems of today incorporate modules to fully incorporate e-commerce and e-business.
7. ERP systems have the capability to interact in real-time with trading partners. ERP systems are built to interact with the IT systems of trading partners such as customers and suppliers.
8. ERP systems are **scalable**, which means they can grow with the business.

**EXHIBIT 6-4****Five Dimensions of ERP Benefits****Operational**

- Reduction of cost and cycle time
- Improvement of productivity, quality, and customer service

**Managerial**

- Improved performance, decision making, and resource management

**Strategic**

- Support for business growth and business alliance
- Building cost leadership and business innovations
- Generating product differentiation
- Building external linkages
- Generating or sustaining competitiveness
- Enabling e-commerce and increasing Web integration

**IT infrastructure**

- Building business flexibility for current and future changes
- IT cost reduction
- Increased IT infrastructure capability

**Organizational**

- Changing work patterns and work focus
- Facilitating organizational learning
- Empowerment
- Building common vision
- Increased employee morale and satisfaction

These characteristics can allow more efficient processes, better information flow between processes and to management, and therefore increased organization efficiency, effectiveness, and cost control.

Two researchers named Shari Shang and Peter Seddon undertook an extremely detailed study of companies that had implemented ERP systems. They examined the websites of the top software sellers of ERP systems. Each of these websites contained the success stories of customers who had implemented ERP systems. Shang and Seddon studied 233 of these business cases and developed a list of benefits that can be gained by implementing ERP systems. Exhibit 6-4 is a summary of the five dimensions of benefits that Shang and Seddon identified as a result of their study.<sup>5</sup>

## Risks of ERP Systems

The risks inherent in ERP systems can be categorized into the two primary risk areas: implementation and operation.

**Implementation Risks** The risks inherent in an ERP implementation are very similar to risks of implementing any IT system. However, the scope, size, and complexity of an ERP system increase many of these risks. Since the intent of ERP is to implement the system across the entire enterprise and to incorporate all business processes into the ERP system, the scope, size, and complexity increase tremendously. This causes the implementation of an ERP system to be very costly, time-consuming, and potentially disruptive to current operations.

<sup>5</sup> Shari Shang and Peter B. Seddon, "Assessing and Managing the Benefits of Enterprise Systems: The Business Manager's Perspective," *Information Systems Journal*, October 2002, vol. 12, issue 4, pp. 271–299.

ERP implementation cost and the time required have been briefly discussed in other sections of this chapter. In summary, large organizations may spend in excess of \$100 million and 1–2 years to implement an ERP system. Upgrading ERP systems to new versions of the same ERP system are also expensive and time-consuming, but not as expensive or time-consuming as the original implementation.

The complexity of an ERP system is due to the enterprise-wide scope and integrated nature of an ERP system. All business processes are incorporated into the ERP system, but the system is also integrated in the sense that each process affects other processes. For example, the sale of goods in an ERP system may automatically trigger more production, which in turn would trigger the purchase of raw materials. The need to ensure that these integrated processes are triggered at the correct time and in the correct amounts is a very complex implementation issue.

**Operation Risks** As was true for implementation risks, the operation risks inherent in ERP systems are similar to those for other IT systems. The extent of the risks may be larger, since the ERP system is enterprise-wide and processes are integrated. For example, a risk of any IT system is availability. An IT system failure can stop or disrupt operations. The failure of a legacy system that is not enterprise-wide may affect only part of the organization's processes. For example, if a separate legacy system for payroll fails, it would not necessarily impact sales or purchase processes. However, an ERP system would normally incorporate all business processes. Therefore, if the ERP system fails, it has the potential to stop or disrupt all processes across the entire enterprise.

The full scope of operation risks are those identified in the AICPA Trust Services Principles as described in Chapter 4. Those risks are as follows:

1. **Security.** The system is protected against unauthorized (physical and logical) access.
2. **Availability.** The system is available for operation and use as committed or agreed.
3. **Processing integrity.** System processing is complete, accurate, timely, and authorized.
4. **Online privacy.** Personal information obtained as a result of e-commerce is collected, used, disclosed, and retained as committed or agreed.
5. **Confidentiality.** Information designated as confidential is protected as committed or agreed.

Each of these risks becomes magnified when the IT system is an ERP system. Security becomes a greater risk because the processes are integrated and, often, automatically triggered in ERP systems. Therefore, any unauthorized user can affect more processes than in an older, legacy system. For example, unauthorized access to a purchase module in an ERP system could allow an unauthorized user to trigger not only purchase activities, but also the related payment within accounts payable.

Processing integrity risks are also magnified in ERP systems due to the integrated nature of the processes. Incorrect data generated in a given process can automatically trigger other processes and post flawed data to other processes. Processes may be triggered at the wrong time, and incorrect data can be spread over several processes and ERP modules. It is important to understand that such processing integrity problems are possible in any IT system. But they have the potential to be more damaging in an ERP system.

Online privacy and confidentiality risks are also magnified in ERP systems. ERP systems often have sales and customer relationship management modules in an e-commerce mode. This means that sales and customer data are exchanged via the Web or EDI. In ERP systems, these front office systems of e-commerce and sales are automatically integrated into the back office systems of an ERP system. The back office modules include the financials, supply chain management, and human resources modules. Therefore, in an ERP system, the e-commerce activity of customers often automatically integrates into the general ledger and related processes. This interconnectivity causes more areas for private and confidential information to be available.

As discussed in previous chapters, cloud-based systems can dramatically change the security, availability processing integrity, and confidentiality risks. The choice of a cloud-based ERP system shifts the responsibility for controls in each of these areas to the cloud provider.

## ERP Systems and the Sarbanes–Oxley Act (Study Objective 8)

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Referring back to Exhibit 6-3, you will notice that within the financials module, there is a section entitled “Corporate Governance.” Since the passage of the Sarbanes–Oxley Act of 2002, ERP systems have been enhanced to include functions that assist management in complying with sections of the Act. For example, Section 404 of the Act requires assessment of internal controls. An internal control report is required to accompany each financial statement filing. The internal control report must establish management’s responsibility for the company’s internal controls and related financial reporting systems. It must also include an assessment of the effectiveness of the company’s internal controls and related financial reporting systems. If there are any weaknesses in internal controls, they must be disclosed in this report.

Enhanced ERP systems provide feedback information to management regarding internal controls. To effectively use this function of an ERP system, there are important steps the company should accomplish:

1. Establish and maintain a list of incompatible duties. These incompatible duties are often called **conflicting abilities**. For example, proper segregation of duties should not allow an employee to both approve purchases and record or approve goods received at the receiving dock. A company must review all of the possible activities conducted by employees within the accounting system and catalog the list of conflicting abilities.
2. As user ID and passwords are assigned to employees, ensure that they are given access and authority only to those parts of the system required. If done correctly, this should segregate duties to avoid giving conflicting abilities to any employee involved with the ERP system. This assigning of access and authority for a specific user ID is called a **user profile**. ERP systems can be used to properly segregate duties. The ERP system can incorporate a matrix of tasks that are conflicting abilities. For each employee ID and password, the system can check the employee’s access to various tasks to ensure that no employee can initiate or conduct incompatible tasks. The ERP system electronically segregates duties by limiting the types of transactions each employee can perform. For example, an individual employee should not have system

access to initiate a purchase and record it as received. In ERP systems in which integrated modules often automatically trigger events, recording the receipt can automatically initiate a check for payment. Thus, it is important that any employee not have authorization in the ERP system to initiate a purchase and also record the receipt.

3. Because of promotions or other job changes, an employee may have different access or authorizations. It is important that a company review the user profile and change any access and authority levels as necessary. Forgetting to do this may lead to an employee having conflicting abilities.
4. Configure the ERP system to track and report any instances where an employee initiated or recorded an event with conflicting abilities. For processes tracked by the ERP software, a report can be generated that identifies which employees are authorized to initiate and conduct processes. Based on each employee's user profile, audit trails can be constructed and reported that indicate which employees initiated or conducted individual processes. This module within the ERP system can map processes to assist management in understanding whether duties are appropriately segregated. The timing for this reporting of conflicting abilities is determined by management. Some companies review these reports on a periodic basis, such as weekly or monthly. Alternatively, companies may use real-time notification, where the ERP system continually scans for conflicting ability events. If one is detected, an e-mail or text message is immediately sent to the appropriate manager so that it can be addressed in real time.
5. Monitoring these periodic reports or real-time reports allows the appropriate manager to determine if user profiles should be changed to prevent future conflicting abilities.

Segregation of duties is an important part of internal control that can help prevent errors and fraud. By using the process outlined here, an ERP system can assist management in monitoring internal control, monitoring errors and problems, and monitoring exceptions to internal controls. An ERP system can also produce other reports related to monitoring internal controls. There are too many reports to describe each one, but Exhibit 6-5 lists some examples of internal controls monitored in an accounts payable system.

The main purpose of these reports is to ensure that transactions are carried out only in accordance with management's authorization and that unauthorized transactions are prevented or detected. They also provide objective evidence that management can use when assessing compliance with Sarbanes–Oxley internal control requirements.

**EXHIBIT 6-5****Examples of Accounts Payable Internal Control Reports**

Report	Purpose
Purchase orders without a requisition	To ensure all purchases are requisitioned before the purchase takes place
Purchase orders created after the invoice date	To prevent the creation of a purchase order invoice date after the invoice date
Blocked invoice report	To resolve discrepancies on invoices so that they can be paid on a timely basis

## Summary of Study Objectives

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**An overview of an ERP system.** An enterprise resource planning (ERP) system is a multimodule software system that can integrate all business processes and functions of the entire organization into a single software system using a single database. Each module is intended to collect, process, and store data of a functional area of the organization and to integrate with related processes. The ERP system is the IT infrastructure that has enhanced and enabled e-commerce and e-business. ERP systems and e-business are mutually supporting parts of the organization. ERP systems enhance e-business, and e-business has enhanced the process efficiency of ERP systems. ERP systems contain modules and use an operational database and a data warehouse.

**The history of ERP systems.** ERP systems can be traced back to software that was developed during the 1960s and 1970s to track inventory in manufacturing companies. The first generation of this software was called materials requirements planning (MRP) software. MRP software evolved into manufacturing resource planning (MRP II) systems. MRP II was much broader and more encompassing than MRP software. MRP software was intended to support the purchase of raw materials for manufacturing needs. The purpose of MRP II was to integrate manufacturing, engineering, marketing, and finance units to run on the same information system and to use a single database for these functions. As MRP and MRP II systems were becoming popular in large manufacturing companies, early pioneers of ERP systems were working on a broader concept of information system software. However, ERP software did not become popular in the large corporation software market until the 1990s. During the last half of 1990s, there was very rapid growth in the sales of ERP software to Fortune 500 companies.

**Current ERP system characteristics.** Most large businesses have implemented ERP systems that are connected to the IT systems of trading partners. EDI, Internet EDI, or extranets are used to connect a company's ERP system to the IT systems of its suppliers and customers. For example, suppliers may monitor their customers' inventory levels and electronically trigger a shipment when items they supply reach pre-arranged reorder levels. IT spending on ERP systems was flat in the early years following 2000, but it began to rise in 2004. Although ERP spending may decline when economic conditions are poor, several factors can lead to increased spending on ERP systems. ERP has become so important to daily operations that companies cannot allow their ERP systems to become outdated.

**The modules of an ERP system.** The ERP systems used by large organizations are actually more complex and encompass more of the enterprise than depicted in Exhibit 6-1. There are many modules in modern ERP systems that encompass the entire organization. This chapter does not describe each of these modules in detail, but focuses on those modules most closely tied to accounting: financials, human resources, procurement and logistics, product development and manufacturing, sales and services, analytics, supply chain management (SCM), and customer relationship management (CRM).

**The market segments of ERP software systems.** There are at least two tiers of ERP systems within the market for ERP software. Tier one includes software often used

by large, multinational corporations. Three popular tier one ERP systems are SAP, Oracle, and Microsoft Dynamics AX. Tier two describes software used by midsized businesses and organizations. A growing trend is cloud-based ERP systems. ERP software providers have, or likely will provide, cloud-based ERP systems.

**Implementation issues of ERP systems.** There are many important factors and issues to bear in mind when an organization considers implementation of an ERP system. The management of an organization must consider each of these issues before or during the ERP implementation. These issues include hiring a consulting firm, the best-fit ERP system, which modules to implement, whether to use the best of breed or the entire package of brand-provided ERP modules, business process reengineering, customization of the ERP system, the costs of hardware and software, testing the ERP system, data conversion, training of employees, and the choice from the various methods of conversion or “go live.”

**The benefits and risks of ERP systems.** There are many benefits to ERP systems. The characteristics of an ERP system allow more efficient processes, better information flow between processes and to management, and the consequent increased organization efficiency, effectiveness, and cost control. There are also implementation and operation risks of ERP systems. The inherent implementation risks are very similar to risks of implementing any IT system. However, the scope, size, and complexity of an ERP system increase many of these risks.

**ERP systems and the Sarbanes–Oxley Act.** Since the passage of the Sarbanes–Oxley Act of 2002, ERP systems have been enhanced to include functions that assist management in complying with sections of the Act. These enhanced ERP systems provide feedback information to management regarding internal controls. By tracking each employee’s ID and password, audit trails can be constructed and reports generated that identify which employees initiated or conducted specific transactions or tasks. ERP systems can also be used to properly segregate duties. The ERP system can incorporate a matrix of tasks that are incompatible. For each employee ID and password, the system can limit employee’s access to ensure that no employee can initiate or conduct tasks that are conflicting abilities. An ERP system also allows real-time monitoring and reporting of exceptions.

## Key Terms

Availability	Data warehouse	Materials requirements planning (MRP)	SAP
Back office modules	Enterprise resource planning (ERP)	Microsoft Dynamics AX	Scalable
Best of breed	Front office	Microsoft Dynamics GP	Security
Big bang implementation	modules	Modular	Supply chain
Business process reengineering (BPR)	Location-wise implementation	implementation	management (SCM)
Conflicting abilities	Manufacturing resource planning (MRP II)	Operational database	Tier one
Customer relationship management (CRM)		Oracle	Tier two
		Processing integrity	User profile
			Y2K compatibility

## End of Chapter Material

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### Concept Check



- 1 Which of the following advantages is least likely to be experienced by a company implementing an enterprise resource planning (ERP) system?
  - a. Reduced cost
  - b. Improved efficiency
  - c. Broader access to information
  - d. Reduced errors
- 2 An ERP system is a software system that provides each of the following except
  - a. collection, processing, storage, and reporting of transactional data
  - b. enhancement of e-commerce and e-business
  - c. coordination of multiple business processes
  - d. physical controls for the prevention of inventory theft
- 3 Which of the following is not a feature of an ERP system's database?
  - a. Increased efficiency
  - b. Increased need for data storage within functional areas
  - c. Increased customer service capability
  - d. Increased data sharing across functional areas
- 4 Manufacturing companies implement ERP systems for the primary purpose of
  - a. increasing productivity
  - b. reducing inventory quantities
  - c. sharing information
  - d. reducing investments
- 5 What company developed the first true ERP systems?
  - a. Microsoft
  - b. PeopleSoft
  - c. SAP
  - d. IBM
- 6 In the late 1990s, the Y2K compatibility issue was concerned primarily with computer systems'
  - a. file retrieval capability
  - b. data storage
  - c. human resource comparisons
  - d. capital budgeting
- 7 The primary difference between ERP and ERP II systems is that ERP II may include
  - a. Internet EDI
  - b. logistics modules
  - c. reporting modules
  - d. a data warehouse
- 8 Which of the following is not one of the reasons for increased spending on ERP systems in recent years?
  - a. The need for Sarbanes–Oxley compliance
  - b. Globalization and increased competitive pressures
  - c. The need for earnings management
  - d. The need for customer service enhancements
- 9 Supply chain management (SCM) is a critical business activity that connects a company more closely with its
  - a. customers
  - b. suppliers
  - c. subsidiaries
  - d. customers and suppliers
- 10 The type of ERP system used by large, multinational corporations is known as
  - a. big bang implementation
  - b. modular implementation
  - c. tier one software
  - d. tier two software
- 11 Which of the following ERP approaches accomplishes the ERP implementation beginning with one department?
  - a. The pilot method
  - b. The modular implementation approach
  - c. The big bang approach
  - d. The location-wise implementation method
- 12 Which of the following statements best describes the risks of ERP systems?
  - a. The risks of implementing and operating ERP systems are nearly identical to the risks of implementing and operating IT systems.
  - b. The risks of operating and implementing ERP systems are greater than the risks of implementing and operating IT systems, due to the scope, size, and complexity of ERP systems.
  - c. The risks of implementing ERP systems are greater than the risks of implementing IT systems, but the operating risks are nearly identical.
  - d. The risks of operating ERP systems are greater than the risks of operating IT systems, but the implementation risks are nearly identical.

## Discussion Questions

- 13 (SO 1) Describe how ERP systems enhance efficiency in a business organization.
- 14 (SO 1) Why is real-time processing essential in an ERP system?
- 15 (SO 1) How has ERP increased the responsibilities of customer service representatives?
- 16 (SO 1) What is an MRP II system and how is it different from the ERP systems in use today?
- 17 (SO 1) What are the two databases used by ERP systems?
- 18 (SO 1) Differentiate between the enterprise-wide and nonvolatile features of a company's data warehouse.
- 19 (SO 2) What was unique about SAP's first ERP system?
- 20 (SO 2, SO 5) Differentiate between the features of SAP's R/1, R/2, and R/3. What does the "R" stand for in this name?
- 21 (SO 3) How do ERP II systems allow businesses to improve efficiencies with respect to sharing information with trading partners?
- 22 (SO 3) How did the tragic events of September 11, 2001, affect the market for ERP systems?
- 23 (SO 4) What are some of the activities included in an ERP module for supply chain management?
- 24 (SO 4) What are some of the features of an ERP module for customer relationship management?
- 25 (SO 5) Which company is today's top seller of ERP systems in the United States?
- 26 (SO 5) Differentiate between Oracle's back office and front office modules.
- 27 (SO 5) Which tier one company introduced the first ERP system that was "pure Internet," requiring no programming code to reside on the client computer?
- 28 (SO 5, SO 6) Which of the tier one ERP companies is likely to provide the "best fit" for a manufacturing firm? for a human resources placement company?
- 29 (SO 6) Why is business process reengineering an important aspect of ERP implementation?
- 30 (SO 6) Why should customization of an ERP system be limited?
- 31 (SO 6) Differentiate between location-wise and modular implementation approaches to the conversion to an ERP system.
- 32 (SO 7) Which method of conversion to an ERP system is sometimes referred to as a "pilot" method? Why is this name appropriate?

- 33 (SO 8) How can an ERP system assist a company in its efforts to comply with the Sarbanes-Oxley Act of 2002?

## Brief Exercises

- 34 (SO 2) Why was there so much growth in the sales of ERP systems in the late 1990s?
- 35 (SO 3) What are the five most common reasons for increased spending on ERP systems in the early 2000s? Which of these reasons was the impetus for Viper's ERP implementation in 2003?
- 36 (SO 4) Match the ERP modules on the left with their purpose of the related processes on the right:

I. Financials	a. Taking customer orders and preparing for the impending revenue and cash collection
II. Human Resources	b. Maintaining of the general ledger and supporting journals and subledgers
III. Procurement and Logistics	c. Keeping track of purchasing and movement of goods and materials
IV. Product Development and Manufacturing	d. Accounting for personnel and payroll activities
V. Sales and Services	e. Data mining and other processes for obtaining feedback and supporting managerial decision making
VI. Analytics	f. Planning and scheduling of conversion activities

- 37 (SO 6) Discuss the potential advantages and disadvantages that exist with respect to engaging a consultant for an ERP implementation.
- 38 (SO 7) What are the primary benefits of an ERP system? What are the primary risks?
- 39 (SO 7) What are Shang and Seddon's five dimensions of ERP benefits?
- 40 (SO 7) Name the AICPA Trust Services Principles' five operations risks. Why are these risks greater for ERP systems than for other IT systems?
- 41 (SO 8) Explain how an ERP system can enhance internal controls. Specifically, how can it facilitate the separation of duties?

## Problems

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- 42** (SO 1) Describe the ERP's modular interface that is necessary in a typical manufacturing environment.
- 43** (SO 2) Identify and describe the first generation of ERP systems used in the 1970s and the second generation of ERP systems used in the 1980s.
- 44** (SO 4) Compare and contrast the functionality of the logistics module and supply chain management activities.
- 45** (SO 7, 8) Suppose a company is experiencing problems with omitted transactions in the conversion processes—that is, inventory transactions are not always being recorded as they occur. How can an ERP system help to alleviate such a problem?
- 46** (SO 6) Using the Internet or other research tool, search for the terms “best of breed ERP systems strategy” and ERP. Locate information that addresses the debate and dilemma faced by many companies regarding the implementation choice between best of breed technology and new applications from an ERP vendor. Write a brief memo to discuss this issue.
- 47** (SO 6) Using the Internet or other research tool, search for the terms “big bang” and ERP. Identify at least one company that represents a success story with regard to this ERP implementation method (other than Marathon, as described in this chapter's Real-World example). Also identify at least one company that experienced problems with this approach (other than the City of Tacoma, as described in this chapter's Real-World example).
- 48** (SO 6) Using the Internet or other research tool, search for the terms “ERP” and “SME.” Describe why a small to medium-sized entity might choose an ERP system.
- 49** (SO 6) Using the Internet or other research tool, search for “ERP software in the cloud” and outline (a) pros, (b) cons, and (c) considerations of adopting cloud deployment for an ERP system.
- 50** (SO 6) Using the Internet or other research tool, search for “Total Cost of Ownership” and “ERP Software” and describe costs to consider when calculating the total cost of ownership for an ERP system.
- 51** (SO 6) Using the Internet or other research tool, search for “compare ERP software” and describe pros and cons of two Midmarket/tier two ERP systems.
- 52** (SO 6) Using the Internet or other research tool, search for “SAP software” and describe the type of company where SAP would be a good choice for an ERP system.
- 53** (SO 6) Using the Internet or other research tool, search for “Microsoft Dynamics GP software” and describe the type of company where Great Plains would be a good choice for an ERP system.

## Cases

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- 54** Michael Michner Industries (MMI) is a manufacturer of warehouse and inventory tracking systems. MMI has four U.S. plants and three warehouses. The company employs 3,500 workers at these facilities and the corporate headquarters. MMI is using legacy systems for its accounting, materials requirement planning, receivables, payables, inventory, and payroll processes. These various legacy systems were developed at different times and do not necessarily have common data formats or programming. Often, MMI must export data from one legacy system to incorporate into a second legacy system. The president has decided that the company must switch to an ERP system to bring the company's systems up to date and to enable the company to remain competitive.
- Required:**
- Describe how an ERP system could improve performance at MMI.
- b.** Describe the relative advantages and disadvantages of a big bang versus a modular implementation.
- c.** If MMI chooses a modular implementation, how might it choose the order in which to implement modules?
- 55** Chacon University is a Midwest university with 16,000 students, using various legacy systems for student records, financial systems, human resources, and financial aid. The president of Chacon heard a presentation about ERP systems at a seminar for university administrators.

**Required:**

Read the article at [http://www.cio.com/article/107706/university\\_ERP\\_Big\\_Mess\\_on\\_Campus](http://www.cio.com/article/107706/university_ERP_Big_Mess_on_Campus). In addition, search online for “Montclair University” and “Oracle” to read about another university's ERP implementation problems. Summarize the problems with using an ERP system at a university.

## Solutions to Concept Check

- 1 (CIA, CMA Adapted) (SO 1) **a. Reduced cost** is the advantage least likely to be experienced by a company implementing an ERP system. Although ERP systems can lead to significant benefits, many companies experience increases in IT equipment costs and related staffing costs. This is because multiple additional computer systems are needed to link the ERP systems and facilitate their smooth functioning.
- 2 (SO 1) An enterprise resource planning (ERP) system is a software system that provides each of the given options except **d. physical controls for the prevention of inventory theft**.
- 3 (SO 1) **b. Increased need for data storage within functional areas** is not a feature of an ERP system's database. ERPs operate on an operational database, which allows for the centralized storage of data.
- 4 (CIA Adapted) (SO 1) Manufacturing companies implement ERP systems for the primary purpose of **c. sharing information**. To compete globally, companies must be able to share information quickly and effectively across the organization.
- 5 (SO 2) **c. SAP** developed the first true ERP systems.
- 6 (SO 2) In the late 1990s, the Y2K compatibility issue was concerned primarily with computer systems' **b. date storage**. The concern was that older legacy systems would "blow up" when faced with a date of 2000 or later, as they might interpret the year "00" as 1900 instead of 2000.
- 7 (SO 2) The primary difference between ERP and ERP II systems is that ERP II may include **a. Internet EDI**. EDI, Internet EDI, or extranets are used to connect a company's ERP systems with the IT systems of its trading partners.
- 8 (SO 3) **c. The need for earnings management** is not a reason for increased spending on ERP systems in recent years.
- 9 (SO 4) Supply chain management is a critical business activity that connects a company more closely with its **d. customers and suppliers**.
- 10 (SO 5) The type of ERP system used by large, multinational corporations is known as **c. tier one software**. Answers a. and b. are implementation methods rather than types of systems.
- 11 (SO 6) **b. The modular implementation approach** accomplishes the ERP implementation one department at a time. This approach normally limits the scope of implementation to one functional department, gradually phasing in each module.
- 12 (SO 7) The following statement best describes the risks of ERP systems: **b. The risks of operating and implementing ERP systems are greater than the risks of implementing and operating IT systems, due to the scope, size, and complexity of ERP systems**.

## CHAPTER 7

# Auditing Information Technology-Based Processes

### STUDY OBJECTIVES

This chapter will help you gain an understanding of the following concepts:

- 1.** An introduction to auditing IT processes
- 2.** The various types of audits and auditors
- 3.** Information risk and IT-enhanced internal control
- 4.** Authoritative literature used in auditing
- 5.** Management assertions used in the auditing process and the related audit objectives
- 6.** The phases of an IT audit
- 7.** The use of computers in audits
- 8.** Tests of controls
- 9.** Tests of transactions and tests of balances
- 10.** Audit completion/reporting
- 11.** Other audit considerations
- 12.** Ethical issues related to auditing

Auditing information technology-based processes is the focus of this chapter. The Real World example on the next page will help you understand the context of many concepts included in this chapter. Please read the Real World example to begin effective reading and studying of this chapter.

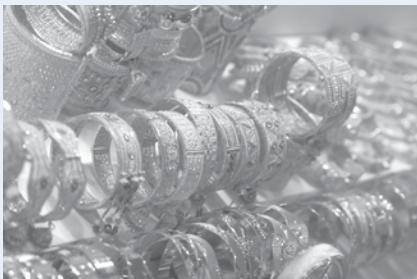
### Introduction to Auditing IT Processes (Study Objective 1)

Nearly all business organizations rely on computerized systems to assist in the accounting function. Technological advances have transformed the business world by providing new ways for companies to do business and maintain records. This boom in technological developments has increased the amount of information that is readily available. Business managers, investors, creditors, and government agencies often have a tremendous amount of data to use when making important business decisions. Likewise, the accounting profession is undergoing unprecedented change as a result of the explosion of available data, complexity of the data, and new technological tools. However, accountants are often challenged to verify the accuracy and completeness of information.

Accountants have an important role in the business world because they are called upon to improve the quality of information provided to decision makers. Accounting services that improve the quality of information are called **assurance services**. Many types of services performed by

accountants are considered assurance services because they lend credibility to the underlying financial information. An audit is the most common type of assurance service.

## The Real World



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The Aurafin brand is renowned in the jewelry industry as the fashion leader in fine gold. Owned by Richline Group, Inc., a subsidiary of Berkshire Hathaway, Inc., the brand is sold by retail giants like JCPenney, Macy's and many television and online networks. However, Aurafin has overcome significant challenges in maintaining its customer relationships. Several years ago, Aurafin experienced such severe problems with transaction fulfillment and delivery that its customers were taking

notice. In fact, JCPenney had implemented a supplier scorecard system, a type of vendor audit whereby companies doing business with JCPenney were evaluated on the basis of the quality of service provided. This system brought to light some significant violations in Aurafin's business processes, including weak controls and inadequate computer systems.

Aurafin took quick action, undergoing a thorough IT audit that identified the specific causes of its failures. Aurafin acted swiftly upon the recommendations of its auditors and implemented a more reliable technology platform that empowered it to apply a variety of new audit and control techniques and to get its systems in sync with its business goals. Aurafin credited the audit processes to its newfound success, including its recognition as JCPenney's "Vendor of the Year." This chapter focuses on various aspects of an IT audit, as well as the accountant's techniques for evaluating IT processes, and their importance in business processes.

## Types of Audits and Auditors (Study Objective 2)

An audit is a type of assurance service that involves accumulating and analyzing support for information provided by others. The main purpose of the audit is to assure users of financial information about the accuracy and completeness of the information. To carry out an audit, accountants collect and evaluate proof of procedures, transactions, and/or account balances and compare the information with established criteria. The three primary types of audits include compliance audits, operational audits, and financial statement audits. Although all audits involve an investigation of supporting information, each type of audit has a different purpose.

- **Compliance audits** determine whether the company has complied with regulations and policies established by contractual agreements, governmental agencies, company management, or other high authority.
- **Operational audits** assess operating policies and procedures for efficiency and effectiveness.
- **Financial statement audits** determine whether the company has prepared and presented its financial statements fairly, and in accordance with established financial accounting criteria.

Audits are typically conducted by accountants who have knowledge of the established criteria. For example, financial statement audits are performed by **certified public accountants (CPAs)** who have extensive knowledge of generally accepted accounting principles (GAAP) in the United States and/or International Financial

Reporting Standards (IFRS). There are different types of audit specialization that exist in business practice today, including internal auditors, IT auditors, government auditors, and CPA firms. An **internal auditor** is an employee of the company that he or she audits. Most large companies have a staff of internal auditors who perform compliance, operational, and financial audit functions at the request of management. Some internal auditors achieve special certification as certified internal auditors (CIAs). **IT auditors** specialize in information systems assurance, control, and security, and they may work for CPA firms, government agencies, or with the internal audit group for any type of business organization. Some IT auditors achieve special certification as certified information systems auditors (CISAs). **Government auditors** conduct audits of government agencies or income tax returns. CPA firms represent the interests of the public by performing independent audits of many types of business organizations.

Each type of auditor may perform any of the three types of audits described earlier. However, only CPA firms can conduct financial statement audits of companies whose stock is sold in public markets such as the New York Stock Exchange. An important requirement for CPA firms is that they must be neutral with regard to the company being audited. This requirement of neutrality allows the CPA firm to provide a completely unbiased opinion on the information it audits, and it is the foundation of an external audit performed by CPAs. An **external audit** is performed by independent auditors who are objective and neutral with respect to the company and information being audited. To keep their neutrality, CPA firms and their individual CPAs are generally prohibited from having financial or managerial connections with client companies and from having personal ties to those working for client companies. A CPA's objectivity could be impaired by having these types of relationships with a client company or with anyone having the ability to influence the client's decisions and financial reporting activities.

The Ford example illustrates the importance of an objective and diligent internal audit practice and its strong link to the finance and technology functions.

## The Real World

Top management at Ford Motor Co. is proud of the fact that Ford was the only U.S. auto manufacturer to make it through the darkest days of the economic recession (between 2008 and 2010) without government assistance. This is due, in part, to Ford's long history of focusing on financial processes and controls, and its ability to alter its processes under pressures of elevated risks or new compliance requirements. A key element in this process is a rotational succession and development plan in use for staffing Ford's internal audit team. Under this model, the internal audit department is comprised of experienced professionals on rotation from the

company's finance and IT functions, who serve the internal audit department for two to three years before returning to a previous or different functional area. This allows Ford's personnel to gain broad corporate exposure and to develop strong risk, control, and compliance skills to take with them to the various areas where they will work after their internal audit stint. This also helps to promote the importance of the internal audit function throughout the organization. By carefully planning the succession so that no new auditors will audit their prior functions for at least 12 months, Ford's plan ensures that its internal auditors maintain a high level of objectivity.

Any audit may be affected by the amount and type of computerization and data used by the company. All types of auditors should have knowledge concerning technology-based systems and data management techniques so that they can properly

audit IT systems. The remainder of this chapter will concentrate on financial statement audits conducted by CPA firms, as this is the most common type of audit service used in the modern business world. However, many of the topics applicable to financial statement audits conducted by CPA firms are also applicable to other types of audits performed by other types of auditors. The company's internal auditors may also assist in the performance of a financial statement audit, but only an independent CPA may issue an opinion on the overall fair presentation of the financial statements.

Performing financial statement audits is a main service of CPA firms, and they devote a large portion of time to these audits. Because many companies manage large volumes of data and use sophisticated IT accounting systems to prepare financial statements, it is increasingly important for auditors to enhance the quality of their services in auditing those systems. IT auditing is a part of the financial statement audit that evaluates a company's computerized accounting information systems. Since the IT processes are typically a major factor in the financial statement audit, an auditor must gain a sufficient understanding of the characteristics of a company's IT system. It is crucial for auditors to understand the impact of IT on the company's accounting systems and internal controls.

As mentioned previously, a financial statement audit is conducted in order to express an opinion on the fair presentation of financial statements. This is the primary goal of a financial statement audit, and this goal is not affected by the presence or absence of IT accounting systems. However, the use of computers may significantly change the way a company processes and communicates information, and it may affect the underlying internal controls. Therefore, the IT environment plays a key role in how auditors conduct their work in the following areas:

- Consideration of risk
- Audit procedures used to obtain knowledge of the accounting and internal control systems
- Design and performance of audit tests

## Information Risk and IT-Enhanced Internal Control (Study Objective 3)

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As business environments become more complex, the possibility of receiving unreliable information increases. **Information risk** is the chance that information used by decision makers may be inaccurate. Following are some causes of information risk:

- *The remoteness of information.* Decision makers are typically forced to rely on others for information. When the source of the information is removed from the decision maker, the information stands a greater chance of being misstated. A decision maker may become detached from the source of important information due to geographic distances, organizational layers, or other factors that are often associated with a company's growth.
- *The volume and complexity of the underlying data.* As a business grows, the volume and complexity of its transactions increase, which may result in information overload. This tends to increase the chance that misstated information may exist undetected.
- *The motive of the preparer.* Those who prepare information may have goals different from those of the decision maker. As a result, the information may be slanted in favor of a particular viewpoint or incentive, which impacts its presentation and decision-making usefulness.

The most common way for decision makers to reduce information risk is to rely upon information that has been audited by an independent party. Because information users generally do not have the time or ability to verify information for themselves, they depend on auditors for accurate and unbiased judgments. Even if decision makers wanted to verify the information, it may be difficult to do so when the financial information consists of unstructured data or Big Data, and is contained in computerized accounting systems or in the cloud. These are the main reasons that a discussion of information-based processing and the related audit function are included in the study of accounting information systems.

Various risks are created by the existence of IT-based business processes. For example, because the details of transactions are often entered directly into the computer system, there may be no paper documentation maintained to support the transactions. This is often referred to as the **loss of audit trail visibility** because there is a lack of physical evidence to visibly view. There is also a greater likelihood that data may be lost or altered due to system failure, database destruction, unauthorized access, or environmental damage. In addition, IT systems do many tasks that previously were manually performed by humans. Since IT systems, rather than humans, do these tasks, there are increased internal control risks, such as a lack of segregated duties and fewer opportunities to authorize and review transactions.

Despite the risks, there are important advantages to using IT-based systems. Internal controls can actually be enhanced if care is exercised in implementing these systems. Computer controls can compensate for the lack of manual controls. In addition, if programs are tested properly before being activated, the risk of human error (such as a mathematical and/or classification mistake) is virtually eliminated because computers process all information consistently.

In addition to internal control enhancements, IT-based processes provide higher quality information to management. Information is higher quality when it is supplied in a timely manner and administered effectively. When high-quality information is used to make decisions, the result is more effective management.

## Authoritative Literature Used in Auditing (Study Objective 4)

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The work of an auditor must be conducted in accordance with several sources of authoritative literature, as described next.

**Generally accepted auditing standards (GAAS)** are broad guidelines for an auditor's professional responsibilities. These 10 standards are divided into 3 categories that include general qualifications and conduct of an auditor (general standards), guidelines for performing the audit (standards of fieldwork), and requirements for the written report communicating the results of the audit (standards of reporting). Exhibit 7-1 summarizes these standards by category.

GAAS provides a general framework for conducting quality audits, but this framework is not specific enough to provide useful guidance in the actual performance of an audit engagement. For such detailed guidance, auditors rely upon standards issued by various governing bodies and professional associations, as follows:

- The **Public Company Accounting Oversight Board (PCAOB)** was organized in 2003 for the purpose of establishing auditing standards for public companies in the United States. These standards serve as interpretations of GAAS and guidelines for quality control within CPA firms. The PCAOB was established by the Sarbanes–Oxley Act, which was created in response to several major

**EXHIBIT 7-1****Generally Accepted Auditing Standards**

<b>General Standards</b>	<b>Standards of Fieldwork</b>	<b>Standards of Reporting</b>
<p>1. The audit is to be performed by a person or persons having adequate technical training and proficiency as an auditor.</p> <p>2. Independence in mental attitude is to be maintained in all matters related to the audit engagement.</p> <p>3. Due professional care is to be exercised in all phases of the audit process.</p>	<p>1. The audit is to be adequately planned and supervised.</p> <p>2. An understanding of internal control is to be obtained as part of the planning process for the purpose of determining the nature, timing, and extent of tests to be performed.</p> <p>3. Evidence is to be obtained through inspection, inquiries, observation, and confirmations in order to provide a reasonable basis for forming an overall opinion on the audit.</p>	<p>1. The written report must state whether the financial statements are presented in accordance with the established criteria.</p> <p>2. The written report identifies any circumstances in which established principles have not been consistently applied in the current period in relation to the prior period.</p> <p>3. The financial statements are assumed to contain adequate informative disclosures unless otherwise indicated in the written report.</p> <p>4. The written report expresses an opinion on the fairness of the financial statements as a whole, or an assertion to the effect that an opinion cannot be expressed (and the reasons therefor). The report also describes the character of the auditor's work and the degree of responsibility assumed by the auditor.</p>

corporate accounting scandals, including those affecting Enron, WorldCom, and others.

- The **Auditing Standards Board (ASB)** of the American Institute of CPAs (AICPA) was the primary standard-setting body prior to the PCAOB. The ASB has issued Statements on Auditing Standards (SAs) that have historically been widely used in practice and will continue to be the standards applicable to non-public companies.
- The **International Auditing and Assurance Standards Board (IAASB)** was established by the International Federation of Accountants (IFAC) to set International Standards on Auditing (ISAs) that contribute to the uniform application of auditing practices on a worldwide basis. ISAs are similar to SAs; however, ISAs tend to extend SAs because of their usefulness in audits of multinational companies. Although auditors have a primary responsibility to comply with standards issued within their own countries, ISAs are useful in expanding those requirements in order to meet different needs in other countries where the audited information may also be used.
- The **Internal Auditing Standards Board (IASB)** was established by the Institute of Internal Auditors (IIA) to issue standards that pertain to attributes of internal audit activities, performance criteria, and implementation guidance.
- The **Information Systems Audit and Control Association (ISACA)** issues Information Systems Auditing Standards (ISASs) that provide guidelines for conducting the IT audit. These standards address audit issues unique to a company's information systems environment, including control and security issues.

Although SAs, ISAs, and ISASs contribute more detailed guidance than is provided by GAAS, they still do not furnish the auditor with specific direction regarding

the types of audit tests to use and the manner in which conclusions should be drawn. Auditors must resort to industry guidelines, professional journals, textbooks, and other resources for those purposes. Many CPA firms and internal audit groups develop their own specific policies and procedures for designing and conducting effective audit engagements. Still, individual audits must be customized to apply to the specific environment of each company or each business unit being audited. Accordingly, auditors must exercise a considerable amount of professional judgment in performing audits.

## Management Assertions and Audit Objectives (Study Objective 5)

Responsibility for operations, compliance, and financial reporting lies with management of the company. A company's various reports are assumed to represent a set of management assertions. **Management assertions** are claims regarding the condition of the business organization in terms of its operations, financial results, and compliance with laws and regulations. The role of the auditors is to analyze the underlying facts to decide whether information provided by management is fairly presented. Auditors design audit tests to analyze information in order to determine whether management's assertions are valid. To accomplish this, audit tests are created to address audit objectives related to management's assertions. Exhibit 7-2 summarizes the relationship between management assertions and audit objectives for a financial statement audit.

The audit objectives described in Exhibit 7-2 may be applied to any category of transaction and the related account balances. Auditors design specific tests to address these objectives in each audit area. For example, an auditor will develop tests to determine whether a company has properly accounted for its borrowing

### EXHIBIT 7-2

#### Management Assertions and Related Audit Objectives

Management Assertions	Audit Objectives
<b>Existence/Occurrence</b>	Determine that recorded transactions, events, and related account balances are real and have been properly authorized.
<b>Valuation and Allocation</b>	Determine that recorded transactions and related account balances are <ul style="list-style-type: none"> <li>• Accurate in terms of dollar amounts and quantities, and any related allocation adjustments are properly recorded</li> <li>• Supported by detailed evidence</li> <li>• Correctly summarized and posted to the general ledger</li> <li>• Recorded at estimated realizable values</li> </ul>
<b>Cutoff</b>	Determine that recorded transactions and events have been recorded in the proper time period.
<b>Completeness</b>	Determine that all existing transactions and related accounted balances are recorded—i.e., that none have been omitted.
<b>Rights and Obligations</b>	Determine that transactions and related asset account balances are actually owned. Similarly, determine that liability account balances represent actual obligations.
<b>Classification and Presentation</b>	Determine that recorded transactions and related account balances are recorded in the proper accounts and all required disclosures are properly presented and clearly expressed so the financial statements are understandable.

**EXHIBIT 7-3****Specific Audit Procedures Address Audit Objectives and Assertions**

<b>Procedure:</b>	<b>Performed by:</b>	<b>Reviewed by:</b>
<ol style="list-style-type: none"><li>1. Obtain written confirmation from financial institutions regarding the amount of borrowings at year end. (Existence, Obligations, Valuation)</li><li>2. Obtain copies of each loan agreement and<ul style="list-style-type: none"><li>• Note the interest rate and interest payment dates. Determine that interest expense and interest payable are recorded in the proper amounts and in the proper period. (Valuation and Allocation, Cutoff)</li><li>• Note the principal payment dates. Determine that the current and noncurrent classifications are computed correctly. (Classification)</li><li>• Note the existence of any restrictions placed on the company by this agreement. Determine whether the company is in compliance with all such restrictions. (Presentation)</li></ul></li><li>3. Examine canceled checks for any principal payments made during the period. (Valuation)</li><li>4. Review the minutes of the board of directors meetings to determine whether additional borrowing arrangements exist. (Completeness)</li><li>5. Inquire of management as to the existence of additional borrowing arrangements. (Completeness)</li></ol>		

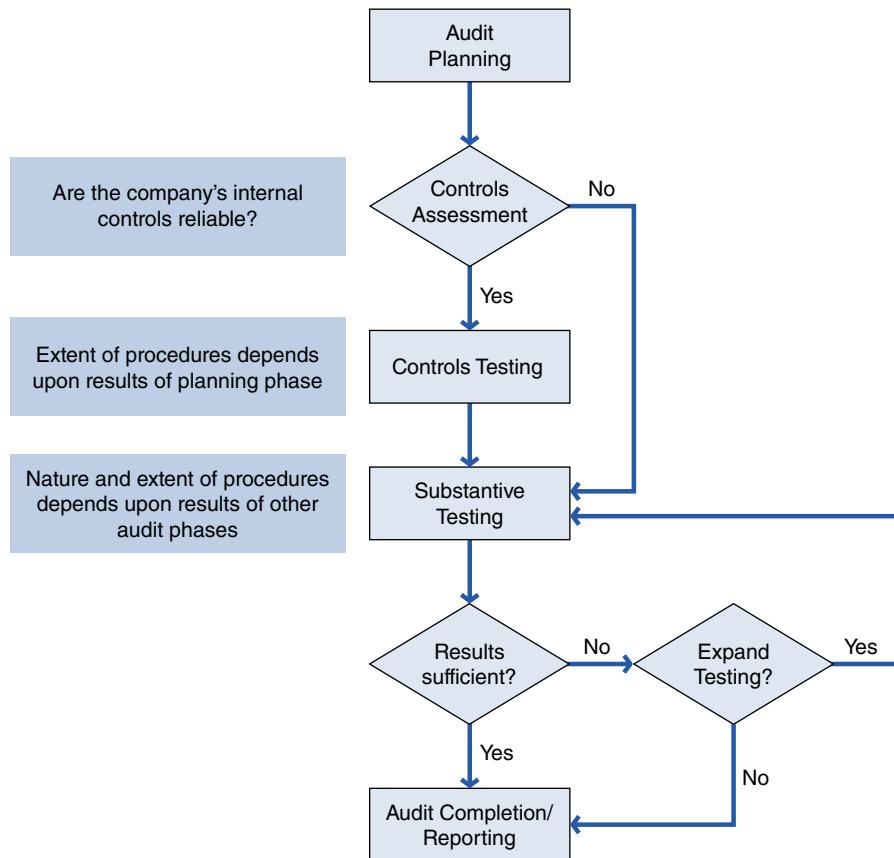
transactions during the period. These tests are specific to the accounts and information systems in place at the company being audited. Audit tests developed for an audit client are documented in an **audit program**. Exhibit 7-3 presents an excerpt from a typical audit program covering notes payable and the related accounts and information systems. The related management assertions are shown in parentheses.

As shown in Exhibit 7-3, a unique set of audit tests determines whether each objective is met for each major account or type of transaction. For example, a test for completeness of notes payable involves the review of board meeting minutes to determine whether additional borrowing arrangements exist that are not recorded. If, instead, the auditors were testing for the completeness objective related to accounts receivable and sales, a relevant test would be to examine shipping reports and investigate whether each related sales transaction was properly included in the accounting records. Thus, audit testing for any objective may involve diverse testing techniques with different kinds of information collected to support each different account and transaction.

Auditors must think about how the features of a company's IT systems and the extent of relevant data influence management's assertions and the general audit objectives. These matters have a big impact on the choice of audit methodologies used. The next section relates these IT considerations to the different phases of an audit.

## Phases of an IT Audit (Study Objective 6)

An IT audit generally follows the same pattern as a typical financial statement audit. There are four primary phases of the audit: planning, tests of controls, substantive tests, and audit completion/reporting. Exhibit 7-4 provides an overview of these phases.



**EXHIBIT 7-4** Process Map of the Phases of an Audit

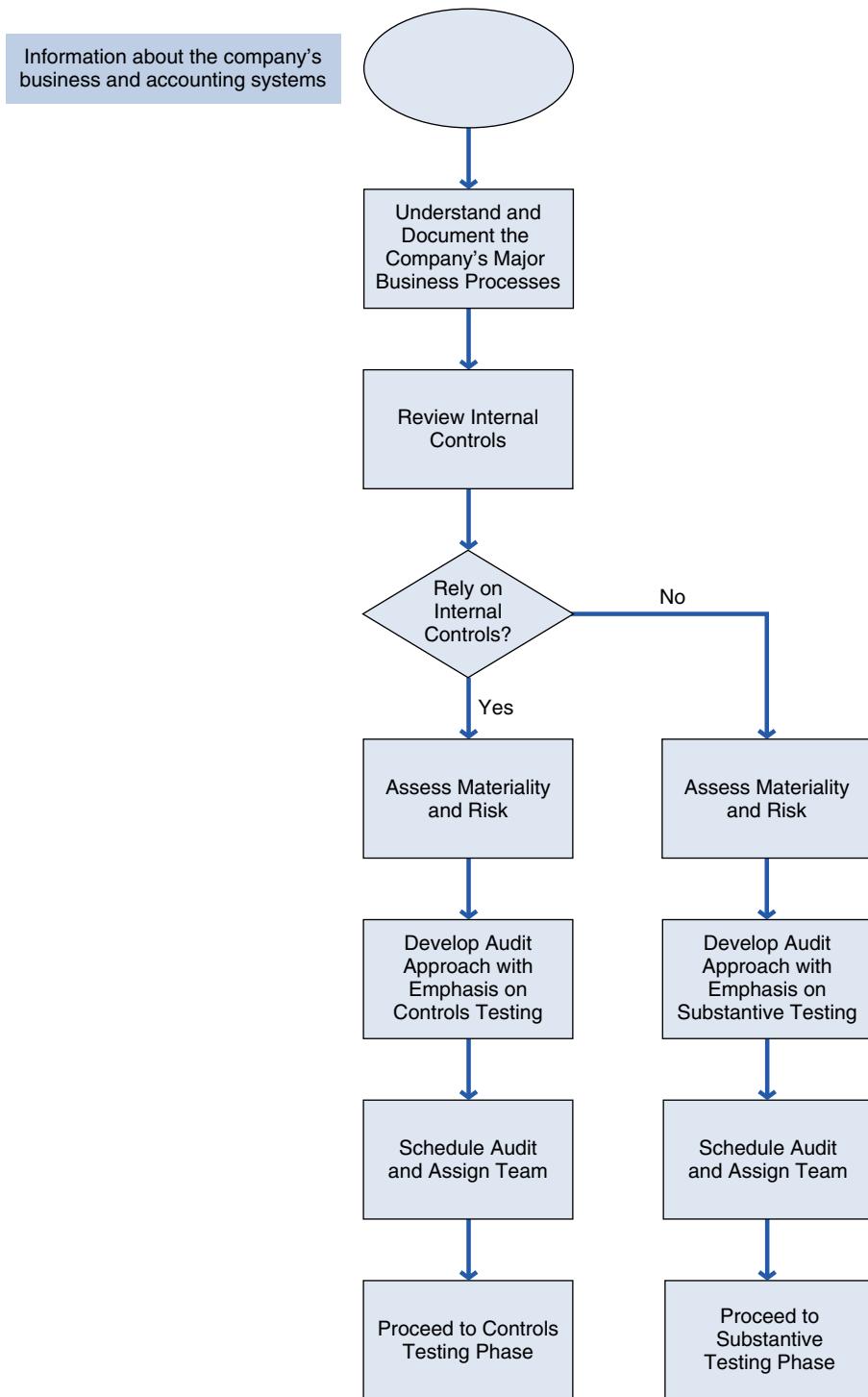
Through each phase of an audit, evidence is accumulated to support the conclusions reached by the auditors. **Audit evidence** is proof of the fairness of financial information. The techniques used for gathering evidence include the following:

- Physically examining or inspecting assets or supporting information
- Obtaining written confirmation from an independent source
- Reperforming tasks or recalculating information, either manually or electronically
- Observing activities
- Making inquiries of company personnel
- Analyzing financial relationships and making comparisons to determine reasonableness

The various phases of the audits typically include a combination of these techniques.

## Audit Planning

During the **planning phase** of an audit, the auditor must gain a thorough understanding of the company's business and financial reporting systems. In doing so, auditors review and assess the risks and controls related to the business, establish materiality guidelines, and develop relevant tests addressing the assertions and objectives (presented earlier). A process map of the planning phase of the audit is presented in Exhibit 7-5.



**EXHIBIT 7-5** Audit Planning Phase Process Map

The tasks of assessing materiality and audit risk are very subjective and are therefore typically performed by experienced auditors. In determining **materiality**, auditors estimate the monetary amounts that are large enough to make a difference in decision making. Materiality estimates are then assigned to account balances so that

auditors can decide how much evidence is needed. Transactions and account balances that are equal to or greater than the materiality limits will be carefully tested. Those below the materiality limits are often considered insignificant (if it is unlikely that they will impact decision making) and therefore receive little or no attention on the audit. Some of these items with immaterial balances may still be audited, though, especially if they are considered areas of high risk. **Risk** refers to the likelihood that errors or fraud may occur. Risk can be inherent in the company's business (due to such things as the nature of operations, the nature of data available, the economy, or management's strategies), or it may be caused by weak internal controls. Auditors need to perform risk assessment to carefully consider the risks and the resulting problems to which the company may be susceptible. There will always be some risk that material errors or fraud may not be discovered in an audit. Accordingly, each risk factor and the materiality estimates are important to consider in determining the nature and extent of audit tests to be applied.

The audit planning process is likely to vary significantly depending upon the extent of data used by the company. As companies and their auditors move forward in the way they identify risks, they may implement Big Data analytics to search the past for clues about the future. Also, audit planning depends upon the company's financial reporting regime. If the company has adopted International Financial Reporting Standards (IFRS) or is in the process of convergence, changes in the audit approach should be anticipated. In addition to obvious changes in the reporting requirements and related modifications to its IT systems, many companies' implementation of IFRS requires transformation of its business processes, policies, and controls. Moreover, adapting to value measures, relying on more external data, and understanding key assumptions necessary in the preparation of IFRS-based financial statements will likely cause management and auditors to evaluate supporting evidence differently than if U.S. GAAP was used. IFRS generally allows more use of judgment than GAAP's rules-based guidance; thus, a change in accounting regimes may change the decisions made by managers and by auditors.

A big part of the audit planning process is the gathering of evidence about the company's internal controls. Auditors typically gain an understanding of internal controls by interviewing key members of management and the IT staff. They also observe policies and procedures and review IT user manuals and system flowcharts. They often prepare narratives or memos to summarize the results of their findings. In addition, company personnel may be asked to complete a questionnaire about the company's accounting systems, including its IT implementation and operations, the types of hardware and software used, and control of computer resources. The understanding of internal controls provides the basis for designing appropriate audit tests to be used in the remaining phases of the audit. Therefore, it is very important that the auditor understand how complex its clients' IT systems are and what types of evidence may be available for use in the audit.

The process of evaluating internal controls and designing meaningful audit tests is more complex for automated systems than for manual systems. Using just human eyes, an auditor cannot easily spot the controls that are part of an automated (computer) system. In recognition of the fact that accounting records and files often exist in both paper and electronic form, auditing standards address the importance of understanding both the automated and manual procedures that make up an organization's internal controls.

In addition to their increasingly complex automated systems, many large and medium-size business organizations are becoming more challenging to audit due to the abundance of data that exists. Many modern businesses have a growing number of

transactions with an expanding network of external parties, resulting in a surplus of data that is available to audit. Yet every company is different in terms of the various kinds of data used to support decision-making and how the data is managed. The availability of Big Data sets in auditing may complicate the auditors' judgment, making it difficult to determine the extent to which data must be analyzed. Yet auditors are always required to consider how misstatements may occur. Accordingly, auditors must adapt the scope of their data analysis to the various sizes and sources of data that impact business decisions.

Regardless of the volume and velocity of the underlying data, auditors need to obtain evidence for the following:

- How data is captured and used
- How standard journal entries are initiated, recorded, and processed
- How nonstandard journal entries and adjusting entries are initiated, recorded, and processed

IT auditors may be called upon to consider the effects of computer processing on the audit or to assist in testing those automated procedures.

## Use of Computers in Audits (Study Objective 7)

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Many companies design their IT systems so that important information such as purchase and sales orders, shipping and receiving reports, and invoices can be retrieved from the system in readable form. This kind of supporting information, as well as journals and ledgers, can serve as evidence for auditors. Under these conditions, auditors can compare information used to input data into the system with reports generated from the system, without gaining extensive knowledge of the computer system logic. In such cases, the use of IT systems does not have a great impact on the conduct of the audit, since the auditor can perform audit testing in essentially the same manner as would be done for a manual system. This practice is known as **auditing around the computer** because it does not require evaluation of computer controls. Sometimes it is also referred to as "the black box approach," because it does not involve detailed knowledge of the computer programs. Auditing around the computer merely uses and tests *output* of the computer system in the same manner as the audit would be conducted if the information had been generated manually. Because this approach does not consider the effectiveness of computer controls, auditing around the computer has limited usefulness.

**Auditing through the computer** involves directly testing the internal controls within the IT system. It is sometimes referred to as "the white box approach" because it requires auditors to understand the computer system logic. This approach requires auditors to evaluate IT controls and processing so that they can determine whether the information generated from the system is reliable. Auditing through the computer is necessary under the following conditions:

- The auditor wants to test computer controls as a basis for evaluating risk and reducing the amount of substantive audit testing required.
- The auditor is required to report on internal controls in connection with a financial statement audit of a public company.
- Supporting documents are available only in electronic form.

Auditors can use their own computer systems and audit software to help conduct the audit. This approach is known as **auditing with the computer**. A variety of **computer-assisted audit techniques (CAATs)** are available for auditing with the computer. CAATs are useful audit tools because they make it possible for auditors to use computers to test more evidence in less time. Yet, despite the abundance of CAATs, auditors must realize that technological tools are merely enablers. They serve to challenge auditors to think critically and use technology effectively to transform data into insights.

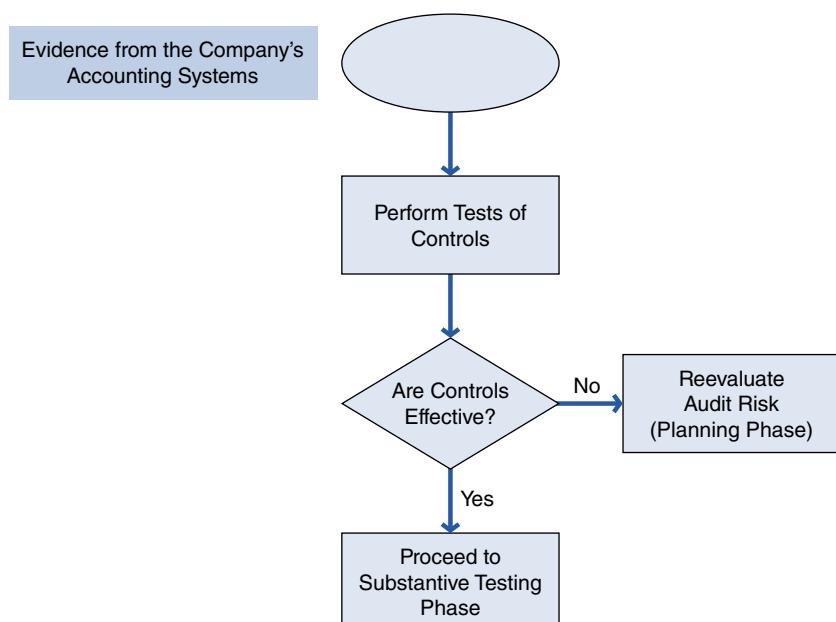
Next, we will focus on techniques used to audit through the computer and to audit with the computer in the testing phases of the audit.

## Tests of Controls (Study Objective 8)

Exhibit 7-6 presents the components of the tests of controls phase of the audit. The **tests of controls** involve audit procedures designed to evaluate both general controls and application controls. Recall from Chapter 4 that general controls relate to all aspects of the IT environment, whereas application controls relate to specific software applications that cover a particular type of transaction. During audit planning, auditors learn about the types of controls that exist within their client's IT environment. Then they may test those controls to determine whether they are reliable as a means of reducing risk. Tests of controls are sometimes referred to as "compliance tests" because they are designed to determine whether controls function in compliance with management's intentions. The following section discusses how these controls are evaluated.

### General Controls

General controls must be tested before other control testing takes place. Since **general controls** are the automated controls that affect all computer applications, the reliability of application controls is considered only after general controls have



**EXHIBIT 7-6** Controls Testing Phase Process Map

been tested. This is because weak general controls can cause misstatements that pervade the accounting system—even in applications that are believed to be strong. For example, if there are weak general controls, a company's hardware and software could be accessed by an unauthorized user who could alter the data or the programs. So even if the application controls were working as designed, the general control deficiency could result in errors in the underlying information. Accordingly, the effectiveness of general controls is the foundation for the IT control environment. If general controls are not functioning as designed, auditors will not devote attention to the testing of application controls; rather, they will reevaluate the audit approach (according to Exhibit 7-4) with reduced reliance on controls.

There are two broad categories of general controls that relate to IT systems:

- IT administration and the related operating systems development and maintenance processes
- Security controls and related access issues

These categories and their related audit techniques are described in detail next.

**IT Administration** IT departments should be organized so that an effective and efficient workplace is created and supported. Auditors should verify that the company's management promotes high standards with regard to controlling its IT environment. Related audit tests include review for the existence and communication of company policies regarding the following important aspects of administrative control:

- Personal accountability and segregation of incompatible responsibilities
- Job descriptions and clear lines of authority
- Computer security, data security, and virus protection
- IT systems documentation

If the company does not separate the functions of system design, programming, and operations, auditors should observe whether supervisors carefully review the work performed by employees with incompatible duties. This type of managerial oversight may serve as a compensating control.

In order to verify proper control over operations of the IT system, auditors should review the policies and procedures covering operator tasks. This should identify the hardware and software used and the timetable for performing tasks. Detailed instructions for carrying out the tasks should be documented, along with a list of employees who should have access to the outputs. Also, in order to test for adequate segregation of duties, auditors should make sure that the operator manuals do not include information about the system design or program code.

Details about the internal logic of computer systems should be documented in IT manuals. Auditors should verify that such information exists and is kept up-to-date. IT documentation often includes system flowcharts and other systems development data. System operators and users should not have access to this information, in order for the company to maintain good segregation of duties.

To evaluate a company's administrative effectiveness in terms of IT maintenance, auditors should review system documentation to find out whether system maintenance projects are properly authorized. In addition, auditors should determine whether the company maintains control over systems documentation and programs by using a system librarian. A librarian is responsible for maintaining and controlling access to up-to-date systems documentation and programs. Additional tests to be performed when the company makes changes in its IT environment are described later in this chapter. Other access control issues are discussed in the next section.

**Security Controls** Auditors are concerned about whether a company's computer system has controls in place to prevent unauthorized access to or destruction of information within the accounting information systems. Unauthorized access may occur internally when employees retrieve information that they should not have, or externally when unauthorized users (or hackers) outside the company retrieve information that they should not have. Access risks tend to escalate as companies embrace newer technologies and allow sensitive data to be shared via smart devices, Web and mobile applications, and social networks. Destruction of information may occur as a result of natural disasters, accidents, and other environmental conditions. Controls that protect the company from these risks include various access controls, physical controls, environmental controls, and business continuity policies. You may find it helpful to refer back to Exhibit 4-5, which presents the various types of controls that a company may use to prevent risk of loss due to unauthorized use, network break-ins, and environmental problems. As auditors gain an understanding of a company's information systems, they can find out if the types of controls listed in Exhibit 4-5 are being used to prevent or detect the related risk. When controls are in place, they can be tested for effective operation. Following are some ways that an auditor can test these controls.

In order to test *internal* access controls, auditors should

- Determine that the company has properly segregated IT duties or has compensated for a lack of segregation by improving supervisory reviews.
- Perform **authenticity tests** to evaluate whether the computer systems used to access programs and data files are limited to authorized employees according to the company's authority tables. Policy and procedure manuals should describe control over the use of passwords, security tokens, biometric devices, etc. Employees should be required to have passwords, and their level of access should be consistent with their job responsibilities. Auditors can design controls tests to determine whether access is being controlled in accordance with company policies.
- Review computer logs for login failures, to gauge access times for reasonableness in light of the types of tasks performed, or to detect unusual activity. In such cases, audit tests may need to be expanded for appropriate follow up.
- View an electronic audit trail to determine whether access to operating systems has taken place according to the company's policies.
- Perform tests to be sure that computer access privileges are blocked for employees who have been terminated and revised for employees who have changed job responsibilities.

To test *external* access controls, auditors may perform the following:

- **Authenticity tests**, as previously described.
- **Penetration tests**, which involve various methods of entering the company's system to determine whether controls are working as intended. For example, auditors may search for weaknesses in a company's firewall by attempting unauthorized access to the system.
- **Vulnerability assessments**, which analyze a company's control environment for possible weaknesses. For example, auditors may send test messages through a company's system to find out whether encryption of private information is occurring properly. Special software programs are available to help auditors identify weak points in a company's security measures.

- **Review of access logs** to identify unauthorized users or failed access attempts. For example, auditors should discuss with IT managers the factors involved in rejecting unauthorized access, and verify the consistency of the managers' explanations with documented policies.

In order to maintain good controls, a company's managers should not rely on their auditors to test for computer access violations, but should monitor the systems on their own on an ongoing basis. Then auditors can examine security reports issued by the IT department or review its security detection systems to test the effectiveness of the company's access controls. The frequency of reporting and the manner of follow up are important elements of the control environment.

One of the most effective ways a company can protect its computer system is to place physical and environmental controls in the computer center. Physical controls include locks, security guards, alarms, cameras, and card keys. Physical controls not only limit access to the company's computers, but also are important for preventing damage to computer resources. In addition to assessing physical controls, auditors should evaluate the IT environment to determine that proper temperature control is maintained, fireproofing systems are installed, and an emergency power supply is in place.

To test another important feature of effective security control, auditors should determine whether the company would be able to continue its accounting processes in the event of a catastrophe caused by human error, crime, acts of nature, or other unforeseen events. All foreseeable causes should be considered in deciding whether the company is adequately protected. To make such a determination, auditors typically review the company's disaster recovery plan, backup procedures, virus protection procedures, and insurance coverage, and discuss with management the reasonableness of these policies.

As mentioned earlier, application controls are tested only after the general controls are proven to be strong. When general controls have been tested and found to be operating effectively, auditors then test applications controls to see if they are also working as intended.

## **Application Controls**

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**Application controls** are computerized controls over application programs. Since any company may use many different computer programs in its day-to-day business, there may be many different types of application controls to consider in an audit. Auditors test the company's systems documentation to be sure that adequate details exist for all application programs. The details should include a list of all applications critical to the information being audited, along with supporting source code that is kept up to date in the IT library. Backup copies should be stored off-site. In addition to testing systems documentation, auditors should test the three main functions of the computer applications, including input, processing, and output.

**Input Controls** Auditors perform tests to verify the correctness of information input to software programs. Auditors are concerned about whether errors are being prevented and detected during the input stage of data processing. Some of the most widely used computer tests of input controls are summarized in Exhibit 7-7.

Each of the controls presented in Exhibit 7-7 may be used by the company as an internal control measure. In most cases, the same type of function can be performed

**EXHIBIT 7-7****Input Controls**

<b>Control</b>	<b>Description</b>
<b>Financial totals:</b>	Mathematical sums of dollar amounts or item counts. Useful because they typically identify the amount of a journal entry made in the financial accounting system. Tested by comparing system-generated totals with totals computed by auditors.
<b>Financial control totals</b>	
<b>Batch totals</b>	
<b>Hash totals</b>	Mathematical sums of data that are meaningless to the financial statements (such as vendor numbers or check numbers), but useful for controlling the data and especially for detecting possible missing items. Tested by comparing system-generated totals with totals computed by auditors.
<b>Completeness tests or redundancy tests:</b>	Counting the number of entries (record counts) or the order of documents in a series (sequence verification). Useful for determining whether application records are complete or if any items are incorrectly included more than once. Also ensures that processing takes place only when all fields within the data file are filled in. Tested by comparing system-generated counts with counts/listings prepared by auditors.
<b>Record counts</b>	
<b>Sequence verification</b>	
<b>Limit tests</b>	Scanning entries for reasonable limits, such as predetermined limits on check amounts or a customer's credit. Useful in preventing errors and unauthorized processing. Tested by comparing programmed limits with company policies.
<b>Validation checks</b>	Scanning entries to verify whether there is missing or bogus information. Entries are reviewed for valid dates and labeling, records are reviewed for reasonable values and sequences, and fields are reviewed for valid limits or missing data. Tested by comparing programmed information with predetermined values documented in the program code.
<b>Field checks</b>	Scanning entries to determine that data exist in the proper alpha or numeric format. Useful in preventing processing errors due to unrecognized data. Tested by comparing the data format with program code.

by auditors as a test of the related control. Auditors test these controls to determine whether control risks are being prevented or detected. Auditors observe controls that the company has in place and perform the comparisons on a limited basis to determine their effectiveness. These tests can be performed manually or by electronic methods.

**Processing Controls** IT audit procedures typically include a combination of data accuracy tests, whereby the data processed by computer applications are reviewed for correct dollar amounts or other numerical values. Following are examples of effective processing controls:

- **Run-to-run totals** involve the recalculation of amounts from one process to the next to determine whether data have been lost or altered during the process.
- **Balancing tests** involve a comparison of different items that are expected to have the same values, such as comparing two batches or comparing actual data against a predetermined control total.
- **Mathematical accuracy tests** verify whether system calculations are correct. Completeness tests, redundancy tests, and limit tests, introduced earlier, check for inclusion of the correct data. Many other procedures, previously described as input control tests, can be performed again during applications processing to check for the possibility of lost or unprocessed data.

When evaluating financial information, auditors may use Benford's Law to help discover whether errors or fraud may exist in a data set. **Benford's Law**, also known

as the first-digit law, was named for a physicist, Frank Benford, who discovered a specific, but nonuniform pattern in the frequency of digits occurring as the first number in a list of numbers. Benford found that the number 1 is likely to be the leading digit approximately one-third of the time, and the number 2 is the leading digit about 18 percent of the time. The number 9, on the other hand, is a leading digit in less than 5 percent of occurrences. Benford's Law applies to large data sets of naturally occurring numbers and is therefore useful to auditors in evaluating possible errors or fraud in sales and accounts receivable balances, accounts payable and disbursements balances, income tax data, and more. It would predict, for instance, that about half of the numerical observations within the data set of cash disbursements should begin with a 1 or 2. If the numbers had been fabricated, they would not likely follow this natural distribution. However, Benford's Law is not applicable to assigned numbers (such as customer account numbers or phone numbers). Audit procedures that apply Benford's Law can be carried out using spreadsheet programs or special application of audit software.

Exhibit 7-8 presents a comparison of several **computer assisted audit techniques (CAATs)**.

**EXHIBIT 7-8**
**Comparison of Computer-Assisted Audit Techniques (CAATs) for Testing Applications Controls**

Technique	Summary Description	Advantages	Disadvantages
Test data method	Auditors develop fictitious data that appears authentic, and process this "test data" separately, using client's computer system or a nonclient computer.	Little technical expertise required. Used during normal processing, and well-suited for performing tests of controls in batch systems.	Risk of data contamination if test data is not properly removed after the testing. Time consuming to design test data to include both authentic and illogical data. Tests only anticipated problems. Provides only a static test of controls.
Program tracing and tagging	Auditors follow transactions through all processing steps in sequence, using a nonclient computer.	Efficient because it uses actual data.	May require special technical expertise to consider all paths of program logic.
Program mapping	Auditors count the number of times a program statement is executed to determine whether program code has been bypassed.	Efficient because it uses actual data.	May require special technical expertise to consider all paths of program logic.
Integrated test facility	Auditors develop test data and process simultaneously with actual data.	Very effective for simple applications. Used during normal processing. Provides ongoing tests of controls.	Risk of data destruction. Time consuming. Less effective for complex applications.
Parallel simulation	Auditors develop program like client's application, then use it to process a copy of actual data.	Independent test that allows for large sample sizes. Moderate technical expertise required.	Practicality depends on the complexity of the application. Conducted at a particular point of time.
Embedded audit modules	Auditors insert tests within application. May be used periodically or continuously.	Identifies processing problems as they occur.	Lacks objectivity because it cannot identify unanticipated activity.

## The Real World

As one of the Big Four CPA firms, EY employs thousands of auditors in its IT Risk and Assurance Advisory Services group. This specialized service group assists with financial statement audits and provides other services concerning its clients' information systems. Information systems assurance services focus on audits of business information systems, assessment of business processes and the underlying control environment, and the use of CAATs to verify accounting and financial data.

EY is responsible for auditing the financial statements of many public companies. It serves clients in hundreds of locations around the globe. These client companies are quite diverse in terms of the type of business they perform, their size, and their complexity, but tend to be alike in their need for timely information. The use of CAATs helps EY provide timely service to its clients, while accumulating audit evidence necessary for doing its job as auditor.

**Output Controls** Audit tests that evaluate general controls over access and backup procedures may also be used in the testing of specific computer application outputs. It is important that auditors test for proper control of financial information resulting from applications processing. Regardless of whether the results are printed or retained electronically, auditors may perform the following procedures to test application outputs:

- **Reasonableness tests** compare the reports and other results with test data or other criteria.
- **Audit trail tests** trace transactions through the application to ensure that the reporting is a correct reflection of the processing and inputs.
- **Rounding errors tests** determine whether significant errors exist due to the way amounts are rounded and summarized.

As part of the controls testing phase of an audit, auditors should also verify that the company is performing timely and accurate reconciliations. A **reconciliation** is a detailed report assessing the correctness of an account balance or transaction record that is consistent with supporting information and the company's policies and procedures. Account balance details and supporting information may be

## The Real World

The embezzlement case at Koss Corporation, introduced in Chapter 3, described the fraudulent acts of the company's VP of Finance, Sue Sachdeva. In the aftermath of the discovery of the frauds, an SEC investigation revealed many control failures at Koss, including problems with account reconciliations. Either the reconciliations were not maintained in the accounting records, not prepared correctly, or not prepared at all.

Some of the reconciliations were performed by Sachdeva herself, despite the fact that she had been involved in the initial authorization or recording of the underlying transactions. This provided an opportunity for Sachdeva to modify the reconciliations in order to conceal her wrongdoing. The CPA firm that audited Koss's financial statements was dismissed because its audit procedures did not uncover these serious problems.

derived from applications outputs. In order to enhance controls, reconciliations should be performed by independent company personnel—those who were not involved with the tasks of initiating or recording the transactions within the accounts being reconciled.

At the conclusion of the controls testing phase of the audit, an auditor must determine the overall reliability of the client's internal controls. Auditors strive to rely on internal controls as a way to reduce the amount of evidence needed in the remaining phases of the audit. They can be reasonably sure that information is accurate when it comes from a system that is proven to have strong controls. Therefore, once the general and application controls are tested and found to be effective, the amount of additional evidence needed in the next phase of the audit can be reduced. It is also worthwhile to note that controls testing can be done nearly anytime during the period, so auditors can schedule their work at a convenient time. This convenience factor, plus the reduction in additional audit evidence required, sometimes makes testing controls more efficient than testing transactions and account balances.

## Tests of Transactions and Tests of Balances (Study Objective 9)

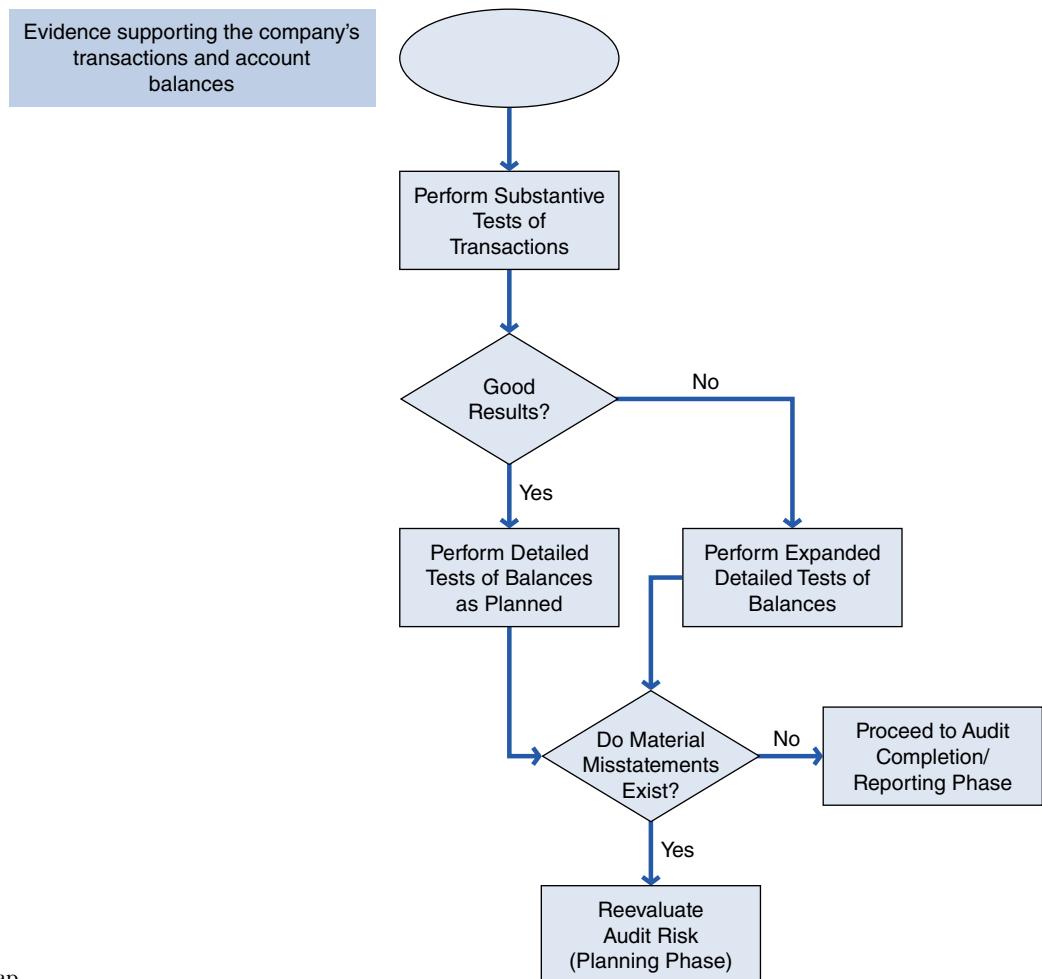
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The auditor's tests of the accuracy of monetary amounts of transactions and account balances are known as **substantive testing**. Substantive testing is very different from testing controls. Substantive tests evaluate whether information *is correct*, whereas control tests determine whether the information is managed under a system that *promotes correctness*. Some level of substantive testing is required regardless of the results of control testing. If weak internal controls exist or if important controls are not in place, extensive substantive testing will be required. On the other hand, if controls are found to be effective, the amount of substantive testing required is significantly lower, because there is less chance of error in the underlying records. Exhibit 7-9 presents a process map of the substantive testing phase of the audit.

In an IT environment, the evidence needed to determine the correctness of transactions and account balances is contained in electronic data files within the computer system, from where it may be pulled by specialized audit techniques. Some techniques used to test controls can also be used to test transactions and financial statement balances. For example, parallel simulations, the test data method, the embedded audit module, and the integrated test facility can be used for both control testing and substantive testing.

Recent trends such as advances in automated controls; new compliance requirements; integration of governance, risk management, and compliance (GRC) activities; and real-time financial reporting have created the need for continuous auditing. Continuous auditing, or continuous monitoring, is a process of constant evidence-gathering and analysis to provide assurance on the information as soon as it occurs or shortly thereafter. It can be performed by management and/or auditors.

When companies use automated controls and maintain critical business information in electronic form, auditors can analyze the relevant data throughout the period. Audited information is always in demand to facilitate critical business decisions, so continuous auditing is becoming more mainstream. Also, continuous monitoring of internal controls is important so that control deficiencies can be detected before they become significant. Deficiencies can be evaluated and corrected in time to improve operational performance and avoid reporting issues. Chapter 6 discusses how ERP systems can be used to monitor internal controls.



**EXHIBIT 7-9** Substantive Testing Phase Process Map

Continuous auditing techniques, such those available with the embedded audit module approach and program tagging, are very popular forms of substantive testing. Additionally, a type of parallel simulation can be used to provide continuous assurance, whereby an audit module is embedded in a database to analyze all updates to the data and compare the results with those in the database. When companies use e-commerce or e-business systems to conduct business online, auditors know that financial accounting information is produced in real time and is immediately available for auditing purposes. Also, as more companies use Big Data, it is more likely that ongoing, real-time data analysis will be necessary. The SEC, PCAOB, and AICPA also approve the use of continuous auditing. In response to corporate failures, such as those at Enron and WorldCom, continuous auditing helps auditors stay involved with their client's business and perform audit testing in a more thorough manner.

Continuous auditing generally requires that the auditors access their client's systems online so that audit data can be obtained on an ongoing basis. Audit data is then downloaded and tested by auditors as soon as possible after the data is received. Continuous auditing may then be applied for various forms of audit testing, including continuing risk monitoring and assessment (CRMA), continuous control monitoring (CCM), and continuous data monitoring (CDM). But as

companies collect more data and embrace Big Data analytics, challenges may arise concerning data inconsistencies, incomplete data, and threats to privacy. Auditors must be quick to adapt to these challenges.

Most auditors use **generalized audit software (GAS)** or **data analysis software (DAS)** to perform audit tests on electronic data files taken from commonly used database systems. These computerized auditing tools make it possible for auditors to be much more efficient in performing routine audit tests such as:

- Mathematical and statistical calculations
- Data queries
- Identification of missing items in a sequence
- Stratification and comparison of data items
- Selection of items of interest from the data files
- Summarization of testing results into a useful format for decision making

The use of GAS or DAS is especially useful when there are large volumes of data and when there is a need for timely, correct information.

GAS and DAS are also evolving to handle even larger and more diverse data sets, which allow auditors to use more types of unstructured data as audit evidence and to perform more creative analytical procedures and predictive analyses. Some examples of the use of Big Data analytics in this phase of the audit include:

- Examining social media to anticipate issues such as inventory obsolescence and warranty claims
- Obtaining data about weather patterns or stock market performance to predict sales activity
- Viewing surveillance camera footage to corroborate the existence of a new fleet of vehicles
- Using radiofrequency identifiers to monitor inventory movements
- Using the global positioning system (GPS) location of company delivery trucks to determine the status of sales transactions
- Performing an electronic match of key transaction information, such as customer orders, shipping reports, and sales invoices.

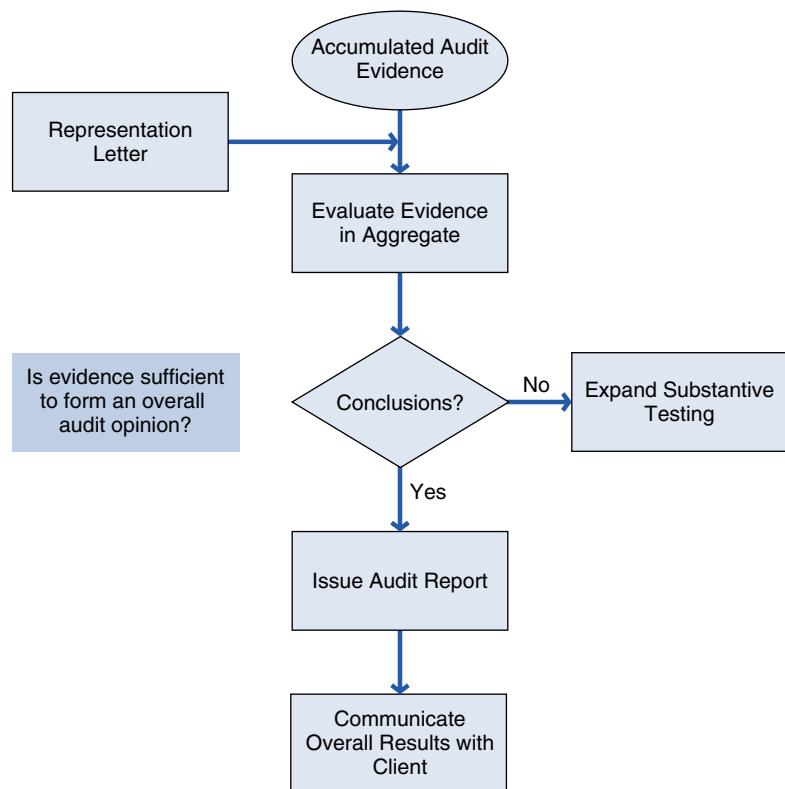
These techniques allow audit tests to be completed quickly, accurately, and thoroughly, therefore providing auditors with a way to meet the growing needs of decision makers who expect precise, immediate information.

## Audit Completion/Reporting (Study Objective 10)

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After the tests of controls and substantive audit tests have been completed, auditors evaluate all the evidence that has been accumulated and draw conclusions based on this evidence. This phase is the **audit completion/reporting phase**. The processes within this final phase of the audit are presented in Exhibit 7-10.

In forming a conclusion, auditors must consider whether the evidence supports the information presented. All of the evidence from all phases of the audit and covering all types of accounts and transactions must be considered collectively so that the auditors can make an overall decision on the fairness of the information. The auditors must also consider whether the extent of testing has been adequate in light of the risks and controls identified during the planning phase versus the results of procedures performed in the testing phases.



**EXHIBIT 7-10** Audit Completion/Reporting Phase Process Map

The completion phase includes many tasks that are needed to wrap up the audit. For many types of audits, the most important task is obtaining a **letter of representations** from company management. The letter of representations is often considered the most significant single piece of audit evidence, because it is a signed acknowledgement of management's responsibility for the reported information. In this letter, management must declare that it has provided complete and accurate information to its auditors during all phases of the audit.

For a financial statement audit, when the auditors are satisfied with the extent of testing and a representations letter has been obtained from the client, an audit report must be issued. The audit report expresses the auditors' overall opinion of the financial statements, and may be issued in one of four forms:

1. **Unqualified opinion**, which states that the auditors believe the financial statements are fairly and consistently presented in accordance with GAAP or IFRS.
2. **Qualified opinion**, which identifies certain exceptions to an unqualified opinion.
3. **Adverse opinion**, which notes that there are material misstatements presented.
4. **Disclaimer**, which states that the auditors are unable to reach a conclusion.

When reporting on the effectiveness of internal controls auditors must choose between an unqualified, adverse, or disclaimer opinion. Communication is key to the proper conclusion of an audit. In addition to management communicating information in the representations letter and auditors issuing the audit report, auditors must discuss the overall results of the audit with the company's directors.

# Other Audit Considerations (Study Objective 11)

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## Different IT Environments

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Most companies use microcomputers or personal computers (PCs) in their accounting processes. General controls covering PCs are often less advanced than those covering the mainframe and client–server systems. As a result, PCs may face a greater risk of loss due to unauthorized access, lack of segregation of duties, lack of backup control, and computer viruses. Following are some audit techniques used to test controls specifically in the use of PCs:

- Make sure that PCs and removable hard drives are locked in place to ensure physical security. In addition, programs and data files should be password protected to prevent online misuse by unauthorized persons.
- Make sure that computer programmers do not have access to systems operations, so that there is no opportunity to alter source code and the related operational data. Software programs loaded on PCs should not permit the users to make program changes. Also ascertain that computer-generated reports are regularly reviewed by management.
- Compare dates and data included on backup files with live operating programs in order to determine the frequency of backup procedures.
- Verify the use of antivirus software and the frequency of virus scans.

In addition to or as an alternative to using PCs, companies may operate within IT environments that involve networks, database management systems, e-commerce systems, cloud computing, and/or other forms of IT outsourcing. Many of the procedures described previously may also be used for these different computer configurations.

When companies have accounting information systems organized in local area networks (LANs) or wide area networks (WANs), the auditors must understand how the network is structured. In other words, they must learn how the company's computers are linked together, including the location of all servers and workstations. All of the risks and audit procedures that apply to a PC environment may also exist in networks, but the potential for loss is much greater. Since network operations typically involve a large number of computers, many users, and a high volume of data transfers, any lack of network controls could cause widespread damage. Auditors must apply tests over the entire network. It is especially important for auditors to test the software that manages the network and controls access to the servers.

When companies use database systems, the database management system (including the data, applications, and related controls) replicates or partitions data for many different users. When data is organized in a consistent way, it is relatively easy for auditors to select items for testing. However, challenges may be encountered when unstructured data is present, and there are some other special considerations for auditors testing database management systems. For example, since many users may have access to the data, the auditors must be sure to evaluate access controls surrounding the database. In addition, it is more important than ever to maintain proper backups in a database environment, because so many people depend on the consistent operation of the database and availability of data. Auditors are responsible for understanding how the data is managed so that they are reliable as a source of information. In addition to testing access and backup controls, as discussed earlier

in this chapter, the auditors should perform tests to verify that a database administrator is monitoring access to the company's data and backing up the database on a regular basis. Since many different applications may access and change the data in the database, database control is especially important.

Security risks always exist in companies that use e-commerce, because their computer systems are linked online with the systems of their business partners. As a result, the reliability of a company's IT system depends upon the reliability of its customers' and/or suppliers' systems. The audit procedures used to assess controls in e-commerce environments were addressed earlier in this chapter in the discussion on external access controls. In addition, auditors often

- Inspect message logs to identify the points of remote access, verify proper sequencing of transactions, and review for timely follow-up on unsuccessful transmissions between business partners
- Verify that the company has evaluated the computer systems of its business partners prior to doing business over the Internet
- Reprocess transactions to see whether they are controlled properly.

Because of the difficulty of testing all possible points of access in an online system, auditors sometimes find it more cost effective to perform substantive tests rather than extensive tests of controls.

Some companies may rely on external, independent computer service providers to handle all or part of their IT needs. This is known as **IT outsourcing**. IT outsourcing creates a challenge for auditors, who must gain an adequate understanding of risks and controls that are located at an independent service center. However, the service center will likely have its own auditors who monitor, test, and/or report on internal controls. This third-party report can be used as audit evidence about the effectiveness of internal controls. Alternatively, auditors may choose to conduct testing at the service center's business location, or perform audit tests around the client's computer.

When companies use cloud computing, their auditors need to thoroughly understand the underlying technologies and related risks and controls. Within a cloud computing environment, the service provider performs important tasks that are traditionally the responsibility of the company's managers. Accordingly, risk assessment may be particularly challenging because the threats to a company's data is uncontrolled, and often unforeseen, by the company.

In addition to merely identifying the threats inherent in a cloud computing environment, it is particularly difficult to estimate their potential costs and overall impact. However, they may be far-reaching, to say the least. It is therefore more important than ever for a company and its auditors to carefully consider whether all relevant risks have been identified and controlled. Below are some sample questions for auditors to consider when evaluating a cloud computing environment:

#### Security Risks:

- What damage could result if an unauthorized user accessed the company's data?
- How and when is data encrypted?
- How does the cloud service provider handle internal security?

#### Availability Risks:

- What damage could result if the company's data was unavailable during peak times or for an extended period?

- How does the cloud service provider segregate information between clients?
- What disaster recovery and business continuity plans are in place?

#### Processing Risks:

- How are response times and other aspects of operating performance monitored?
- How does the service provider monitor its capacity for data storage and usage?
- Is the service provider's system flexible enough to accommodate the company's anticipated growth?

#### Compliance Risks:

- What compliance standards does the cloud service provider meet?
- What third-party assurance information is in place?
- What additional information is available to help the company maintain compliance with applicable laws and regulations?

Once an auditor has considered all the aspects of risk, an audit in a cloud computing environment can be carried out according to a typical audit approach. However, because there is no such thing as a standard cloud, it is not possible to standardize a risk assessment process and audit procedures for a cloud computing environment. Therefore, tests of controls must be specifically designed to determine whether identified risks are being properly mitigated, and substantive tests are used in areas where controls are deemed to be lacking. For either type of test, an auditor can gain access to the cloud system and perform testing from the company's location. Useful guidance in conducting audit procedures for cloud computing is available from ISACA's IT Assurance Framework, the International Organization for Standardization (ISO) user guides, and the AICPA's Service Organization Controls (SOC) Framework.

When an auditor is engaged to audit a company that uses cloud computing or some other outsourced service, then the auditor must decide how to obtain evidence regarding the service provider's overall control environment. Auditors can perform their own testing, as described previously, or they can obtain the following types of **SOC reports** from the service provider's auditors:

- SOC 1 reports address internal controls over financial reporting.
  - Type I reports contain management's assessment and the auditor's opinion on the operating *design* of internal controls over financial reporting.
  - Type II reports extend the Type I report by also evaluating the *operating effectiveness* of internal controls.
- SOC 2 reports consider controls over compliance and operations, including the Trust Services Principles of security, availability, processing integrity, confidentiality, and privacy of a service provider's systems.
  - Type I or Type II conclusions may apply in the same manner as for SOC 1 reports.
- SOC 3 reports are unaudited but contain an auditing firm's conclusion on the elements of the Trust Services Principles.

## Changes in a Client's IT Environment

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When a company changes the type of hardware or software used or otherwise modifies its IT environment, its auditors must consider whether additional audit testing is needed. During its period of change, data may be taken from different systems at

different times. As a result, auditors should consider applying tests of controls at multiple times throughout the period in order to determine the effectiveness of controls under each of the systems. Specific audit tests include verification of the following items:

- An assessment of user needs
- Proper authorization for new projects and program changes
- An adequate feasibility study and cost-benefit analysis
- Proper design documentation, including revisions for changes made via updated versions, replacements, or maintenance
- Proper user instructions, including revisions for changes made via updated versions, replacements, or maintenance
- Adequate testing before the system is put into use

Overall, auditors need to evaluate the company's procedures for developing, implementing, and maintaining new systems or changes in existing systems. Chapter 5 addressed the systems development life cycle, which involves the various stages of change within the IT function.

When a client company plans to implement new computerized systems, auditors may find it advantageous to review the new features before they are placed in use. This way, the auditors can have a chance to identify controls and risks in the system, and to communicate relevant issues to management prior to the implementation. This may also give the auditors time to develop effective audit tests to be used when the system is activated.

## **Sampling versus Population Testing**

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Auditors cannot always evaluate every aspect of every item that impacts reported information. Auditors often rely on **sampling**, whereby they choose and test a limited number of items or transactions and then draw conclusions about the information as a whole on the basis of the results. Since audit tests often do not cover all items in the population, there is some risk that a sample, or subset, of the population may not represent the balance as a whole. Auditors try to use sampling so that a fair representation of the population is evaluated. Computerized software is often employed to help auditors select samples. Random numbers can be generated by software programs. A sample is random if each item in the population has an equal chance of being chosen. The use of computer programs ensures that there is no bias in selecting the test items. Auditors may also choose sample items by other methods, such as a selection based on item size. The choice of an appropriate sampling technique is very subjective, and different auditors tend to have different practices for using and selecting samples.

As businesses evolve, they are more likely to be in possession of Big Data sets. With the rise of Big Data comes an increase in information risk; thus, auditors are challenged to reconsider what constitutes adequate audit evidence. They may transition from the use of sampling strategies toward **population testing**, where continuous auditing techniques are used to evaluate 100 percent of the population, often in real time. This means that auditors review all transactions instead of a sample of transactions. Population testing is becoming more widespread, as many auditors now have the capability to connect electronically with their clients' accounting information systems.

## Ethical Issues Related to Auditing (Study Objective 12)

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All types of auditors must follow guidelines promoting ethical conduct. For financial statement auditors, the PCAOB/AICPA has established a Code of Professional Conduct, commonly called its code of ethics. This code of ethics is made up of two sections, the principles and the rules. The principles are the foundation for the honorable behavior expected of CPAs while performing professional duties, whereas the rules provide more detailed guidance. Following are the six principles of the code:

1. *Responsibilities.* In carrying out their professional duties, CPAs should exercise sensitive professional and moral judgments in all their activities.
2. *The Public Interest.* CPAs should act in a way that will serve the public interest, honor the public trust, and demonstrate commitment to professionalism.
3. *Integrity.* To maintain and broaden public confidence, CPAs should perform their professional duties with the highest sense of integrity.
4. *Objectivity and Independence.* CPAs should maintain objectivity and be free of conflicts of interest in the performance of their professional duties. CPAs in public practice should be independent in fact and appearance when providing auditing and other attestation services.
5. *Due Care.* CPAs should observe the profession's technical and ethical standards, strive continually to improve competence and the quality of services, and discharge professional responsibility to the best of their ability.
6. *Scope and Nature of Services.* CPAs in public practice should observe the principles of the Code of Professional Conduct in determining the scope and nature of services to be provided.

Internal auditors and IT auditors must abide by ethical standards established by the IIA and ISACA, respectively. The IIA Code of Ethics is founded on the principles of integrity, objectivity, confidentiality, and competency. Similarly, ISACA's Code of Professional Ethics recognizes due diligence, objectivity, competency, communication, maintaining privacy and confidentiality, and serving in the interests of stakeholders.

These professional codes of ethics are adopted by their respective constituencies in recognizing their ethical responsibilities to others. Compliance with a code of conduct depends primarily upon the understanding and voluntary actions of its members. In the United States, many states and professional organizations have special committees that are responsible for considering cases of wrongdoing and enforcing the code of ethics. Committee sanctions may include informal discussions, investigating complaints, issuing warning letters, holding hearings and trials, and suspension or expulsion of the professional certification.

Of all the ethical principles applicable to auditors, the one that generally receives the most attention is the requirement for financial statement auditors to maintain independence. The early pages of this chapter described the importance of auditors being unbiased, which is the essence of independence. The requirement for independence makes the CPA profession unique compared with other business professionals. CPA firms are restricted from performing audit engagements when they have financial, managerial, or personal relationships with clients or when they have the ability to influence their clients.

## The Real World

In the case of the Phar-Mor pharmaceutical company fraud, the auditors became too close to the management of Phar-Mor and shared audit information that they should not have. For example, the auditors told management which stores they would select for inventory testing.

Phar-Mor managers were then able to move inventory between stores to conceal inventory shortages in the stores that were to be audited by the CPA firm. The auditors failed to maintain neutrality and objectivity as they conducted the audit.

The Phar-Mor example illustrates the point that an auditor's independence may be jeopardized if the auditors become too friendly with their clients. Auditors have an ethical obligation to never let anything, including close relationships with their clients, compromise their independence and objectivity.

## SOX

The Sarbanes–Oxley Act restricts auditors by prohibiting them from performing certain types of services for their clients. For example, auditors cannot perform IT design and implementation services for companies which are also audit clients. The Act regards IT services as involving management decisions that would affect the financial information provided by the company. This would ultimately place the audit firm in a position of auditing its own work and would therefore violate its objectivity.

The Sarbanes–Oxley Act also increases management's responsibilities regarding the fair presentation of the financial statements. It requires public companies to have an audit committee as a subcommittee of the board of directors. The audit committee is charged with the responsibility for overseeing the audit functions and approving all services provided by its auditors. In addition, the Sarbanes–Oxley Act requires top management to verify in writing that the financial statements are fairly stated and that the company has adequate internal controls over financial reporting.

Auditors who are responsible for auditing financial statements and for reporting on the effectiveness of their clients' internal controls should *not* be in a position of making managerial decisions, designing or implementing policies and procedures, or preparing financial information for their clients, as such tasks would jeopardize their objectivity. If auditors were to be engaged in such tasks, they could not possibly audit the client's underlying financial statements and internal controls in a truly unbiased manner.

In fulfilling their ethical responsibilities, auditors must practice professional skepticism during the audit. **Professional skepticism** means that the auditors should not automatically assume that their clients are honest, but must have a questioning mind and a persistent approach to evaluating evidence for possible misstatements. Misstatements may result from error or fraud, and auditors have equal responsibility for searching for both causes of material misstatements.

Concerning fraud in the business organization, recall from Chapter 3 the distinction between employee fraud and management fraud: Employee fraud involves stealing assets, whereas management fraud is the intentional misstatement of financial information. Fraud may be difficult for auditors to find, because the perpetrator often tries to hide the fraud. Auditors must recognize that management may be in a position to override established controls, and that employees may work in collusion to carry out a fraudulent act. This makes it even more difficult for auditors to detect fraud.

The example of fraud perpetrated by Crazy Eddie's describes the importance to auditors of knowing their clients well and exercising professional skepticism. In the

## The Real World

A widely publicized case of management fraud involved Crazy Eddie's electronics retail stores in New York. This case is particularly outrageous because the management of the company, including Eddie Antar and his family, used nearly every trick in the book to commit financial statement fraud and con the auditors in the process. Some of the tactics used by Antar included the reporting of fictitious sales and overstated inventories, hiding liabilities and expenses, and falsifying financial statement

disclosures. The Antars used their employees and suppliers to help carry out their illegal schemes. They also tampered with audit evidence.

Because the auditors were too trusting and did not carefully protect the audit files when they went home at the end of the day, the client (Crazy Eddie's) had the opportunity to alter audit documents. Even though this fraud occurred over two decades ago, it still provides a clear example of how management fraud can be pulled off and how auditors can be deceived.

exercise of professional skepticism, auditors should make sure that the audit procedures include the following:

- Examination of financial reporting for unauthorized or unusual entries
- Review of estimated information and changes in financial reporting for possible biases
- Evaluation of a reasonable business purpose for all significant transactions.

It is important for auditors to consider the conditions under which fraud could be committed, including the possible pressures, opportunities, and rationalization for committing dishonest acts. In the context of a client's IT systems, auditors should also think about the possibility that computer programs could be altered to report information in a manner that is favorable for the company.

Modern financial statement auditing tends to concentrate on analyzing risks, evaluating clients' computer systems, and testing the related controls, with reduced emphasis on substantive procedures. Although it is important to understand the company's accounting systems and to determine whether related controls are effective, this type of testing is not enough to satisfy the responsibilities of the audit profession. Auditors should be careful about balancing the mix of audit procedures between tests of controls and substantive tests. Emphasis on computer processes and internal controls may lead to an overreliance on the accounting system, which could be circumvented by management. Therefore, it is important to also perform substantive procedures that focus on the actual transactions and account balances that make up the financial statements.

Accountants are sometimes called upon to perform a specialized type of assurance service called forensic auditing. **Forensic auditing** is designed specifically for finding and preventing fraud and is used for companies where fraud is known or believed to exist. Some accountants who work on forensic audits become **certified fraud examiners (CFEs)** and are considered experts in the detection of fraud. Some CFEs specialize in computer forensics, which involves the detection of abuses within computer systems. IT auditors may play an instrumental role in gathering and analyzing data needed to perform or assist in a forensic audit. The need for the services of these types of auditors is expected to grow in the future, because opportunities for cyber crimes will likely increase as the use of Big Data and cloud computing become more widespread.

## The Real World

Examples of management fraud were discovered at Enron, Xerox, WorldCom, and other large, well-known companies during the past two decades. In fact, many of the big corporate fraud cases that have been in the news in recent years involved the company's chief executive or top accounting managers. The financial statement misstatements resulting from these frauds have been staggering. At WorldCom, for example, nearly \$4 billion in operating expenses were hidden when management decided to capitalize the expenditures rather than report

them on the income statement. This illustrates the importance to auditors of varying the mix of audit procedures to include a reasonable combination of tests of controls and substantive tests. Even in large companies with sophisticated systems of internal control, the audit needs to include tests of the accounting balances in order to increase the chances of discovering misstatement, including those potentially resulting from management's intentional circumvention of internal controls in order to perpetrate fraud.

## Summary of Study Objectives

**An introduction to auditing IT processes.** Nearly all companies use computerized systems to conduct business and account for business activities, and many businesses are overwhelmed with the volume of computerized data available for reporting and decision-making purposes. In light of this heightened volume of information and level of information processing, the audit function is as important as ever in improving the quality of information available to decision makers.

**The various types of audits and auditors.** The three primary types of audits include compliance audits, operational audits, and financial statement audits. Audits may be conducted by CPAs, internal auditors, IT auditors, or government auditors.

**Information risk and IT-enhanced internal control.** Information risk is the chance that information available to decision makers may be inaccurate. Information risk may be reduced through the use of information that has been audited. Auditors rely on both manual and computer controls to reduce information risk. Computer controls often compensate for weaknesses in manual controls.

**Authoritative literature used in auditing.** Audit guidance is found in generally accepted auditing standards, as well as standards issued by the Public Company Accounting Oversight Board, the Auditing Standards Board, the International Auditing and Assurance Standards Board, and the Information Systems Audit and Control Association.

**Management assertions used in the auditing process and the related audit objectives.** Management makes claims regarding the financial status and results of operations of the business organization, and audit objectives relate to each of these assertions. The assertions include existence, valuation, completeness, rights and obligations, and presentation and disclosure.

**The phases of an IT audit.** An audit engagement is typically characterized by four phases, including planning, tests of controls, substantive testing, and completion/reporting.

**The use of computers in audits.** Depending on the nature of a client company's computerized systems, an auditor may perform auditing around the computer, auditing through the computer, or auditing with the computer using computer-assisted audit techniques.

**Tests of controls.** General controls and application controls can be tested during an audit to determine whether they are working as they were designed to work. This will be done only if the auditor intends to rely on the effectiveness of the client's internal controls as a means of justifying a reduced extent of substantive tests in the remaining phases of the audit.

**Tests of transactions and tests of balances.** Substantive tests involve the accumulation of evidence in support of transactions that have occurred and the resulting account balances. The extent of substantive testing necessary in an audit depends upon the strength of the client's underlying controls.

**Audit completion/reporting.** The final phase of an audit involves an evaluation of the evidence accumulated from all audit tests in order to reach an overall conclusion on the fair presentation of the reported information. Thorough communication is key in this phase; the company's management issues a letter of representations, the auditors issue an audit report, and discussions are held with company directors.

**Other audit considerations.** Audit procedures need to be tailored to the specific characteristics of each client's business. In particular, extensive testing is generally used when auditing personal computer environments, for companies using extensive database or networking systems, and for companies where significant computer changes have been implemented. To assist in efficient completion of audit tests, sampling techniques are available whereby a subset of the population is tested.

**Ethical issues related to auditing.** Auditors are bound by a code of conduct adopted by the professional organizations that guide the various practices of auditing. The ethical principles that are the foundation of these code include professional responsibilities, service to the stakeholders/public interest, integrity, objectivity and independence, the exercise of due care, and the observance of professional conduct.

## Key Terms

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Adverse opinion	Auditing through the computer	Computer-assisted audit techniques (CAATs)	General controls
Application controls	Auditing with the computer	Continuous auditing	Generalized audit software (GAS)
Assurance services	Authenticity tests	Data analysis software (DAS)	Generally accepted auditing standards (GAAS)
Audit completion/ reporting phase	Balancing tests	Disclaimer	Governmental auditors
Audit evidence	Benford's Law	Embedded audit module	Hash totals
Audit program	Certified Fraud Examiner (CFE)	External audit	Information risk
Audit trail tests	Certified Public Accountant (CPA)	Field checks	Information Systems
Auditing around the computer	Compliance audits	Financial statement audits	Audit and Control Association (ISACA)
Auditing Standards Board (ASB)		Financial totals	Integrated test facility
		Forensic auditing	

Internal auditors	Management assertions	Public Company	SAS No. 94
Internal Auditing Standards Board (IASB)	Materiality	Accounting Oversight Board (PCAOB)	SOC reports
International Auditing and Assurance Standards Board (IAASB)	Mathematical accuracy tests	Qualified opinion	Substantive testing
IT auditors	Operational audits	Reasonableness tests	Test data method
IT outsourcing	Parallel simulation	Reconciliation	Tests of controls
Letter of representations	Penetration tests	Redundancy tests	Unqualified opinion
Limit tests	Planning phase	Risk	Validation checks
Loss of audit trail visibility	Population testing	Rounding errors tests	Vulnerability assessments
	Professional skepticism	Run-to-run totals	
	Program mapping	Sampling	
	Program tracing		

## End of Chapter Material

### Concept Check



- 1 Which of the following types of audits is most likely to be conducted for the purpose of identifying areas for cost savings?
- Financial statement audits
  - Operational audits
  - Regulatory audits
  - Compliance audits
- 2 Financial statement audits are required to be performed by
- government auditors
  - CPAs
  - internal auditors
  - IT auditors
- 3 Which of the following is **not** considered a cause of information risk?
- Management's geographic location is far from the source of the information needed to make effective decisions.
  - The information is collected and prepared by persons who use the information for very different purposes.
  - The information relates to business activities that are not well understood by those who collect and summarize the information for decision makers.
  - The information has been tested by internal auditors and a CPA firm.
- 4 Which of the following is **not** a part of generally accepted auditing standards?
- General standards
  - Standards of fieldwork
  - Standards of information systems
  - Standards of reporting
- 5 Which of the following best describes what is meant by the term "generally accepted auditing standards"?
- Procedures used to gather evidence to support the accuracy of a client's financial statements
  - Measures of the quality of an auditor's conduct in carrying out professional responsibilities
  - Professional pronouncements issued by the Auditing Standards Board
  - Rules acknowledged by the accounting profession because of their widespread application
- 6 In an audit of financial statements in accordance with generally accepted auditing standards, an auditor is required to
- document the auditor's understanding of the client company's internal controls
  - search for weaknesses in the operation of the client company's internal controls
  - perform tests of controls to evaluate the effectiveness of the client company's internal controls
  - determine whether controls are appropriately operating to prevent or detect material misstatements
- 7 Auditors should develop a written audit program so that
- all material transactions will be included in substantive testing
  - substantive testing performed prior to year end will be minimized
  - the procedures will achieve specific audit objectives related to specific management assertions
  - each account balance will be tested under either a substantive test or a test of controls

- 8 Which of the following audit objectives relates to the management assertion of existence?
- A transaction is recorded in the proper period.
  - A transaction actually occurred (i.e., it is real).
  - A transaction is properly presented in the financial statements.
  - A transaction is supported by detailed evidence.
- 9 Which of the following statements regarding an audit program is true?
- An audit program should be standardized so it may be used on any client engagement.
  - The audit program should be completed by the client company before the audit planning stage begins.
  - An audit program should be developed by the internal auditor during the audit's completion/reporting phase.
  - An audit program establishes responsibility for each audit test by requiring the signature or initials of the auditor who performed the test.
- 10 Risk assessment is a process designed to
- identify possible circumstances and events that may affect the business
  - establish policies and procedures to carry out internal controls
  - identify and capture information in a timely manner
  - test the internal controls throughout the year
- 11 Which of the following audit procedures is most likely to be performed during the planning phase of the audit?
- Obtain an understanding of the client's risk assessment process.
  - Identify specific internal control activities that are designed to prevent fraud.
  - Evaluate the reasonableness of the client's accounting estimates.
  - Test the timely cutoff of cash payments and collections.
- 12 Which of the following is the most significant disadvantage of auditing around the computer rather than through the computer?
- The time involved in testing processing controls is significant.
  - The cost involved in testing processing controls is significant.
  - A portion of the audit trail is not tested.
  - The technical expertise required to test processing controls is extensive.
- 13 The primary objective of compliance testing in a financial statement audit is to determine whether
- procedures have been updated regularly
  - financial statement amounts are accurately stated
  - internal controls are functioning as designed
  - collusion is taking place
- 14 Which of the following computer assisted auditing techniques processes actual client input data (or a copy of the real data) on a controlled program under the auditor's control to periodically test controls in the client's computer system?
- Test data method
  - Embedded audit module
  - Integrated test facility
  - Parallel simulation
- 15 Which of the following computer assisted auditing techniques allows fictitious and real transactions to be processed together without client personnel being aware of the testing process?
- Test data method
  - Embedded audit module
  - Integrated test facility
  - Parallel simulation
- 16 Which of the following is a general control to test for external access to a client's computerized systems?
- Penetration tests
  - Hash totals
  - Field checks
  - Program tracing
- 17 Suppose that during the planning phase of an audit, the auditor determines that weaknesses exist in the client's computerized systems. These weaknesses make the client company susceptible to the risk of an unauthorized break-in. Which type of audit procedures should be emphasized in the remaining phases of this audit?
- Tests of controls
  - Penetration tests
  - Substantive tests
  - Rounding errors tests
- 18 Generalized audit software can be used to
- examine the consistency of data maintained on computer files
  - perform audit tests of multiple computer files concurrently
  - verify the processing logic of operating system software
  - process test data against master files that contain both real and fictitious data

- 19 Independent auditors are generally actively involved in each of the following tasks except
- preparation of a client's financial statements and accompanying notes
  - advising client management as to the applicability of a new accounting standard
  - proposing adjustments to a client's financial statements
  - advising client management about the presentation of the financial statements
- 20 Which of the following is most likely to be an attribute unique to the financial statement audit work of CPAs, compared with work performed by attorneys or practitioners of other business professions?
- Due professional care
  - Competence
  - Independence
  - A complex underlying body of professional knowledge
- 21 Which of the following terms is **not** associated with a financial statement auditor's requirement to maintain independence?
- Objectivity
  - Neutrality
  - Professional skepticism
  - Competence
- 30 (SP 4) Which professional standard-setting organization provides guidance on the conduct of an IT audit?
- 31 (SO 5) If management is responsible for its own financial statements, why are auditors important?
- 32 (SO 6) List the techniques used for gathering evidence.
- 33 (SO 6) During which phase of an audit would an auditor consider risk assessment and materiality?
- 34 (SO 7) Distinguish between auditing through the computer and auditing with the computer. When are auditors required to audit through the computer as opposed to auditing around the computer?
- 35 (SO 8) Explain why it is customary to complete the testing of general controls before testing applications controls.
- 36 (SO 8) Identify four important aspects of administrative control in an IT environment.
- 37 (SO 8) Explain why Benford's Law is useful to auditors in the detection of fraud.
- 38 (SO 8) Think about a place you have worked where computers were present. What are some physical and environmental controls that you have observed in the workplace? Provide at least two examples of each from your personal experience.
- 39 (SO 8) Batch totals and hash totals are common input controls. Considering the fact that hash totals can be used with batch processing, differentiate between these two types of controls.
- 40 (SO 8) The test data method and an integrated test facility are similar in that they are both tests of applications controls and they both rely on the use of test data. Explain the difference between these two audit techniques.
- 41 (SO 9) Explain the necessity for performing substantive testing even for audit clients with strong internal controls and sophisticated IT systems.
- 42 (SO 9) What kinds of audit tools are used to perform routine tests on electronic data files taken from databases? List the types of tests that can be performed with these tools.
- 43 (SO 10) Which of the four types of audit reports is the most favorable for an audit client? Which is the least favorable?
- 44 (SO 10) Why is it so important to obtain a letter of representation from an audit client?
- 45 (SO 11) How can auditors evaluate internal controls when their clients use IT outsourcing?
- 46 (SO 12) An auditor's characteristic of professional skepticism is most closely associated with which ethical principle of the AICPA Code of Professional Conduct?

### Discussion Questions

- 22 (SO 1) What are assurance services? What value do assurance services provide?
- 23 (SO 2) Differentiate between a compliance audit and an operational audit.
- 24 (SO 2) Which type of audit is most likely to be performed by government auditors? Which type of audit is most likely to be performed by internal auditors?
- 25 (SO 2) Identify the three areas of an auditor's work that are significantly impacted by the presence of IT accounting systems.
- 26 (SO 3) Describe the three causes of information risk.
- 27 (SO 3) Explain how an audit trail might get "lost" within a computerized system.
- 28 (SO 3) Explain how the presence of IT processes can improve the quality of information that management uses for decision making.
- 29 (SO 4) Distinguish among the focuses of the GAAS standards of fieldwork and standards of reporting.

### Brief Exercises

- 47** (SO 2) Why is it necessary for a CPA to be prohibited from having financial or personal connections with a client? Provide an example of how a financial connection to a company would impair an auditor's objectivity. Provide an example of how a personal relationship might impair an auditor's objectivity.
- 48** (SO 3) From an internal control perspective, discuss the advantages and disadvantages of using IT-based accounting systems.
- 49** (SO 4) Explain why standards of fieldwork for GAAS are not particularly helpful to an auditor who is trying to determine the types of testing to be used on an audit engagement.
- 50** (SO 5) Kim and Kresiki are assigned to perform the audit of Ying & Yang's Yoga Company. During the audit, it was discovered that the amount of sales reported on Ying & Yang's income statement was understated because one week's purchasing transactions were not recorded due to a computer glitch. Kim claims that this problem represents a violation of the management assertion regarding existence, because

the reported account balance was not real. Kresiki argues that the completeness assertion was violated, because relevant data was omitted from the records. Which auditor is correct? Explain your answer.

- 51** (SO 6) One of the most important tasks of the planning phase is for the auditor to gain an understanding of internal controls. How does this differ from the tasks performed during the tests of controls phase?
- 52** (SO 8) How is it possible that a review of computer logs can be used to test for both internal access controls and external access controls? Other than reviewing the computer logs, identify and describe two types of audit procedures performed to test internal access controls, and two types of audit procedures performed to test external access controls.
- 53** (SO 9) Explain why continuous auditing is growing in popularity. Identify and describe a computer-assisted audit technique useful for continuous auditing.
- 54** (SO 11) Distinguish between the various service organization controls (SOC) reporting options available to auditors who evaluate cloud computing service providers.

### Problems

- 55** (SO 4) Given is a list of audit standard-setting bodies (shown on the left) and a description of their purpose (shown on the right). Match each standard-setting body with its purpose.

- |            |  |
|------------|--|
| I. PCAOB   | a. Established by the AICPA to issue SASs  |
| II. ASB    | b. Issues ISAs to provide guidelines for IT audits   |
| III. IAASB | c. Established by the Sarbanes-Oxley Act of 2002 to establish audit guidelines for public companies and their auditors |
| IV. ISACA  | d. Issues ISAs to promote uniformity of worldwide auditing practices   |

- 56** (SO 8) Identify whether each of the following audit tests is used to evaluate internal access controls (I), external access controls (E), or both (B):
- Authenticity tests
  - Penetration tests
  - Vulnerability assessments
  - Review of access logs
  - Review of policies concerning the issuance of passwords and security tokens
- 57** (SO 9) Refer to the notes payable audit program excerpt presented in Exhibit 7-3. If an auditor had a copy of this client's data file for its notes receivable,

how could a general audit software or data analysis software package be used to assist with these audit tests?

- 58** (SO 11) In order to preserve auditor independence, the Sarbanes-Oxley Act of 2002 restricts the types of nonaudit services that auditors can perform for their public-company audit clients. The list includes nine types of services that are prohibited because they are deemed to impair an auditor's independence. Included in the list are the following:

- Financial information systems design and implementation
- Internal audit outsourcing

Describe how an auditor's independence could be impaired if she performed IT design and implementation functions for her audit client. Likewise, how could an auditor's involvement with internal audit outsourcing impair his or her independence with respect to auditing the same company?

- 59** (SO 2) Visit the AICPA website at [www.aicpa.org](http://www.aicpa.org) and select the tab for Career Paths. Click on "This Way to CPA" to locate information on audit careers.
- 60** (SO 4 and 9) Visit the ISACA website at [www.isaca.org](http://www.isaca.org) and click the Knowledge Center tab, then select ITAF (Information Technology Assurance Framework) and click on the IT Audit Basics tab to find articles covering topics concerning the audit process. Locate



- an article on each of the following topics and answer the related question:
- Identify and briefly describe the four categories of CAATs used to support IT auditing.
  - List three possible procedures to be performed by IT auditors who are evaluating controls pertaining to the backup and recovery of a client's data.
- 61 (SO 8) Locate the stock tables for the two major stock exchanges in any issue of the *Wall Street Journal*.

## Cases

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- 63 Kyle Sanders was auditing the financial statements of World Wholesale Industries when she was presented with a curious situation. A member of World's top management team approached her with an anonymous note that had been retrieved from the company's suggestion box. The note accused unnamed employees in World's IT department of altering the accounts payable database by entering bogus transactions involving fictitious vendors. Payments made to this fictitious vendor were being intercepted and cashed by the fraudster.

**Required:**

- What tests of controls would be effective in helping Sanders determine whether World's vendor database was susceptible to fraud?
  - What computer-assisted audit technique would be effective in helping Sanders determine whether World's vendor database had actually been falsified?
- 64 Ryan McGuire is an auditor for a large CPA firm. McGuire was recently assigned to perform a financial statement audit of Kraft Brewery, Inc., a brewery and distributor of German specialty foods. McGuire's firm is auditing Kraft for the first time. The audit is nearly complete, but it has required more time than

Beginning from any point within the table, prepare a list of the first digits of the daily volume for 100 stocks. Determine whether the listed numbers conform to Benford's Law.

- 62 (SO 12) Perform an Internet search to determine the nature of Xerox Corporation's management fraud scheme and to find out what happened to the company after the problems were discovered.

expected. The auditors who performed the planning and testing phases have now been assigned to another client engagement, so McGuire was called in to carry out the completion/reporting phase.

In discussing the details of the audit engagement with the original audit team, McGuire learned that the original team expected that an unqualified audit opinion would be issued. This expectation was based on the extent of audit evidence accumulated, which led to the belief that the financial statements were fairly presented in accordance with GAAP.

Harold Stebbins, Kraft's CFO, is unhappy about the change in audit personnel. He is threatening to refuse to furnish a letter of representation.

**Required:**

- Would it be appropriate for McGuire to reopen the audit testing phases in order to expand procedures, in light of the lack of representative evidence from management? Why, or why not?
- Will McGuire's firm still be able to issue an unqualified audit report if it does not receive the representation letter? Research the standard wording to be included in an unqualified audit report, as well as the typical wording included in a client representation letter. Base your answer on your findings.

## Solutions to Concept Check

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- 1 (CIA Adapted) (SO 2) Of the given types of audits, **b. the operational audit** is most likely to be conducted for the purpose of identifying areas for cost savings. The primary purpose is to enhance efficiency and effectiveness, which is likely to result in cost savings.
- 2 (SO 2) Financial statement audits are required to be performed by **b. CPAs**. CPAs have extensive knowledge of GAAP, which is the required criteria in a financial statement audit. On the other hand, government auditors are specialists in governmental regulations, internal auditors work with gauging compliance with management's directives and operating effectiveness, and IT auditors focus on the effectiveness of computerized processes.
- 3 (SO 3) That **d. the information has been tested by internal auditors and a CPA firm** is not considered a cause of information risk. This is a way to reduce information risk, not a cause of information risk. Answer a. relates to the remoteness of information, b. relates to the motive of the preparer, and c. relates to the complexity of the transactions, which are each associated with increased information risk.
- 4 (SO 4) **c. Standards of information systems** are not a part of generally accepted auditing standards. The

- three categories of GAAS are general standards, standards of fieldwork, and standards of reporting.
- 5 (CPA Adapted) (SO 4) **b. “Measures of the quality of an auditor’s conduct in carrying out professional responsibilities”** best describes what is meant by the term “generally accepted auditing standards.”
- 6 (CPA Adapted) (SO 4) In an audit of financial statements in accordance with generally accepted auditing standards, an auditor is required to **a. document the auditor’s understanding of the client company’s internal control**. Each of the other responses pertain to testing of controls, which are required only if the auditor plans to rely upon the effectiveness of internal controls.
- 7 (CPA Adapted) (SO 5) Auditors should design a written audit program so that **c. the procedures will achieve specific audit objectives related to specific management assertions**.
- 8 (SO 5) The audit objective which relates to the management assertion of existence is that **b. a transaction actually occurred (i.e., it is real)**. Answer a. relates to cutoff; answer c. relates to presentation and disclosure; answer d. relates to valuation.
- 9 (SO 6) The statement regarding an audit program which is true is that **d. an audit program establishes responsibility for each audit test by requiring the signature or initials of the auditor who performed the test**. Answer a. is incorrect because audit programs need to be developed to address the unique nature of each client company. Answers b. and c. are incorrect because the client, including its internal auditors, should not be involved in the development or completion of the audit program; rather, the audit is the independent auditor’s responsibility.
- 10 (CMA Adapted) (SO 6) Risk assessment is a process designed to **a. identify possible circumstances and events that may affect the business**.
- 11 (CPA Adapted) (SO 6) The audit procedure most likely to be performed during the planning phase of the audit is to **a. obtain an understanding of the client’s risk assessment process**. Response b. is performed during tests of controls. Responses c. and d. are performed as part of substantive testing.
- 12 (CIA Adapted) (SO 7) The most significant disadvantage of auditing around the computer rather than through the computer is that **c. a portion of the audit trail is not tested**. The other three responses would each be considered disadvantages of auditing through the computer.
- 13 (CMA Adapted) (SO 8) The primary objective of compliance testing in a financial statement audit is to determine whether **c. internal controls are functioning as designed**. Compliance testing is another term for tests of controls, the purpose of which is to determine whether internal controls are functioning in compliance with management’s intentions.
- 14 (CPA Adapted, CIA Adapted) (SO 8) The computer assisted auditing technique that processes actual client input data (or a copy of the real data) on a controlled program under the auditor’s control to periodically test controls in the client’s computer system is **d. parallel simulation**. Each of the other responses involves use of the client company’s computer system.
- 15 (CPA Adapted) (SO 8) The computer assisted auditing technique that allows fictitious and real transactions to be processed together without client personnel being aware of the testing process is the **c. integrated test facility**.
- 16 (SO 8) The general control to test for external access to a client’s computerized systems is **a. penetration tests**. Answers b., c., and d. are application controls.
- 17 (SO 8 and 9) During the planning phase of an audit, the auditor determines that weaknesses exist in the client’s computerized systems. These weaknesses make the client company susceptible to the risk of an unauthorized break-in. The type of audit procedures that should be emphasized in the remaining phases of this audit is **c. substantive tests**. Answers a., b., and d. each relate to tests of controls, which are to be performed only when good controls have been found to be in place. It is not worthwhile to test weak or ineffective controls, since the purpose of tests of controls is to prove the usefulness of controls as a basis for reducing substantive testing.
- 18 (CIA Adapted) (SO 9) Generalized audit software can be used to **a. examine the consistency of data maintained on computer files**. This response applies to the use of generalized audit software to perform comparisons. None of the other responses relates to the uses described under Study Objective 9.
- 19 (CMA Adapted) (SO 12) Independent auditors are generally actively involved in each of the given tasks except **a. preparation of a client’s financial statements and accompanying notes**. Auditors would be placed in a position of auditing their own work if they prepared financial statements for an audit client.
- 20 (CMA Adapted) (SO 12) The attribute most likely to be unique to the audit work of CPAs, compared with work performed by attorneys or practitioners of other business professions, is **c. Independence**. Most other professionals are advocates for their clients, whereas auditors must be independent with respect to their audit clients.
- 21 (SO 4 and 12) The term not associated with the auditor’s requirement to maintain independence is **d. Competence**. Competence relates to the first general standard within GAAS; each of the other answers relate to independence (the second general standard).

## CHAPTER 8

# Revenue and Cash Collection Processes and Controls

### STUDY OBJECTIVES

This chapter will help you gain an understanding of the following concepts:

- 1.** An introduction to revenue processes
- 2.** Sales processes and the related risks and controls
- 3.** Sales return processes and the related risks and controls
- 4.** Cash collection processes and the related risks and controls
- 5.** An overview of IT systems of revenue and cash collection that enhance the efficiency of revenue processes
- 6.** E-business systems and the related risks and controls
- 7.** Electronic data interchange (EDI) systems and the related risks and controls
- 8.** Point of sale (POS) systems and the related risks and controls
- 9.** Ethical issues related to revenue processes
- 10.** Corporate governance in revenue processes

This chapter examines revenues and cash collection transaction processes. The Real World example on the next page will help you understand the context of many concepts included in this chapter. Please read that Real World example to begin effective reading and studying of this chapter.

### Introduction to Revenue Processes (Study Objective 1)

There are many kinds of companies selling many kinds of products and services. As a result, it is difficult to provide a single example of revenue and cash collection business processes because there is such a variety of companies, types of goods and services sold, and transaction processes followed. For instance, retailers may sell their products to consumers through company-owned department stores, using cash registers with bar coding systems called point of sale (POS) systems. These systems record the sale, collect cash, and update the inventory status all at the time of the sale. On the other hand, a manufacturer may sell products to other companies on 30-day credit terms, deliver the goods and bill the customer at a later date, and collect payment after the 30-day period.

The business processes for a company selling to other companies are likely to be different from a company selling products to consumers. An example of a company that sells to end consumers is Walmart, while an example of a company that sells to other companies is Procter & Gamble (P&G). P&G sells consumer products, such as Crest® toothpaste, to companies (like Walmart) who then resell to consumers. Walmart serves as the “middle man” who buys toothpaste from P&G and resells to consumers. The business processes that Walmart uses to generate and collect revenue are much

## The Real World



Eric Delmar/iStockphoto

Staples®, the large office supply company, sells its products not only in retail stores, but also to other large corporations. Top management at Staples realizes that its corporate sales are dependent upon customers' satisfaction with the buying experience. Staples must have sales processes that maximize customer satisfaction, because the sales processes are what make up the buying experience. However, customer satisfaction depends on a wide range of activities from ordering and product delivery to efficient billing and collection, and facilitating product returns. Staples must implement, monitor,

and improve all of the internal processes that generate sales, deliver to customers, and collect payments. These processes must be able to handle walk-in sales, telephone orders, and Web orders. To improve performance in filling customer orders and collecting cash, Staples monitors the following performance measures:

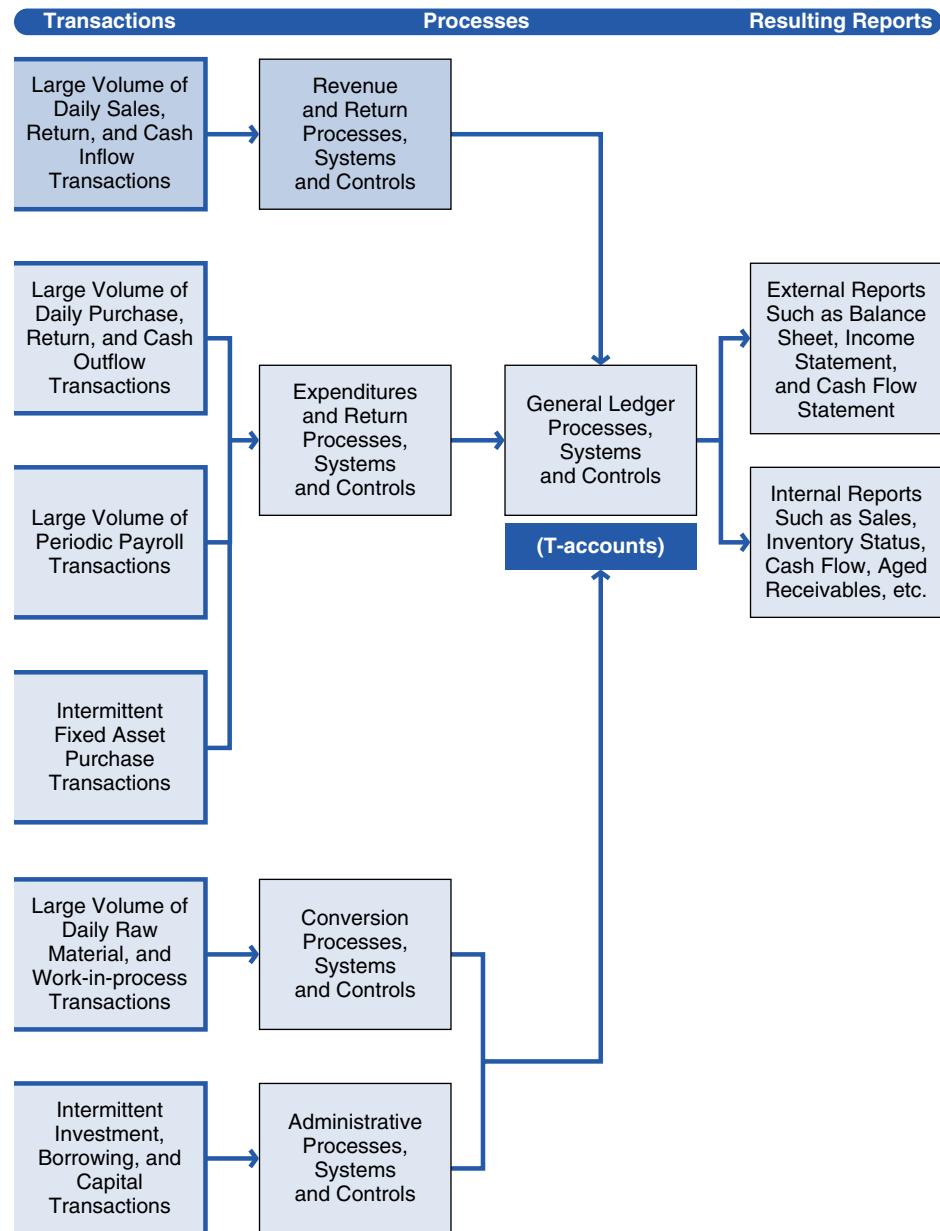
- Order entry accuracy
- Order fill rate versus unit fill rate
- Percent of items mispicked
- Percent of orders delivered next day
- Products delivered undamaged

To perform efficiently in these areas, Staples must have processes in place to enter customer orders, pick the correct items from the warehouse shelves, package and ship the items properly, bill the customer correctly, and collect the payment promptly. If these processes are not well managed, the result may be unhappy customers and reduced sales. This chapter describes these types of revenue processes and the internal controls within those processes.

different from those of P&G. This chapter begins by describing a common set of revenue and cash collection processes for companies that sell goods to other companies. Business process maps, document flowcharts, and data flow diagrams are included as visual representations of the business activities. However, the processes illustrated and described in this chapter can focus only on common characteristics of companies. Not all companies conduct business exactly as presented in this chapter.

Exhibit 8-1 highlights the revenue processes section of the overall accounting system. In a large company, there may be thousands or even hundreds of thousands of sales transactions occurring each day. The company must have systems and processes in place to capture, record, summarize, and report the results of these transactions. The processes are the policies and procedures that employees follow in carrying out a sale, capturing customer data and sales quantities, and routing the resulting sales documents to the right departments within the company. The accounting system uses this flow of sales documents to various departments to record, summarize, and report the results of the sales transactions.

For example, when a sale occurs, the information resulting from that sale must flow into the sales recording systems, the accounts receivable and cash collection systems, and the inventory tracking systems. In IT accounting systems, these recording and processing systems are called **transaction processing systems (TPS)**. Thus, there is a set of processes within the company to conduct sales transactions and handle the related sales information, and there is a TPS within the IT system to record, summarize, and report sales transactions.



**EXHIBIT 8-1** Revenue Processes within the Overall System

Sales transactions also generate other related transactions. Some additional transactions include the:

- movement of inventory to customers,
- recording of accounts receivable,
- collection of cash receipts, and
- processing of sales returns.

Processes for each of these types of transactions must be in place for the company to carry out transactions on a daily basis. The business processes that are common in company-to-company sales transactions are as follows:

- Capture order data from the customer (another company, not the end-user consumer).
- Deliver goods, often via common carrier such as trucking company or rail carrier.
- Record the receivable and bill the customer.
- Handle any product returns from the customer and issue appropriate credit.
- Collect the cash.
- Update the records affected, such as accounts receivable, cash, inventory, revenue, and cost of goods sold.

These types of processes are divided into the following groups:

1. Sales processes, including ordering, delivery, and billing
2. Sales returns processes
3. Cash collection processes

In an integrated automated accounting or ERP system, the related transactions are automatically recorded as part of the sales transaction. For example, Microsoft Dynamics GP, the automated accounting/ERP system referenced in this text, is a fully integrated system that allows one transaction to be entered and all related transactions to be updated at the same time or when the appropriate activities occur (without re-entry of those additional or subsequent transactions). In the case of a sales transaction, Exhibit 8-2 outlines the transactions that are generated in each step of the sales process. This exhibit also identifies the related transactions and activities that are generated automatically by the Microsoft Dynamics GP automated accounting/ERP system.

Although different companies conduct business differently, there tend to be similarities in the way they carry out related business processes. For instance, the sales processes generally involve receipt of a customer's order for products or services, delivery of the products or services, and billing the customer for those products or services. Sales processes also need supporting practices such as credit check and inventory stock authorization. Most companies carry out these types of business transactions; however, the ways they do so are likely to differ. For instance, even though most companies obtain order data from customers, the manner of receiving order data may vary. Orders may take the form of a mailed purchase order, a website order, or an EDI order.

Sales returns are an exception to the sales process; they are essentially a sale reversal that occurs when products are returned from customers. The sales return processes generally involve the receipt of goods and adjustment of customer accounts, inventory records, and other accounting reports.

Cash collections result from completed sales transactions. When cash is received from customers, it must be deposited in the bank. In addition, cash collection processes involve updating and reconciling cash and customer account balances.

The beginning part of this chapter describes common, simple methods of conducting business transactions within the revenue and cash collection processes. These descriptions are ordered according to the three categories explained earlier: sales, sales returns, and cash collections.

**EXHIBIT 8-2****Activities Automatically Generated by Transactions**

<b>Transaction or Activity</b>	<b>Explanation</b>	<b>Transactions Generated</b>
A sales quote, order or invoice is entered into the system.	In Microsoft Dynamics GP, a sales transaction can begin as a quote, order or invoice. If the transaction starts as a quote, the quote can be transferred automatically to an order, and then to an invoice at the appropriate time. In this example, we will assume that a quote has been entered into Microsoft Dynamics GP and prepared for a customer. When the quote is prepared, the customer information, terms of the sale, item number, quantity, and price of the inventory items being purchased are all entered on the quote. The quote essentially looks like an order or invoice, with the exception that QUOTE is identified as the document type.	Quote is entered in the system. (A quote is not a transaction, as an economic event has not yet occurred.)
Quote transferred to an order	When the customer indicates they will place the order, the quote can be automatically transferred to an order without any rekeying of the information already entered on the quote. Additional relevant information such as the required ship date can be added to the order, if required, once the order is created.	The quote is transferred to an order. (An order is not a transaction, as an economic event has not yet occurred.)
Order is fulfilled/shipped	When the seller is ready to ship the goods, the order can be fulfilled. At that time, a picking ticket and packing slip can be automatically created to identify what items need to be taken out of the warehouse (as identified on the picking ticket) and shipped to a customer. The picking ticket and packing slip are created automatically from the order without reentering information. At this stage, if there is a shortage of any of the inventory items on the order, a backorder can automatically be generated to reflect that additional inventory items need to be shipped at a later date.	A picking ticket is automatically created from the order information. The picking ticket prompts warehouse personnel to pull items from inventory and prepare the package to be shipped to the customer. (Inventory is recorded as pulled from the warehouse and reserved for the customer.) A packing slip is generated to be placed in the customer's order so the customer can see what items were shipped.
Order invoiced	Once the items have shipped, an economic transaction has occurred. At this point, an invoice can be created by transferring the order to an invoice. The corresponding/related transactions are updated automatically as the invoice is processed by the system.	<ul style="list-style-type: none"> <li>• Sales transaction (invoice is recorded).</li> <li>• Inventory is reduced and cost of goods sold is charged.</li> <li>• If the sale is on account, the invoice is also recorded in the accounts receivable (A/R) module and the customer's A/R balance is updated in the A/R subsidiary ledger.</li> <li>• If cash was collected from the customer at the time of this sale, the bank reconciliation module is updated with the cash receipt.</li> <li>• The general ledger is updated with the sales transaction, inventory reduction, and the cost of sales transactions.</li> </ul>

**EXHIBIT 8-2** (Continued)

Transaction or Activity	Explanation	Transactions Generated
Subsequent cash collection	If the original invoice is for items sold on account, the following occurs when the customer's payment is received. The invoice that was recorded in the Accounts Receivable (A/R) subsidiary module will be selected and the open A/R is recorded as paid. Only the cash receipt has to be entered. The information for the invoice that is being collected can be selected without the rerecording of the information.	<ul style="list-style-type: none"> <li>• A cash receipt is recorded in the A/R module. The invoice being collected is selected from the open invoices for the customer.</li> <li>• The A/R subsidiary ledger is updated for the receipt.</li> <li>• The cash receipt is automatically recorded in the bank reconciliation module.</li> <li>• The general ledger is automatically updated to reflect the increase in cash and reduction in accounts receivable.</li> </ul>

This chapter also considers the following risks that may affect the revenue and cash collection processes:

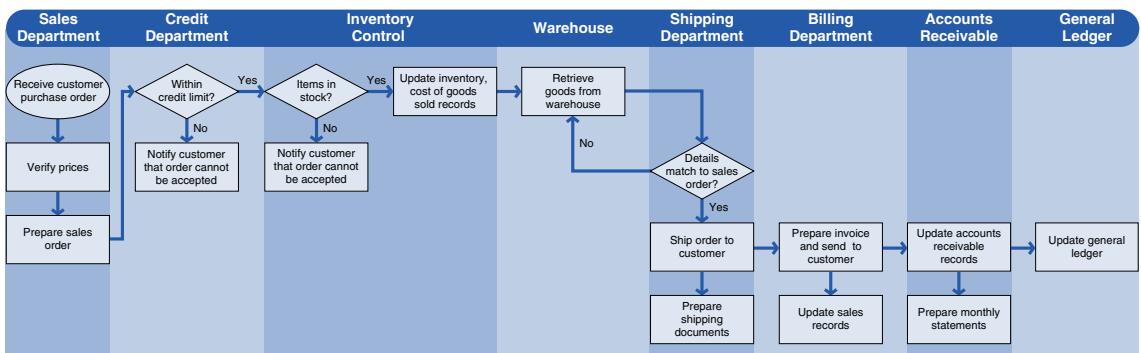
- Recorded transactions may not be valid or complete—that is, they may involve a fictitious customer, incorrect quantities or terms, or erroneous duplication.
- Transactions may be recorded in the wrong amount.
- Valid transactions may be omitted from the records.
- Transactions may be recorded in the wrong customer account.
- Transactions may not be recorded in a timely manner.
- Transactions may not be accumulated or transferred to the accounting records correctly.

The internal control procedures and IT controls that help lessen these risks are presented in exhibits following the discussion of each process category.

After describing the business processes for company-to-company transactions, the latter part of this chapter describes alternative business process models to generate and collect revenue. Examples include e-commerce or Web-based sales, EDI systems, and point of sale systems.

## Sales Processes (Study Objective 2)

The business process map in Exhibit 8-3 depicts the activities related to sales processes. Exhibit 8-4 shows a document flowchart for the sales process, and Exhibit 8-5 shows the sales process in a data flow diagram (DFD). The process begins when a buyer, or customer, places an order with the company. The form designating this order is referred to differently by the customer and seller. From the customer's perspective, this order is called a **purchase order** (because it is making a purchase), while the seller refers to this same order as a **sales order** (because it is making a sale). A customer's purchase order is the source document that conveys the details about the order. When a customer's purchase order is received, it must be entered into the seller's system as a sales order. Depending on the extent of computerization of the seller's system, this could be either manually entered or read automatically by the system.



**EXHIBIT 8-3** Sales Process Map

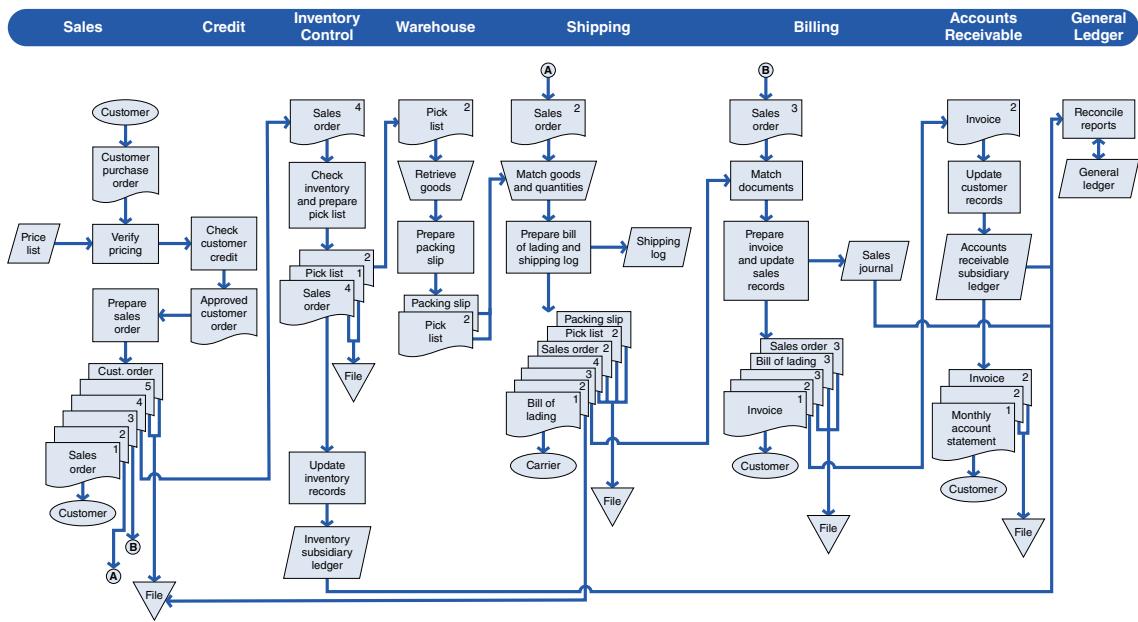


EXHIBIT 8-4 Document Flowchart of a Sales Process

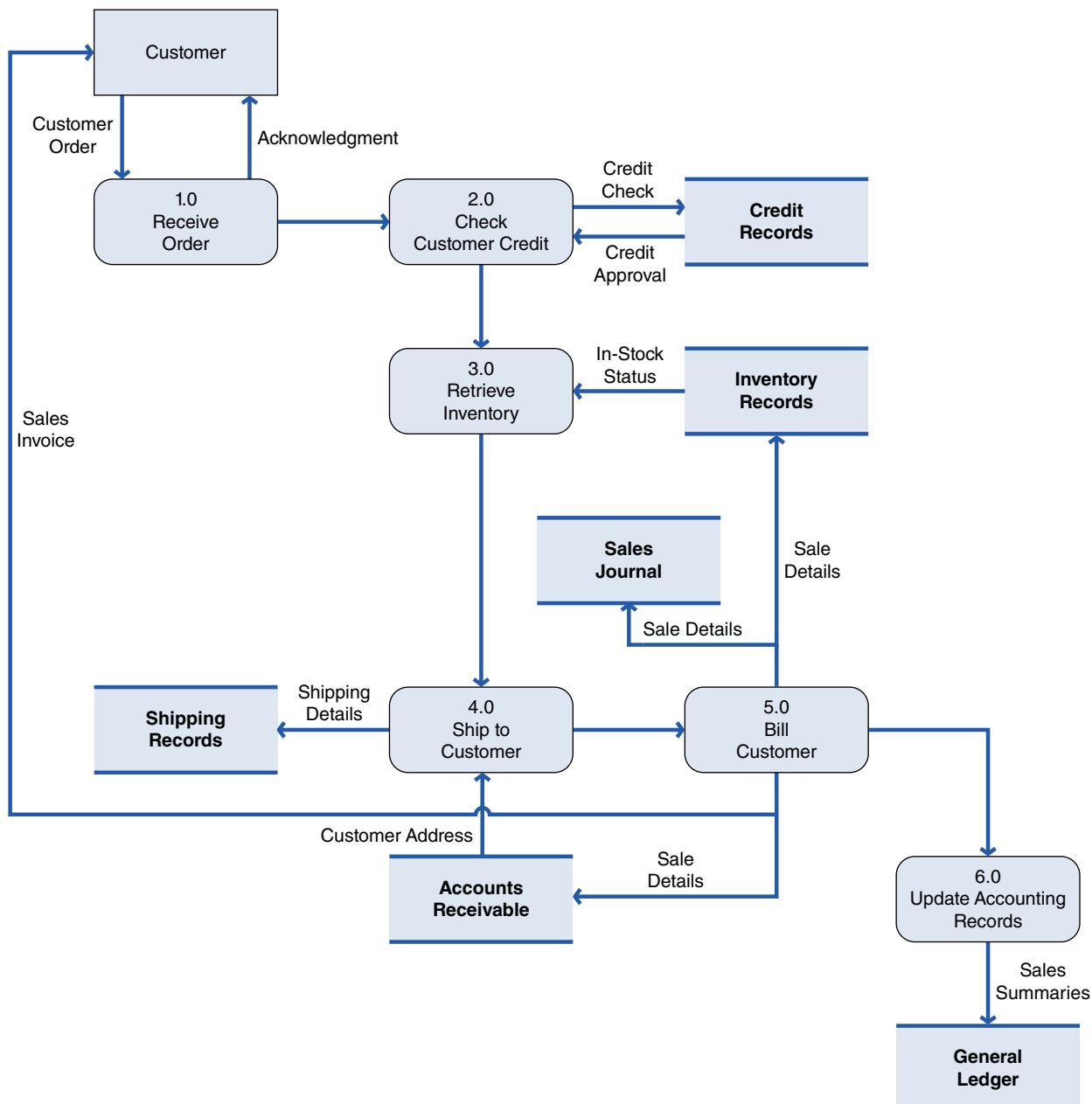
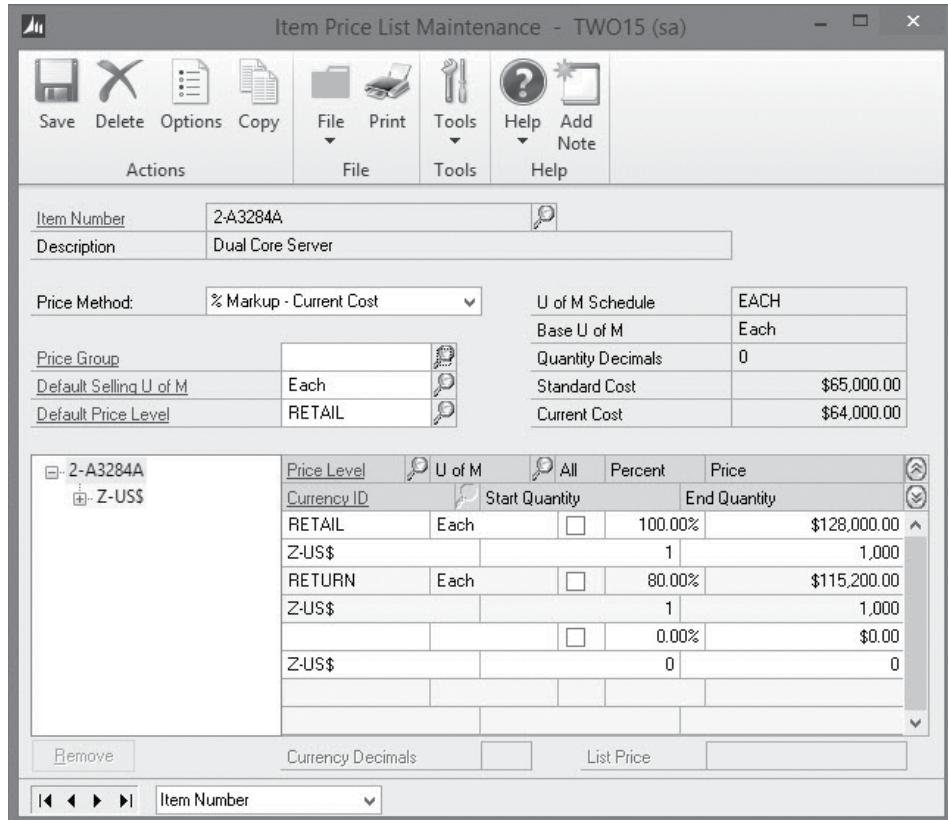


EXHIBIT 8-5 Sales Processes Data Flow Diagram

Sales orders are calculated on the basis of current selling prices of the items sold. The source of these prices is the price list. A **price list** is the entire set of preestablished and approved prices for each product. In most accounting software systems, selling prices are attached to each product in the company's inventory. Exhibit 8-6 shows a price list for a product in Microsoft Dynamics GP. Notice that the same item includes different prices for sales at retail and for a sale that is returned.

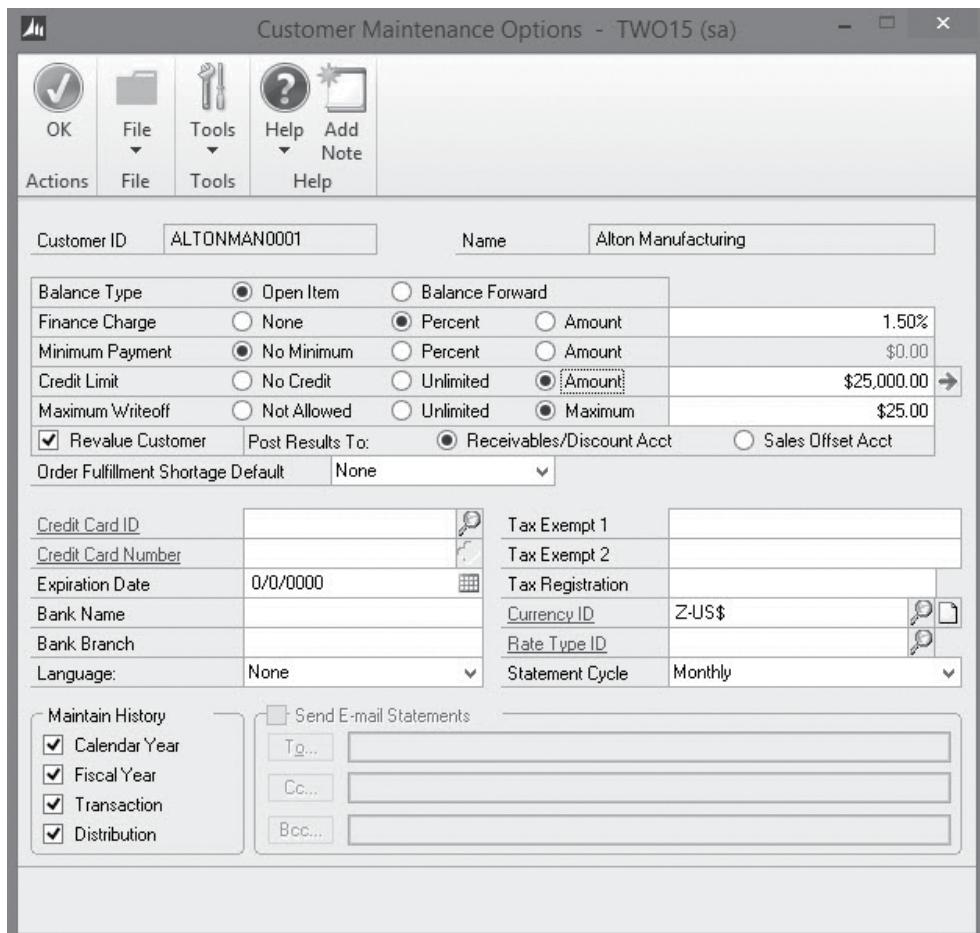
Once a sales order is in the system, the customer's credit status must be checked. For existing customers, a new sale on account should be approved only if it is



**EXHIBIT 8-6** List Price of a Product in Microsoft Dynamics GP

determined that the customer has not exceeded the established credit limit. The **credit limit** is the maximum dollar amount that a customer is allowed to carry as an accounts receivable balance. Each customer should have a preestablished credit limit, which designates the maximum amount of credit the company is willing to extend to that customer. Credit limits may be adjusted on the basis of payment history and the current amount of uncollected sales outstanding. If a sales order is for a new customer, the creditworthiness of that customer must be evaluated before the sale is approved. As new customers are entered into the system, a credit limit must be set for them. Exhibit 8-7 shows a credit limit of \$25,000 for a customer, Alton Manufacturing, as it would be established in Microsoft Dynamics GP accounting software. Whether it is a new or an existing customer, customer records must be examined to determine whether to accept the sale.

If the customer has not exceeded the credit limit, the order is accepted and the customer is notified. Again, it is important to determine whether this sale will push the customer over the established credit limit. In reference to Exhibit 8-7 outlines the setting of a customer's credit limit in Microsoft Dynamics GP. If this customer's account balance showed that it owed \$25,000 from a prior sale, the system would notify the user that the sales transaction exceeded the customer's credit limit. A credit manager would then be required to review the customer's account and decide whether to approve the transaction under these circumstances. If the credit manager approves the customer exceeding the credit limit, a password would be entered into Microsoft Dynamics GP to authorize this exception.



**EXHIBIT 8-7** Establishing a Credit Limit in Microsoft Dynamics GP

It is also important to check the inventory to determine whether the items ordered are in stock. In Microsoft Dynamics GP, when the order is entered, the system automatically checks to see if there is available inventory in stock. If there is a quantity shortage, several options will be presented to the user. The options are explained as follows:

- **Sell the balance** The quantity available in inventory for the site will be allocated (or assigned) to the order or invoice. For example, if you entered 3 for the quantity ordered on a sales order but have 2 available in inventory, the quantity ordered and the quantity invoiced for the item is set to 2, the balance that is available.
- **Override shortage** The shortage will be ignored and the entire quantity will be sold on the order or invoice. The quantity available in inventory will then be negative. This option exists because a company may have physically received inventory or plans to receive the inventory items shortly but they have not yet been received (or entered) in Microsoft Dynamics GP. This allows you to process the order or invoice for the amount that actually will be shipped to the customer.

- **Back order all** The entire quantity will appear in the Quantity to Back Order field and the quantity sold will be zero. This option is selected when customers prefer to not receive partial shipments but instead prefer to receive all items at one time. In Microsoft Dynamics GP, when this option is selected, a back order document can automatically be created to transfer the unfilled items to a back order.
- **Back order balance** This option is similar to the *Back Order All* functionality, except that the quantity shortage will appear in the Quantity to Back Order field and the quantity the seller has available in inventory will be sold. In this case, a back order document can also be automatically created to transfer the unfilled items to a back order.
- **Cancel all** The entire quantity for the item will be canceled. Nothing will be backordered and nothing would be sold for this line item.
- **Cancel balance** The quantity shortage amount will be canceled and the quantity the company has available will be sold. For example, if you entered 3 for the quantity ordered on a sales order but have 2 available in inventory, the quantity ordered remains at 3, the quantity ordered/invoiced is set to 2, and the quantity canceled is set to 1.
- **Distribute** The distribute option allows you to select substitute inventory items and sell items from another warehouse or inventory site, if items are available in other locations.

The inventory quantity checking and presenting of different options, including automatic creation of backorders when placing an order, are examples of the robust functionality of Microsoft Dynamics GP. This type of functionality is what makes a full-featured accounting/ERP system more efficient than simpler systems.

If the items ordered are in stock, a **picking** ticket is prepared to document the quantities and descriptions of items ordered. Items on the picking ticket should be pulled from the warehouse shelves and packaged for the customer. A **packing slip** prepared by warehouse personnel lists all items included in a shipment. For a company-to-company sale, the goods are typically shipped by a common carrier such as a trucking company or rail carrier. The terms of the agreement between the company and the carrier are documented in a **bill of lading**. Finally, inventory records are updated to reflect the decrease in inventory, and a shipping log is prepared. A **shipping log** is a chronological listing of shipments that allows management to track the status of sales and to answer customer inquiries regarding order status.

Once shipment has occurred, customers should be billed for the sale. A sales invoice is prepared and sent to the customer. The **sales invoice** (typically referred to as a **bill**) provides details of the sale and requests payment. The timing of the billing process is important. Since customers will be unhappy if they are billed before they receive the items purchased, billing should not take place prior to shipment. However, it is important to avoid waiting very long after shipping to bill the customer, since that will delay the collection of cash. When customers are billed, accounts receivable records should be updated to reflect the increased amount owed by the customer. Also, the sale should be recorded in a sales journal so that the amount will be included in revenue during the current fiscal period. A **sales journal** is a special journal that records sales transactions. Periodically, the sales amounts in a sales journal are posted to the general ledger. Many companies also prepare customer account statements on a regular basis to accumulate and summarize all the transactions that have taken place between the customer

and the company within the period. In Microsoft Dynamics GP, once a sales transaction is entered and posted, the sales journal, the general ledger, and customer's statements can be automatically generated without having to enter any additional transactional data.

## Risks and Controls in Sales Processes (Study Objective 2, Continued)

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Management should strive to achieve a system of internal controls, using both manual and programmed procedures to minimize the chance of error or fraud. Unfortunately, the existence of good internal controls does not necessarily lead to financial success in terms of a company's ability to make money; internal controls do not ensure high sales and profits. However, effective and efficient internal controls may relieve managers of valuable time that might otherwise be spent on accounting or operational problems, thus making it possible for them to devote more attention to revenue growth and cost reduction.

In terms of the five internal control activities described in Chapter 3, following are common procedures associated with the sales process.

### **Authorization of Transactions**

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Specific individuals within the company should have authoritative responsibility for establishing sales prices, payment terms, credit limits, and guidelines for accepting new customers. Only designated employees should perform these authorization functions. These specific people should have a recognized method of communicating when sales transactions have been authorized. For example, approval may be indicated by a signature or initials on a sales order or shipping document. Such a signature indicates that a designated employee has verified that the sale is to an accepted customer, the customer's credit has been approved (i.e., it has not exceeded its credit limit), and the price is correct. Once a sales order has been filled, established procedures should be in place to verify that the shipment represents items ordered. Thus, proper sales authorization control includes obtaining approval prior to processing an order and again before the order is shipped.

### **Segregation of Duties**

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Within the sales process, the accounting duties related to order entry, credit approval, shipping, billing, information systems, and general accounting need to be separated in order to meet the objectives of internal controls. Recall that individuals with authoritative responsibilities should not also have access to the related records or custody of the related assets. In addition to the authorization responsibilities just described, certain information systems duties are included in the sales process, such as data entry, programming, IT operations, and security. The recording function includes the preparation of sales orders, shipping logs, and sales invoices, as well as general accounting reports such as the sales journal, accounts receivable subsidiary records and customer statements, the general ledger, and financial statements.

Finally, the custody function includes product handling and preparing goods for shipment.

Ideally, good internal controls within the sales process require that accounting for inventory is completely separate from product handling. Also, any person who maintains detailed accounts receivable records should not also be responsible for maintaining the general ledger or handling cash.

## **Adequate Records and Documents**

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Those responsible for recording sales should ensure that supporting documentation is retained and organized. As records are prepared, they should be compared with supporting information to make sure they are accurate and to prevent duplication. Sales orders, shipping logs, invoices, customer account statements, and other related documents should be saved and filed. Record files are often organized by customer name or by the numerical sequence of the documents. When companies account for the numerical sequence of their documents, it is possible to review the list to determine whether omissions have occurred. In addition, if accounting personnel compare the different documents that make up each transaction, they can find out whether the transaction has been carried out properly. For example, when the customer order, packing list, shipping records, and invoice for a single transaction are properly retained, personnel can verify that the records reflect the correct quantities, prices, customer, timing, etc. Maintaining good records also facilitates the performance of independent checks and reconciliations, which will be discussed later.

It is important to note that many companies are deciding to minimize their paper documents. This requires that company personnel, as well as their auditors, be knowledgeable about how to access these documents and transactions electronically.

As an example, an existing Microsoft Dynamics GP company uses a document management system to enter and store all its documents. Sales orders from customers are received electronically through the company's EDI system or an electronic copy is scanned upon receipt. The documents are stored electronically. When a sales invoice is generated, it is not printed, and is transferred to the customer electronically through email or an EDI connection. The matching of the customer's purchase order with the invoice and packing slip is also done electronically within the Microsoft Dynamics GP system. Finally, payments are made to a lock-box. The company retrieves transaction data from the lock box electronically, and the Microsoft Dynamics GP system automatically matches the customer's payment with the outstanding sales invoice. The document management system saves time, money and storage, yet it creates new challenges for company personnel and auditors who can no longer go to a file cabinet to retrieve the matched purchase order, invoice, and shipping document.

## **Security of Assets and Documents**

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A company's inventory of products should be protected by physical controls in the warehouse. Some examples of physical controls are surveillance cameras, security guards, and alarm systems. Likewise, data files, production programs, and accounting records should each be protected from unauthorized access. Passwords, backup

copies, and physical controls (such as locked file cabinets) can protect a company's records.

The use of electronic file storage and storage of information in the cloud is on the increase at most companies. Companies must establish new controls now because they cannot simply lock up and secure their records. More recently, large companies such as Target and Home Depot have found that securing their assets and documents is getting increasingly difficult as cyber hackers were able to access company records and secure confidential company and customer information. These types of data security issues are addressed later in this chapter in Study Objective 6.

## Independent Checks and Reconciliation

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In order to promote accountability for the sales process, companies should implement procedures whereby independent checks and record reconciliations are performed on a regular basis. These procedures are most effective when they are conducted by someone independent of the related authority, recording, and custody functions. Within the sales process, the most common types of independent checks include the verification of information in the sales journal and on sales invoices, the reconciliation of accounts receivable detail with invoices and with the general ledger, and the reconciliation of inventory records with actual (counted) quantities of products on hand.

## Cost-Benefit Considerations

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Companies tend to implement internal controls only if they view the benefits of the control as being greater than the costs of carrying out the task. The extent to which a company implements controls depends upon many factors, including the type of products sold, business or industry factors, and the overall control consciousness of management. Following are some examples of characteristics indicating that a company may be more risky with respect to its sales processes:

- Frequent changes are made to sales prices or customers.
- The pricing structure is complex or based on estimates.
- A large volume of transactions is carried out.
- The company depends on a single or very few key customers.
- Shipments are made by consignees or are under other arrangements not controlled directly by the company.
- The product mix is difficult to differentiate.
- Shipping and/or record keeping are performed at multiple locations.

When any of these types of conditions exist, management should be especially mindful of the internal controls that are in place to reduce the risk of misstated revenues.

As mentioned earlier, the effectiveness of internal controls is measured by their ability to prevent or detect errors and fraud. In determining the likelihood of errors or fraud, accountants must consider the risks that exist within the company's business processes. Exhibit 8-8 presents a summary of the relationship between controls and risks in the revenue processes. This exhibit does not include all the possible controls and risks surrounding the revenue process, but presents controls used to correct some common problems that may be encountered.

**EXHIBIT 8-8****Sales Process Controls and Risks**

<b>Control</b>	<b>Minimizes the Related Risk of:</b>
<b>Authorization:</b> Approval of sales order prior to shipment, including establishing sales prices, payment terms, and credit limits Approval of shipment to proper customer	Invalid customers, over-extended customers, unapproved pricing, or incorrect amounts Fictitious customers or wrong customers
<b>Segregation of Duties:</b> Separation of responsibility for authorization of new customers from custody of inventory Separation of custody of inventory from accounts receivable record keeping Separation of duties related to order entry, credit approval, shipping, billing, information systems, and general accounting	Fictitious customers Invalid sales or omitted transactions Invalid transactions, incorrect amounts or accounts, or omitted transactions
<b>Records and Documents:</b> Preparation of packing lists and shipping records on prenumbered forms Preparation of shipping log and packing list only when products have actually been shipped Initiation of the billing function and updating of the sales journal, inventory records, and customer accounts receivable records only when products have actually been shipped Preparation of customer account statements Matching of key information on related documents (customers, dates, inventory quantities and descriptions, prices, and account codes) prior to shipment	Omitted transactions Invalid transactions, omitted transactions, or timing issues Invalid transactions, omitted transactions, or timing issues Wrong customers or incorrect amounts Invalid transactions, incorrect amounts or accounts, timing issues, or duplicate transactions
<b>Security:</b> Physical controls in inventory and shipping areas IT controls over computer records and physical controls in records storage areas	Invalid sales or omitted transactions Invalid sales, omitted transactions, incorrect amounts or accounts, timing issues, accumulation issues, or duplicate transactions
<b>Independent Checks and Reconciliations:</b> Comparison of shipping records with sales journal and invoices Verification of recorded descriptions, dates, quantities, authorized prices, and mathematical accuracy Mathematical verification of sales journal and comparison to accounts receivable subsidiary ledger and general ledger posting Review of accounts receivable records and comparison with sales invoices	Omitted transactions, incorrect amounts, wrong customers, or timing issues Incorrect amounts or timing issues Problems with the accumulation of transactions and transfer to the general ledger and financial statements Invalid customers, wrong customers, omitted transactions, incorrect amounts, timing issues, or problems with the accumulation of transactions

## Sales Return Processes (Study Objective 3)

It is nearly always the case that a small portion of sales made to customers will ultimately be returned to the seller. A company must have procedures in place for receiving returned goods, crediting customer accounts, and placing the items back in inventory. Exhibit 8-9 is a process map of a sample sales return process. Exhibit 8-10 shows a document flowchart for a sales return process, and Exhibit 8-11 shows a data flow diagram (DFD) of a sales return process.

When customers return goods, the goods are handled by the receiving department. Returned goods are typically accompanied by documentation from the customer, such as a bill of lading and packing slip. The goods should be inspected for possible damage, and reference to the original sales invoice should confirm the historical sale of the goods. A **receiving log** is prepared that lists the chronological sequence of all returned items, and a receiving report records the quantity received. A **receiving report** is a source document completed by personnel in the company's receiving area that documents the quantity and condition of items received. If the returned goods are accepted, they are placed back in the proper location in the warehouse and the inventory records are updated to reflect the increase in inventory.

A **credit memorandum** is prepared to document the return and to adjust the amount of the customer's credit status. A journal of credit memos should be maintained in order to provide a complete listing of all credits issued. Reference to the original sales invoice and approved price list will assure that the credit is issued for the correct amount. Sometimes, a refund check may be issued to the customer. In other cases, the customer's accounts receivable balance will be adjusted for the returned items.

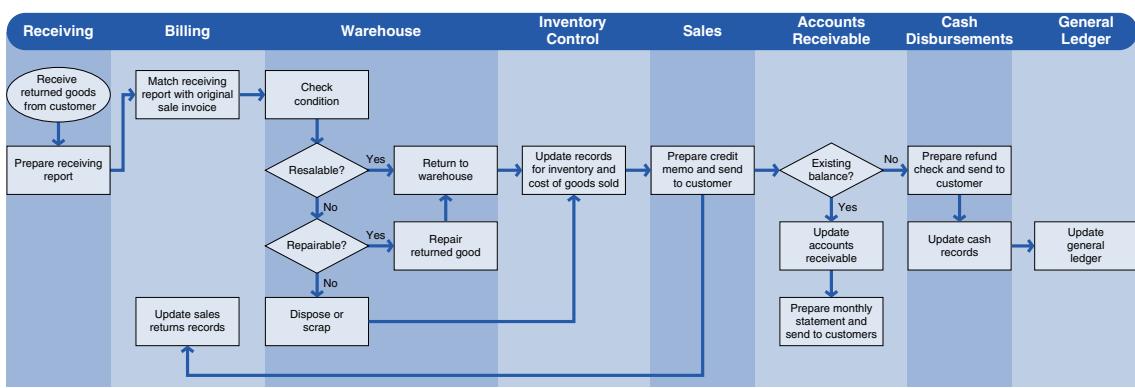
In Microsoft Dynamics GP, the receiving report and subsequent credit memo can be created automatically by retrieving the original invoice in the systems and noting the items that were returned. When the return is processed, the return of goods to inventory (or recording them as damaged) is processed, the credit memo to sales and to the customer's accounts receivable record is processed, and corresponding entries in the general ledger are all updated automatically by simply selecting the original transaction and processing the return.

## Risks and Controls in the Sales Return Processes (Study Objective 3, Continued)

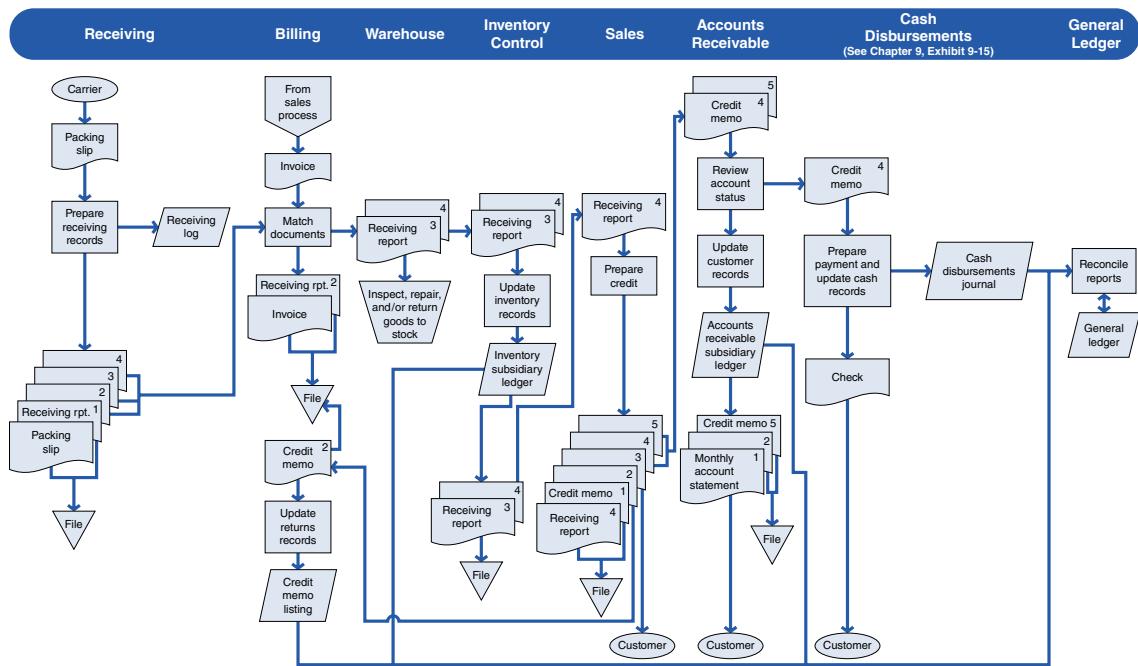
In terms of the five internal control activities, the following specific controls should be implemented over the sales returns process:

### Authorization of Transactions

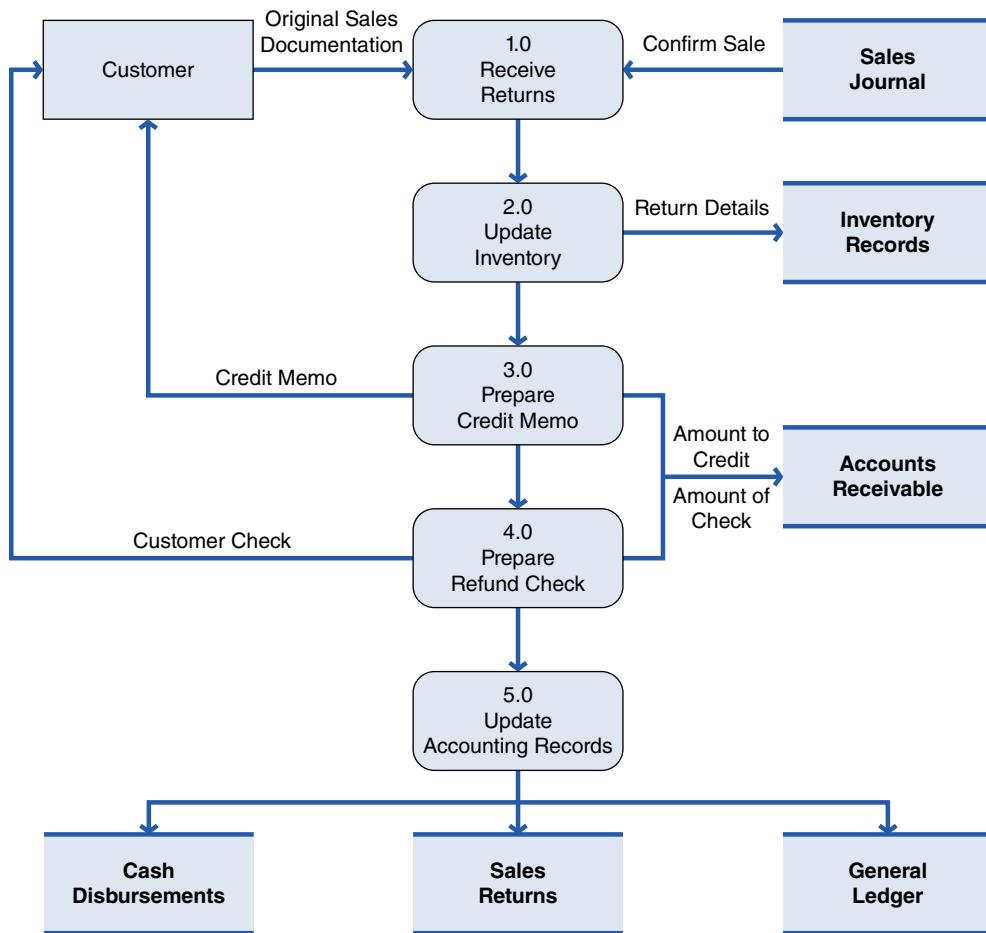
Certain designated individuals within the company should be assigned the authority to develop sales return policies, authorize sales returns, and approve credit memos. Others within the organization should recognize these specific individuals and should not process returns if they have not been approved by a designated person.



**EXHIBIT 8-9** Sales Return Process Map



**EXHIBIT 8-10** Document Flowchart of a Sales Return Process



**EXHIBIT 8-11** Sales Return Processes Data Flow Diagram

## Segregation of Duties

For sales returns, an effective system of internal controls segregates individuals with authoritative duties (such as those already discussed) from those responsible for recording (initiation of the credit memo and preparation of the credit memo journal) and custody (receiving the returned products and transferring them to the proper area in the warehouse). Ideally, anyone who performs a credit memo activity should not also be responsible for data entry, credit approval, shipping and handling inventory, billing, information systems, or general accounting.

## Adequate Records and Documents

Internal controls over sales return records are similar to those for the sales process, whereby the reports documenting movement of the goods and the related notification to the customer should be issued sequentially, organized, and retained. In addition, it is important to match receiving reports for returns with the respective credit memos in order to ensure that the company issues credit for all returns and for the proper amounts. Returns are also matched with the original sales invoices in order

to verify quantities, prices, and item descriptions. Credits for returned products should also be included in customers' account statements.

## Security of Assets and Documents

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Data files, production programs, and accounts receivable records should be restricted to those who are specifically authorized to approve or record the related transactions. Custody of the related assets should be controlled and limited to those specifically designated to handle the receipts or move the returned products. Security over returns has requirements similar to security for the sales process.

## Independent Checks and Reconciliation

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Some specific internal control procedures to be performed to achieve accountability for the sales returns process are presented in Exhibit 8-12. These functions should be performed by someone other than the employee(s) responsible for the regular authorization, recording, and custody of transactions and assets within this process. These controls are similar to the ones performed in the sales process, except that the credit memo and receiving report are the new documents resulting from sales return transactions.

## Cost-Benefit Considerations

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Some circumstances which may exist within a company's sales returns processes that indicate a high level of risk are presented here:

1. Quantities of products returned are often difficult to determine.
2. There is a high volume of credit memo activity.
3. Product prices change frequently, or the pricing structure is otherwise complex.
4. Returns are received at various locations, or the issuance of credit memos may occur at different locations.
5. Returns are received by consignees or under other arrangements not directly controlled by the company.

A company should always consider the risks of its system to determine whether the costs of implementing a control procedure are worthwhile in terms of the benefits realized from that control. The higher the risks, the more controls are generally required, and the more costly its accounting system may become. Exhibit 8-12 summarizes some common control procedures for the sales returns process and the related risks that are addressed through their implementation.

In addition to sales returns, companies may sometimes issue sales allowances as an accommodation to customers who receive defective merchandise, late shipments, or otherwise undesirable products. A **sales allowance** is a credit to the customer account made to compensate the customer for agreeing to keep such merchandise. Sales allowances and returns are similar; however, the return of goods typically does not occur in a sales allowance transaction. Therefore, documentation in a receiving log and the issuance of a receiving report are not necessary. Due to this reduced level of supporting records, many companies require thorough documentation for sales allowances, especially with respect to authorizing the transactions, segregating related duties, and matching original sale documents to ensure proper recording.

**EXHIBIT 8-12****Sales Return Controls and Risks**

<b>Control</b>	<b>Minimizes the Related Risk of:</b>
<b>Authorization:</b> Approval of sales return prior to issuing credit memo	Invalid customers, invalid returns, unapproved pricing, or incorrect amounts
<b>Segregation of Duties:</b> Separation of responsibility for authorization of customers returns from custody of inventory Separation of custody of inventory from accounts receivable record keeping Separation of duties related to credit memo preparation, credit approval, receiving, information systems, and general accounting	Fictitious customers or invalid returns Invalid returns or omitted transactions Invalid transactions, incorrect amounts or accounts, or omitted transactions
<b>Records and Documents:</b> Preparation of receiving reports and credit memos on prenumbered forms Preparation of receiving report and receiving log only when products have actually been received Preparation of credit memos and credit memo journal only when products have actually been received Preparation of customer account statements Matching of key information on related documents (customers, dates, inventory quantities and descriptions, prices, and account codes) prior to issuing credit	Omitted transactions Invalid transactions, omitted transactions, or timing issues Invalid transactions, omitted transactions, or timing issues Wrong customers or incorrect amounts Invalid transactions, incorrect amounts or accounts, timing issues, or duplicate transactions
<b>Security:</b> Physical controls in inventory and receiving areas IT controls over computer records and physical controls in records storage areas	Invalid returns or omitted transactions Invalid returns, omitted transactions, incorrect amounts or accounts, timing issues, accumulation issues, or duplicate transactions
<b>Independent Checks and Reconciliations:</b> Comparison of receiving log with credit memo listing and credit memos Verification of recorded descriptions, quantities, dates, prices, and mathematical accuracy Mathematical verification of credit memo listing and comparison to accounts receivable subsidiary ledger and general ledger posting	Omitted transactions, incorrect amounts, wrong customers, or timing issues Incorrect amounts or timing issues Problems with the accumulation of transactions and transfer to the general ledger and financial statements

## Cash Collection Processes (Study Objective 4)

Company-to-company sales are typically made on account, and a time span is given for the customer to pay. An example of the credit terms of sale would be net 30. This means the customer has 30 days after the invoice date to pay. Therefore, the timing

of a cash collection is such that there will be some number of days between invoice date and collection of the cash. The actual number of days depends on the credit terms of the sale and the diligence of the customer in paying on time. When the customer sends a check, the company must have processes in place to properly handle the receipt. The appropriate employees should match the check with the related sales invoice, deposit the funds in a timely manner, and update customer and cash records. Exhibit 8-13 is a process map of a cash collection process. Exhibit 8-14 shows a document flowchart of cash collection processes, and Exhibit 8-15 shows the cash collection processes in a data flow diagram (DFD).

Collections from customers typically include a **remittance advice**, which is the documentation accompanying payment that identifies the customer account number and invoice to which the payment applies. An example of a remittance advice can be seen on a paper-based credit card statement. Part of the statement is meant to be detached and mailed with the payment. This remittance that is returned enables the company to apply payment to the correct account. In the case of company-to-company sales, a remittance advice identifies the invoice and customer account number to which the payment should be applied. Exhibit 8-16 shows the application of a payment to the appropriate invoice. In Exhibit 8-16, a check mark is placed in the SVC3003 invoice box to apply the payment to that invoice.

For each check received, the customer's payment must be matched with the appropriate invoice or invoices. A list of all cash collections is prepared, and the checks received are recorded in the cash receipts journal. A **cash receipts journal** is a special journal that records all cash collections. The listing of collections is to be forwarded, along with the payments received, to a cashier who prepares the bank deposit. The payments are deposited in the company account, and customer records and cash records must be updated.

At the end of the month, an updated statement of account will be prepared and sent to the customer. This statement reflects the invoices that have been paid and the decrease in the customer's balance owed as a result of these collections. Also, the bank will provide the company with a monthly statement so that the company's cash records can be reconciled to the bank records.

## Risks and Controls in the Cash Collection Processes (Study Objective 4, Continued)

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We now turn our attention to specific internal controls and related risks associated with cash collections from sales revenues. Some internal controls present within a cash receipts process are as follows.

### Authorization of Transactions

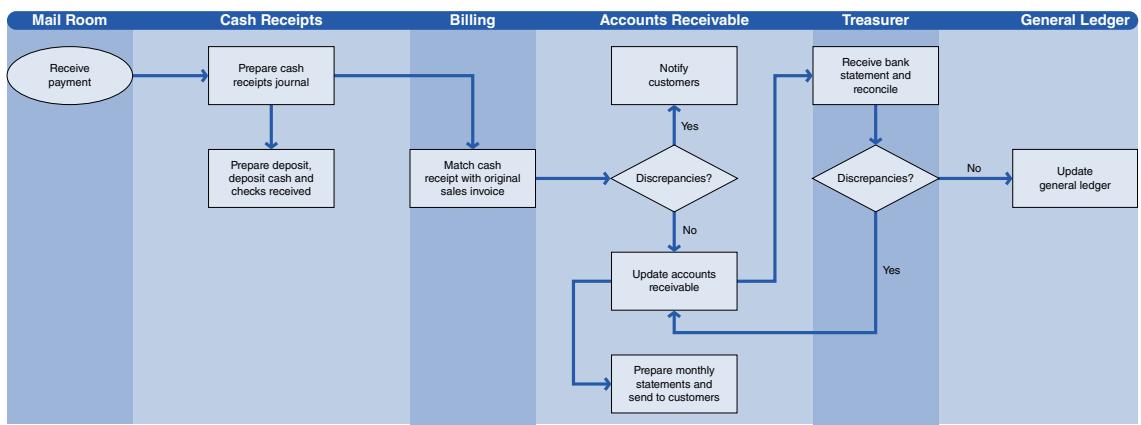
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Appropriate individuals should be assigned responsibility for opening and closing all bank accounts and approving bank deposits or electronic transfers of funds. This ensures that records are updated only for authorized transactions.

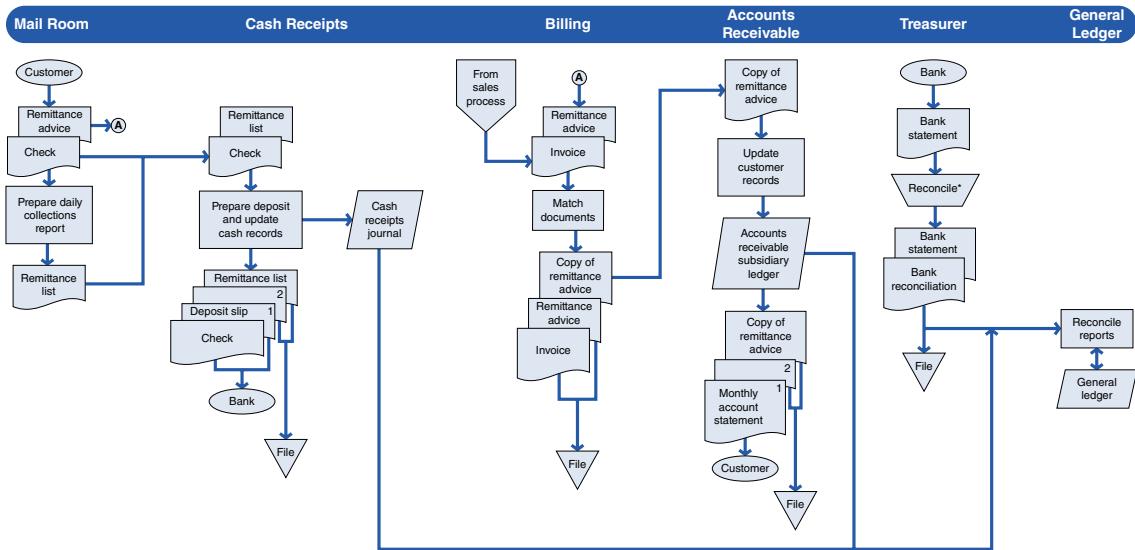
### Segregation of Duties

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As you know, authorization duties (described previously) need to be kept separate from recording and custody duties. Recording responsibilities include maintaining a cash receipts journal, updating accounts receivable records for individual



**EXHIBIT 8-13** Cash Receipts Process Map



**EXHIBIT 8-14** Document Flowchart of a Cash Receipts Process

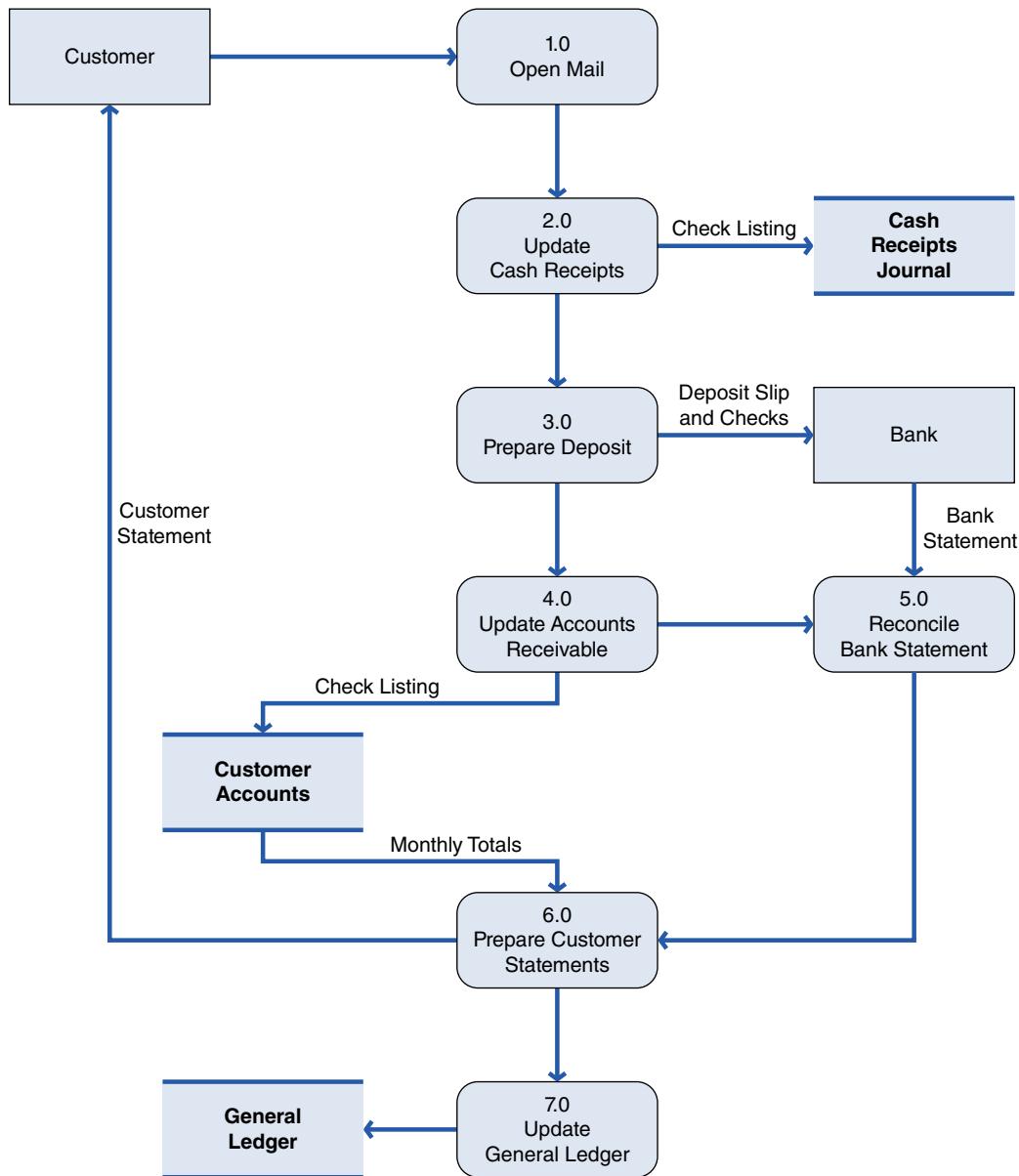
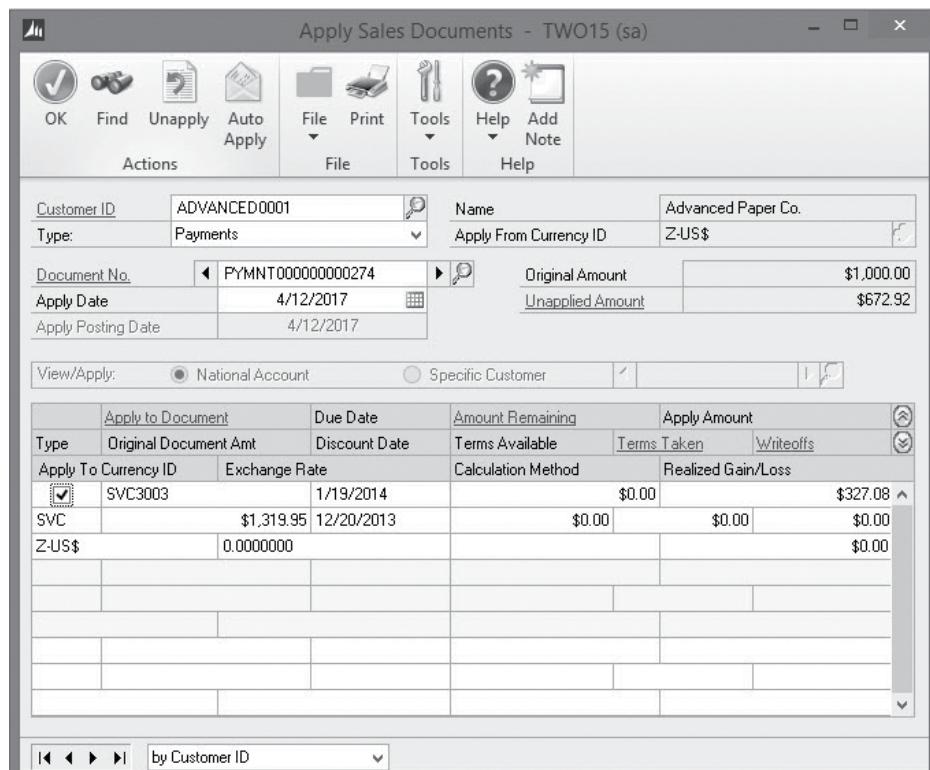


EXHIBIT 8-15 Cash Receipts Processes Data Flow Diagram

customers, and posting accounts receivable subsidiary ledger totals to the general ledger. Custody responsibilities include opening mail, preparing a list of collections, handling receipts of currency and checks, and preparing bank deposits. At a minimum, those who handle cash should not have the authority to access the company's accounting records or reconcile the bank account. In addition, those with responsibility for information systems programming or control should not also have access to the cash or accounting records. Furthermore, anyone responsible for maintaining detailed records for daily cash receipts or accounts receivable subsidiary accounts should not also have access to the general ledger.



**EXHIBIT 8-16** Applying a Payment to an Invoice in Microsoft Dynamics GP

## Adequate Records and Documents

Cash receipts listings should be prepared on a daily basis, so the daily activity of collections should be reconciled to supporting documentation from the bank deposit. Bank deposit receipts should be retained and filed chronologically, and regular, timely bank reconciliations should be prepared and retained. Detailed customer accounts should also be maintained and reconciled with customer statements regularly.

## Security of Assets and Documents

Access to cash collections needs to be limited to those who are expressly authorized to handle cash. Controls over cash collections are likely the most important control procedure, because cash is the asset most susceptible to theft or misappropriation. Because of the universal appeal of cash and the difficulty of proving ownership, a company must take extra precautions to protect this asset. Cash collections should be deposited in the bank in a timely manner to prevent the risk of theft. Also, related computerized data files and programs must be protected from unauthorized use.

## Independent Checks and Reconciliation

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A physical count of cash needs to be conducted from time to time in order to compare actual cash on hand with the amounts in the accounting records. To maximize effectiveness, cash counts should occur on a surprise basis and be conducted by someone not otherwise responsible for any cash receipts functions. Daily bank deposits should also be compared with the detail on the related remittance advice and in the cash receipts journal.

In addition, it is important that companies regularly reconcile their cash accounts with the respective bank statements. Like cash counting procedures, a bank reconciliation should be performed by someone who has no other responsibility for handling cash or accounting for cash transactions. The bank statements should be received directly by the person who prepares the reconciliation, to make sure it is not altered by other company personnel. Among the bank reconciliation tasks are procedures to ensure that deposits are examined for proper dates and that all reconciling items are reviewed and explained.

## Cost-Benefit Considerations

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In addition to the need for tight controls over cash due to its susceptibility to theft, the following circumstances may indicate risks related to cash collections:

1. High volume of cash collections
2. Decentralized cash collections
3. Lack of consistency in the volume or source of collections
4. Presence of cash collections denominated in foreign currencies

Companies often find that maximum internal controls are beneficial with respect to cash collections, due to the great temptation that exists for those in a position to steal cash and the high (and unrecoverable) cost of errors. Even a small company will tend to find ways to segregate duties and implement a variety of internal controls in order to protect its valuable cash. Exhibit 8-17 presents typical procedures used to control cash receipts and the risks that they help to reduce.

In wrapping up the discussion of revenue-related accounting processes, it is important to mention an additional issue that may impact the accounting records related to cash collections for sales transactions. Namely, most companies have occasional problems with customers who fail to pay, leading to the write-off of accounts receivable and the recording of an allowance for uncollectible accounts. Companies should ensure that proper controls are in place to reduce risks related to transactions involving uncollectible accounts. Specifically, responsibilities should be segregated such that no one has the opportunity to write off customer accounts as a cover-up for stolen cash or inventory. In addition, since determining the amount of an allowance for uncollectible accounts is very subjective, it is important that thorough guidelines be established for this process. In order to properly monitor customer payments and determine the amount of an allowance for uncollectible accounts, an accounts receivable aging report should be generated to analyze all customer balances and the respective lengths of time that have elapsed since payments were due.

**EXHIBIT 8-17****Cash Receipts Controls and Risks**

<b>Control</b>	<b>Minimizes the Related Risk of:</b>
<b>Authorization:</b>	
Designated person opens/closes bank accounts	Invalid bank account or omitted transactions
Approval of cash receipt prior to bank deposit	Invalid bank account or incorrect amounts
<b>Segregation of Duties:</b>	
Separation of custody of cash from the responsibility for reconciling the bank accounts	Invalid cash receipts, incorrect amounts, omitted transactions
Separation of custody of cash from accounts receivable record keeping	Invalid cash receipts or omitted transactions
Separation of duties related to cash receipts journal preparation, credit approval, inventory handling, information systems, and general accounting	Invalid transactions, incorrect amounts or accounts, or omitted transactions
<b>Records and Documents:</b>	
Preparation of deposit slips on prenumbered forms	Omitted transactions
Preparation of cash receipts journal and accounts receivable records only when cash has actually been received	Invalid transactions, omitted transactions, or timing issues
Preparation of customer account statements	Wrong customers or incorrect amounts
Matching of key information on related documents (customers, dates, prices, and account codes) prior to reducing customer accounts	Invalid transactions, wrong customer, incorrect amounts or accounts, timing issues, or duplicate transactions
<b>Security:</b>	
Physical controls in areas where cash is received	Lost or stolen cash receipts, invalid receipts, or omitted transactions
IT controls over computer records and physical controls in records storage areas	Invalid receipts, omitted transactions, incorrect amounts or accounts, timing issues, accumulation issues, or duplicate transactions
Cash receipts deposited in bank on a daily basis	Lost or stolen cash receipts
<b>Independent Checks and Reconciliations:</b>	
Cash counts and comparison of daily deposit with cash receipts journal	Invalid receipts, lost or stolen cash, omitted transactions, incorrect amounts or accounts, or timing issues
Preparation of bank reconciliation	Invalid receipts, omitted transactions, incorrect amounts or accounts, timing issues, or lost or stolen cash
Matching of remittance advice with cash receipts journal	Invalid receipts, omitted transactions, incorrect amounts, timing issues, or lost or stolen cash
Mathematical verification of cash receipts journal and comparison with accounts receivable subsidiary ledger and general ledger posting	Problems with the accumulation of transactions and transfer to the general ledger and financial statements

## IT-Enabled Systems of Revenue and Cash Collection Processes (Study Objective 5)

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The previous section described the processes related to revenue transactions. In addition to the activities that take place within those processes, there must also be accounting systems to record, summarize, and report the results of the related transactions. In the majority of organizations, the accounting information system consists of hardware and software within IT systems. However, there is such great variety in accounting software systems in terms of their size, complexity, and extent of automation that it is impossible to describe all of the various kinds of systems. In general, as complexity and automation increase, there are fewer manual processes and more computerized processes. This is also usually true regarding size: Larger IT systems generally have fewer manual processes and more computerized processes. More computerized processes means there would be a greater need for the type of IT controls described in Chapter 4, and it generally means that there are fewer paper documents within the process. As a simple illustration, consider two kinds of restaurants you might visit. A small, family-owned restaurant might not use computers at all, and the server may simply write your order on a pad. On the other hand, a large restaurant chain might have a system completely based on computers, where servers enter orders on the touch screen of a handheld device that transmits the order to the kitchen. The family-owned restaurant would have no need for computer controls, while the restaurant chain would need many computer-based controls.

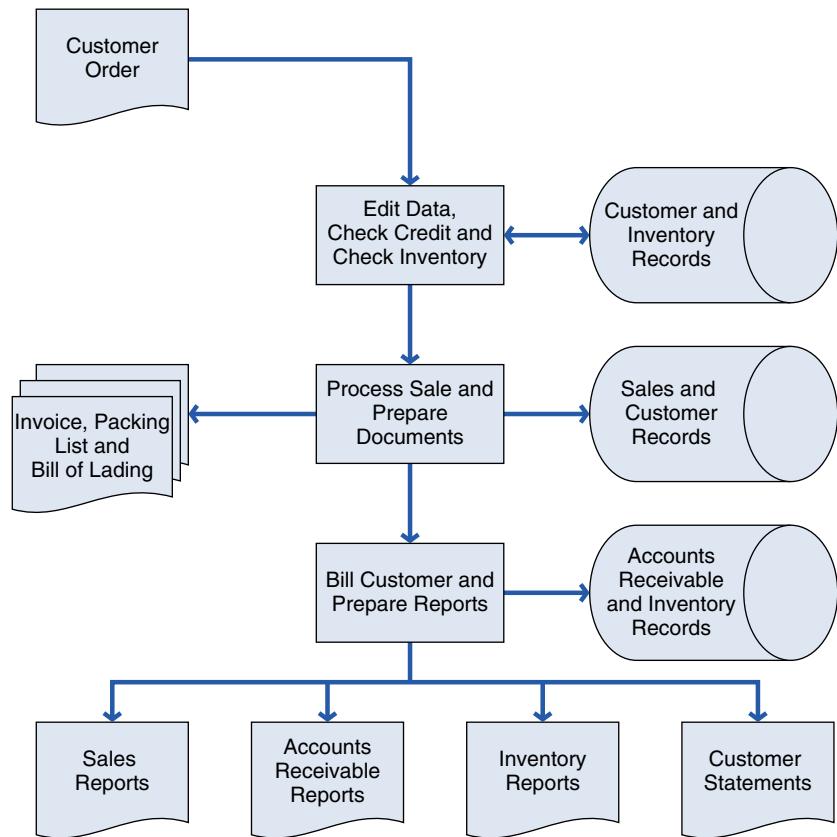
The following section provides a description of a typical revenue processing system and some specialized IT systems:

Exhibit 8-18 is a system flowchart of a generic version of revenue system with some paper documents. The system flowchart documents a system for company-to-company sales. When the customer's order is received, an employee enters it into the IT system by keying the order into an input screen. With online data files, the input data can be edited, the customer's credit status can be reviewed, and inventory levels can be checked. If the order does not exceed the customer's credit limit and the inventory items are available, the order can be processed.

Order processing updates the sales records and the customer's account records. The appropriate documents needed to fill and ship the order may be prepared. These documents usually include a pick list, a packing slip, an invoice, and a bill of lading. The pick list is used by warehouse personnel to select items from the warehouse shelves. The packing slip is used by shipping personnel to ensure the correct items are packed. The bill of lading is the agreement between the common carrier (such as a trucking or rail transporter) and the company. The invoice is sent to the customer.

Usually at the end of the month, customers are billed and regular monthly reports are generated. Customers are billed according to the customer statement. Regular monthly reports would include sales reports, inventory status reports, and accounts receivable reports.

The general and application controls described in Chapter 4 should be used to ensure the security, availability, processing integrity, and confidentiality of this IT system. General controls include authentication of users, computer logs, physical access controls, and business continuity planning. General controls to prevent network break-ins would be necessary if the system uses any network connections to other systems. The application controls help ensure the accuracy and completeness of processing. Input controls used in this system would likely include data



**EXHIBIT 8-18** Revenue Processes System Flowchart

preparation and error handling procedures, programmed input validation checks, and control totals. Well-defined procedures for data preparation and error handling can reduce the chance for mistakes in data entry into the system. The programmed input checks, such as field checks, validity checks, limit checks, and reasonableness checks, will help prevent or detect keying errors. If customer orders are entered in batches, control totals can help ensure the accuracy and completeness of input and processing. Output controls help to protect data through proper distribution, storage, and disposal of reports.

The system depicted in Exhibit 8-18 uses some manual processes, such as keying of data, and some paper forms. More complex IT systems can reduce or eliminate these manual processes and paper forms. For example, orders placed over the Internet would eliminate manual keying by someone within the company. The customer keys in the order while placing an order on the website. The sections that follow describe some types of systems with fewer manual processes and paper forms.

In many companies today, sophisticated, highly integrated IT systems capture, record, and process revenue and cash collection events. These IT systems are more specialized than the generic system described earlier. Such systems include e-commerce systems, electronic data interchange (EDI) systems, and point of sale (POS) systems. **E-commerce systems** incorporate electronic processing of sales-related activities, and generally, e-commerce sales processes are transacted over the Internet. **Electronic data interchange (EDI)** systems communicate sales documents electronically with a standard business format. **Point of sale (POS)** systems process sales at a cash register in retail stores.

When implementing these types of IT systems, many companies find that they must change the methods used to perform sales and collections. As companies redesign these processes to align with their software systems, they conduct what is known as business process reengineering. **Business process reengineering (BPR)** is the purposeful and organized changing of business processes to make the processes more efficient. BPR not only aligns business processes with the IT systems used to record processes, it also improves efficiency and effectiveness of these processes. Thus, the use of sophisticated IT systems usually leads to two kinds of efficiency improvements. First, the underlying processes are reengineered to be conducted more efficiently. Second, the IT systems improve the efficiency of the related information. As an example, Nortel Networks Corporation (formerly known as Northern Telecom) found that EDI reduced its cost of purchasing from approximately \$80 per transaction when paper-based to \$35 per transaction with EDI.<sup>1</sup>

Explanations of three types of IT systems are included in the sections that follow, including e-commerce, EDI, and POS systems. Each of these systems greatly reduces or eliminates the paper-based documentation used in older manual or automated systems. That is, these systems may eliminate the need for paper-based sales orders or paper-based checks. In these IT systems, information is transmitted electronically and payments are collected electronically, not in paper documents. The elimination of paper completely changes the audit trail and the internal controls. Therefore, the sections that follow will describe the risks and controls for these IT systems.

## E-Business Systems and the Related Risks and Controls (Study Objective 6)

Today, there are two popular types of Internet sales, commonly referred to as business to consumer (**B2C**), and business to business (**B2B**). Most people are familiar with B2C sales, whereby a retail or service firm sells directly to consumers using a website. This is also called e-commerce. B2B sales, on the other hand, involve companies using websites to sell products and services to each other. These types of sales transactions are known as e-business. A more detailed description of e-commerce and e-business is presented in Chapter 14.

There are numerous B2C examples, including Amazon.com, CDUniverse.com, Lands' End, J. Crew, and Delta Air Lines. In a B2C sale, the company's website and underlying network and software systems capture sales data, authorize credit card payments, and acknowledge the order via e-mail. The details such as customer, shipping address, items ordered, and credit card number are captured on the website and uploaded into the company's accounting and logistic software systems. The website must interface with the company's data on inventory, customer accounts, prices, and shipping charges.

B2B is not as well known by those in the general public. Like B2C, it involves the use of websites and the Internet to conduct business. The difference is that the transactions are between companies, rather than between a company and consumer. This difference is significant because a B2B sale is between known and trusted parties. The buyer and seller have a preestablished business relationship and may have even negotiated prices and delivery expectations. In a B2C sale, the seller may not have any established relationship with the customer.

<sup>1</sup>F. Borthick and H.P. Roth, "EDI for Reengineering Business Processes," *Management Accounting*, October 1993, pp. 32–37.

## The Real World

Many large corporations sell to other companies. Staples is an example of a company selling to other companies via websites and via direct sales calls. Regarding sales of office supplies to other large corporations, management at Staples realizes that it must support orders in the manner the customer prefers. While Internet-based sales account for the majority of the company's contract revenues, Staples also

uses "virtual sales assistants" which allow sales associates to call on small business customers using an iPad app. This approach allows Staples personnel to nurture customer relationships without requiring them to be on their customers' premises. Neil Ringel, the executive vice president of Staples' business-to-business sales division, referred to the use of iPads as "a gigantic step out of the dark ages."<sup>2</sup>

In both B2B and B2C sales, the advantages of e-commerce include the following:

1. Reduced cost through lower marketing, employee, and paperwork costs
2. Shorter sales cycles due to reduced time to place an order, deliver the order, and collect payment
3. Increased accuracy and reliability of sales data
4. Increased potential market for products and services.

However, the Internet-connected nature of e-commerce sales includes several risks that a company must manage. As described in Chapter 4, the network and Internet connections required to conduct e-commerce are risk exposure areas, or "entry points." The risks involve security, availability, processing integrity, and confidentiality, among others. The risks related to Internet sales are as follows:

### **Security and Confidentiality**

1. Unauthorized access
2. Hackers or other network break-ins
3. Repudiation of sales transactions

### **Processing Integrity**

4. Invalid data entered by customers
5. Incomplete audit trail
6. Errors when integrating data into back-end systems such as accounting, payment processing, and order fulfillment software systems

### **Availability**

7. Hardware and software system failures that block customers from access to the website
8. Virus and worm attacks
9. Denial-of-service attacks by hackers

In addition, there are many online privacy risks to customers. Customer data must be safeguarded by internal controls. The specifics of online privacy risks and controls appear in Chapter 14 on e-commerce.

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<sup>2</sup> Hackett Robert, Staples, Never Stationary. Available at <http://www.fortune.com/2015/03/09/staples-never-stationary/>.

Controls should be in place to reduce the security, availability, processing integrity, and confidentiality risks. The controls that can lessen these risks are described in the next several sections.

## Security and Confidentiality Risks

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To protect the security of the IT system and the confidentiality of the data, it is important to ensure that those accessing the website and conducting sales transactions are valid and authorized users. User authentication is an important control for Internet sales when it is possible to use it. In the case of retail sales to end-user consumers, user authentication may not be appropriate. B2C companies that engage in retail sales do not always ask users to create user IDs and passwords before buying on the website. Customers can perceive this requirement as burdensome or an invasion of privacy. The need to sell to a wide range of unknown customers may prevent online retailers from using authentication controls. The cost of user authentication in terms of lost sales would outweigh any benefit of the controls. In other cases, such as B2B Internet sales, authentication through user IDs and passwords is more important.

To lessen the chance of fraudulent sales, sales without payment, and repudiation of sales, a company must institute controls to assure the authenticity of the customer and the sale. A real danger in Internet sales is that a customer will use false or fictitious payment information in placing an order. A second danger is that a customer will repudiate a sale. “Repudiate” means that the customer claims to not have conducted the transaction. In both situations, it is important that a company have controls in place to ensure that the transaction is with a valid customer with valid payment authorization and that an audit trail is maintained. Customer authentication through user ID and password should also be used. Credit card authorization procedures must be correctly processed. Digital signatures or digital certificates can be used much like a paper signature is used to authenticate and validate the customer. Finally, transactions should be logged and data trails maintained to avoid repudiation.

## Processing Integrity Risks

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As customers enter data on a website to place an order, they may make data entry errors. Controls should be used to minimize these errors. The programming within the website should include steps to check the completeness, accuracy, and validity of the data. You have probably noticed the effect of these controls when ordering items on a website. As two examples, consider what happens if you enter an incorrect state abbreviation or do not complete all necessary fields. Usually, the website provides feedback to you that the state abbreviation is not valid or all necessary fields have not been completed. These are **programmed data input checks** that should be built into any Web-based sale systems. The programmed checks should include many of those described in Chapter 4, such as field checks, validity checks, limit checks, range checks, reasonableness checks, and sign checks.

In a Web-based sale system, there probably is no trail of paper documents to serve as an audit trail. Therefore, the company must capture all relevant data and maintain that data in a form that constitutes an audit trail. Logging transactions can help establish an audit trail in an electronic environment.

Dynamically programmed websites that capture sales data can be considered the front end of the sales process. A company must develop a method to integrate the data captured into the back end processes and applications. An example of a back-end process is one that actually pulls items from warehouses and ships to customers. The data from the website must either be manually entered, or integrated into these back-end processes. Controls must exist to ensure the accuracy of data as it is integrated across back-end processes. Such controls include reconciliations and verifications. Data can be totaled as they come from the website and retotaled after they are integrated into the back-end system. These two totals can be reconciled to make sure they agree.

## Availability Risks

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Any interruptions to the system can cause critical problems for companies that sell via e-commerce. Any time the website is unavailable to customers probably means lost sales. Therefore, the company should put controls in place to minimize service disruptions. These controls can include redundant systems, **disaster recovery plans**, testing of software changes, and capacity planning and testing. Redundancy is needed for servers, data, and networks.

A redundant server system requires maintaining one or more computers as extra, backup Web servers that can operate if the main server goes down. Data redundancy is usually accomplished by having data stored in RAID (redundant array of inexpensive disks). A RAID storage maintains one or more disk drives that mirror each other. In this manner, one or more exact duplicates of the data are maintained. A backup network structure should be in place if communication is lost through the regular network.

Disaster recovery plans must be in place to ensure uninterrupted customer access even through natural disasters such as fire, flood, or earthquake. The company must have plans to continue service when disasters occur.

As changes are made to the website or the underlying software to process sales, it is important that the changes be tested before they are implemented. If such changes are not tested, they may fail and disrupt operations.

Finally, managers must plan for sufficient capacity in the e-commerce system and servers to ensure that the system is not overwhelmed by the number of users accessing it. A slow or stalled website can result in lost sales. Managers should consistently monitor, test, and adjust the capacity of the system to meet its needs.

## Electronic Data Interchange (EDI) Systems and the Risks and Controls (Study Objective 7)

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Electronic data interchange is the inter-company, computer-to-computer transfer of business documents in a standard business format. Three parts of this definition highlight the important characteristics of EDI. Inter-company refers to two or more companies conducting business electronically. The computer-to-computer aspect of the definition indicates that each company's computers are connected via a network. A standard business format is necessary so that companies can interact and trade with a variety of vendors and sellers using EDI. The standard business format allows all vendors and sellers to "speak the same language." The American National

Standards Institute (ANSI) has developed standard formats for the usual documents needed in a sales process, including purchase orders, sales invoices, price quotations, and shipping schedules. The standard in the United States is ANSI X.12.

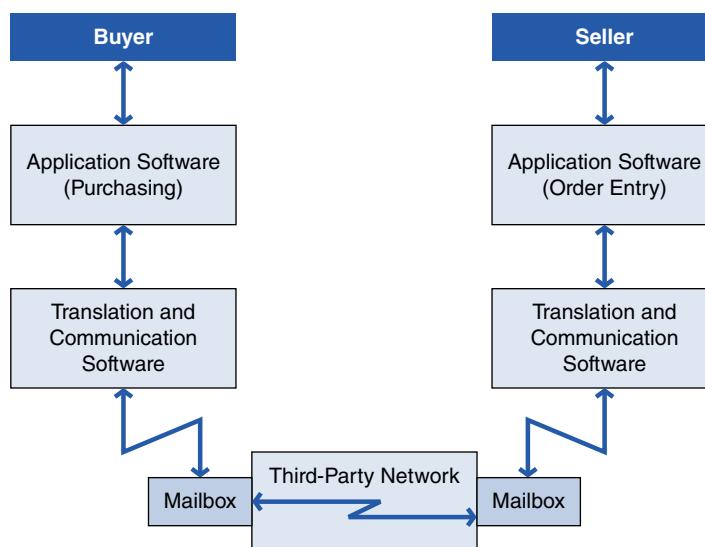
ANSI X.12 standards divide EDI data transmissions into three parts: header and trailer data, labeling interchanges, and data segments. **Header data** contain information about the file or transmission being sent. The header identifies the beginning and end of a particular transaction data set. **Trailer data** also contain data about the file or transmission and identify the end of a particular transaction data set. **Labeling interchanges** identify the type of transactions in the set, such as a set of sales invoices. **Data segments** include the actual data within the invoices, such as quantities and prices.

Although two companies may have a network connection that allows them to be directly linked to each other, it is expensive to develop and maintain such a system. The majority of companies using EDI communicate with trading partners by a third-party network like the one illustrated in Exhibit 8-19.

The two companies in Exhibit 8-19 are not directly connected to each other, but they communicate EDI data through a third-party network via mailboxes in the third party's computer system. These third-party networks are termed **value added networks (VANs)** because they provide other valuable services such as translation and encryption of the EDI data and authentication of a valid and authorized trading partner.

There are many advantages to an EDI system within the revenue and cash collection processes:

1. Reduction or elimination of data keying
2. Elimination of keying errors
3. Elimination of costs related to keying and keying errors
4. Elimination of the time needed to key in orders
5. Elimination of mail delays
6. Elimination of postage costs
7. Reduction in inventory levels as a result of shorter order cycle
8. Competitive advantage through better customer service
9. Preservation of business with existing customers who have adopted EDI



**EXHIBIT 8-19** EDI Using a Third-Party Network

The first four advantages listed relate to time and costs savings from reducing or eliminating data keying. Since EDI transmits data between computers without paper documents, no data entry clerks are needed to key details of a sale from paper documents into the computer system. This saves time and dollars, as well as the errors that are inherent in keying data. Advantages numbered 5 and 6 arise because data is sent electronically rather than by mail. Mail delays and the costs of mailing are completely avoided. Advantage number 7 occurs because there is a significant amount of time saved by avoiding keying, keying errors, and mail delays. This time savings can cut days from the time cycle to enter an order, ship it, and receive payment. Thus, the seller can maintain lower inventory levels and replenish those inventory levels more quickly. Finally, the last two advantages relate to getting or keeping competitive advantages. Sometimes, a company needs EDI in order to survive—for example, to satisfy the transaction processing vendors or sellers it already deals with. In other cases, EDI offers a competitive advantage by allowing a seller to more quickly and accurately service customers.

Newer EDI systems use the Internet, rather than third-party networks, to transmit EDI documents. Companies using Internet EDI realize large cost savings because they avoid the fees paid to a third-party network.

## The Real World

Nortel Networks Corporation (Nortel) has been using Internet EDI for decades. Nortel has customers all over the globe, and the use of the Internet by Nortel customers to transmit purchase orders is a low-cost transmission option for those customers. This was especially beneficial to Nortel in expanding its customer base in Europe and Asia. As Nortel works to gain new customers, a low-cost way to order is an enticement to those customers.

The use of Internet EDI provides additional benefits to Nortel, as it eliminates the need for customers to fax or phone purchase orders or supplier information to Nortel.<sup>3</sup> Thus, improvements can result in terms of reduced human error associated with keying data. Details of Internet EDI are described in a later chapter on e-commerce.

EDI systems cause risks that may be different from those found in traditional manual or IT systems. EDI eliminates much of what would be the traditional paper audit trail of documents, such as sales orders, shipping documents, and invoices. Risks in an EDI system are as follows:

### Security and Confidentiality

1. Unauthorized access
2. Trading partners gaining access to unauthorized data
3. Hackers or other network break-ins
4. Repudiation of sales transactions

<sup>3</sup> Ellen Messmer, "Nortel embraces Net EDI," *Network World*, March 17, 1997, p. 69.

## Processing Integrity

5. Invalid data entered by trading partners
6. Incomplete audit trail
7. Errors when integrating data into back-end systems such as accounting, payment processing, and order fulfillment software systems

## Availability

8. System failures such as hardware and software failures that block customers from accessing to the EDI system.

IT controls can lessen these risks. Exhibit 8-20 summarizes these risks and controls for e-commerce and EDI. The controls are authentication, encryption, transactions logging, control totals, and acknowledgments. **Authentication** is the process of user identification to ensure that only authorized users are accessing the IT system. Authentication occurs through the use of user ID, password, and other unique identifiers. Only valid, authorized trading partners should be allowed to initiate or receive EDI communication. For example, a company would not want an employee to log in from a home computer and submit false orders to be delivered to her home address. Limiting communication to authorized trading partners is accomplished by authentication that uses software-based authentication techniques such as user account IDs and passwords. Authentication can occur at the VAN log-in, within the translation software, and within the application software.

Since data travels over network data lines and third-party networks, it is susceptible to network break-ins. **Encryption**, the coding of data that makes data unreadable to those without the encryption key, is a control that limits risk. Encryption of the data will not prevent these breaches, but will render the data useless. **Transaction logging** occurs when the IT system automatically produces a log of users and the actions they undertake within the IT system. As a computer conducts EDI transactions, it should automatically log each transaction, and this log should be regularly examined and reconciled to ensure that no transactions are lost or unaccounted for.

**Control totals** are subtotals of selected fields for an entire batch of transactions. For example, quantity ordered could be added for a batch of orders. The

Risk	Controls
<b>Security and Confidentiality</b>	
Unauthorized access Hackers or other network break-ins Repudiation of sales transactions	<div style="display: flex; align-items: center; justify-content: space-between;"> <div style="flex-grow: 1; margin-right: 20px;"> <p>Authentication: user ID, password, log-in procedures, access levels, and authority tables</p> <p>Firewall, encryption, vulnerability assessment, intrusion detection, and penetration testing</p> <p>Computer logs</p> </div> <div style="font-size: 2em; margin-top: -10px;">{</div> </div>
<b>Processing Integrity</b>	
Invalid data entered by customers Incomplete audit trail Errors integrating into back-end systems	<div style="display: flex; align-items: center; justify-content: space-between;"> <div style="flex-grow: 1; margin-right: 20px;"> <p>Input controls: field check, validity check, limit check, and reasonableness check</p> <p>Computer logs</p> <p>Software testing</p> </div> <div style="font-size: 2em; margin-top: -10px;">{</div> </div>
<b>Availability</b>	
System failures Virus and worm attacks Denial of service attacks by hackers	<div style="display: flex; align-items: center; justify-content: space-between;"> <div style="flex-grow: 1; margin-right: 20px;"> <p>Business continuity planning, and backup data and systems</p> <p>Firewall, encryption, vulnerability assessment, intrusion detection, and penetration testing</p> </div> <div style="font-size: 2em; margin-top: -10px;">{</div> </div>

**acknowledgment** is a reply that echoes the data control totals. The use of acknowledgments and matching control totals can reduce the risk of erroneous or invalid EDI data in transactions. When an EDI transaction is transmitted, the receiving computer should transmit an acknowledgment to be compared with original data to make sure it was not garbled or lost during transmission.

## Point of Sale (POS) Systems and the Related Risks and Controls (Study Objective 8)

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Many retail operations use point of sale (POS) systems to capture all relevant sales data at the point of sale: the cash register. You have seen POS systems on your shopping visits to grocery or department stores. As you checked out, the bar codes are scanned on the items you purchased, prices were determined by the accessing of inventory and price list data, sales revenue was recorded, and inventory values were updated. All of these processes occur in real time, and the store can provide to its managers or home office daily summaries of sales by cash register or by product. Many companies adopt POS systems because they enhance customer satisfaction by enabling faster and more accurate checkouts. In addition, POS systems have many features that assist accountants and managers in the company, including the following:

1. Touch screen menus for easy training and use by employees lead to fewer errors and more accurate sales and inventory data.
2. Bar code scanning of products eliminates the need to manually enter product codes, quantities, or prices.
3. Real-time access to inventory and price data allows for more accurate pricing at checkout, as well as quick and efficient price updates. List prices can be changed online by a manager and reflected instantly at the checkout register.
4. Credit card authorizations during the sale save time and help prevent credit card fraud.
5. Real-time update of cash, sales, and inventory records allows for immediate analysis of sales trends, inventory needs, and cash on hand.
6. Immediate summaries and analyses can be provided to on-site management or the home office.
7. Integration with the company's general ledger system to post sales, cost of goods sold, inventory, and receivables accounts saves many manual steps.

POS systems are not usually connected to trading partners outside the company. The system is an internal system that may have network connections from individual stores or locations to corporate headquarters. Since it usually does not involve outside network connections, it does not pose as many security or confidentiality risks as e-commerce or EDI systems. The POS software system can actually reduce some processing integrity risks within revenue and cash collection processes. The risks lessened are as follows:

1. Pricing errors for products sold
2. Cash overage or shortage errors
3. Errors in inventory changes—less chance of an incorrect product number
4. Erroneous or invalid sales voids or deletions.

Since a POS system uses extensive computer hardware and software, there are availability risks. Hardware or software failures can make the system unavailable and interrupt or halt business operations. Therefore, it is important for a company to institute controls to lessen the availability risks. Backup systems and backup data procedures should be in place. The organization should also have business continuity and disaster recovery plans in place.

There are many examples of POS systems in the companies where you have probably shopped. Retail stores such as department stores, grocery stores, and bookstores, as well as restaurants, may all use POS systems.

## The Real World

Several years ago, Pizza Hut, Inc., switched all company restaurants to a POS system. The system tremendously increased control over sales, cash, and inventory. Prices for all possible menu combinations are determined at the home office and downloaded into the POS system at each restaurant, thus reducing errors such as charging incorrect prices to customers. As the order is entered in the system, a copy of the order is transmitted to the kitchen so the pizza can be prepared correctly with the requested combination of toppings.

Procedures at the end of the day improve control over cash. A report of cash received can be compared with the bank deposit, and any differences can be reconciled or investigated. Also, at the end of the day, Pizza Hut's POS system prepares a report that can be reviewed by the managers and staff of that restaurant before the start of the next day. That report provides a comparison of carryout, delivery, and in-store sales. It also categorizes sales by type of product such as pizza, sandwich, or salad.

In 2011, a Pizza Hut franchisee, Rage, Inc., added a biometric fingerprint identification system to its POS. Rather than using an ID to log into the POS terminal, employees now scan their fingerprint. Adding a stronger internal control has resulted in a reduction in unauthorized discounts, payroll fraud, and inventory shrinkage. These problems have decreased because it is no longer possible for a manager to just give his ID to another employee to apply discounts, clock in and out of the timekeeping system, or make inventory adjustments.

As you can see, POS adds efficiency, better internal control, and a more efficient interface with the company's general ledger software that makes appropriate entries to record sales, cash, and inventory changes. These processes within the POS system allowed Pizza Hut to improve several aspects of its performance by giving management better feedback. As a result, management is able to use the system to forecast labor needs, control inventory levels, and determine popular sales items to promote via marketing.

## Ethical Issues Related to Revenue Processes (Study Objective 9)



A sad fact of the business and accounting environment is that many deceptions and fraudulent acts relate to revenue measurement and recognition. Many managers or owners succumb to the temptation to inflate (overstate) revenues so that they can make the company's financial performance appear better than it is. Intentional revenue inflation is unethical, and many types of revenue inflation are illegal.

## The Real World

In the early days of personal computers, one of the manufacturers of hard drives was MiniScribe Corporation. The chief executive officer of MiniScribe, Q.T. Wiles, was convicted of fraud in 1994 and subsequently served 30 months in prison for falsifying revenue. To inflate revenues, Q.T. Wiles came up with a novel idea. He made the employees ship bricks, rather than hard drives, in boxes that were sent to distributors.

The company also shipped scrapped parts in boxes that were labeled as hard drives. The company inflated revenue by recording completely fictitious, fraudulent sales of these bricks and scrap materials. In addition to the CEO being sentenced to jail time, the chief financial officer, a CPA, was disciplined by the SEC. The company ultimately failed.<sup>4</sup>

There are many examples of companies inflating revenue. The MiniScribe example points out an unfortunate truth: If top management is intent on falsifying financial statements by inflating revenue, it does not matter how good the underlying processes and accounting systems are; it can still often find ways to misstate revenue despite the effectiveness of the accounting system. Accurate financial reports can only be an output of an accounting system if management desires accurate financial reports. Unethical managers can easily cause fictitious or inflated sales revenues to be recorded, although doing so requires the assistance of those who work for the top managers. Since top managers have so much control over those whom they employ, it is possible for them to convince employees to assist in the deception. If MiniScribe's employees had been more ethical, it would have been more difficult for its leaders to conduct the fraud.

In addition to the novel approach of MiniScribe, there are more mundane ways to inflate revenue. Two popular approaches are "channel stuffing" and "leaving sales open" beyond the end of the fiscal period. **Channel stuffing** is intentionally persuading a customer to buy more than needed, thereby "stuffing" more product into the sales channel. "**Leaving sales open**" refers to moving a period cut-off date forward to include sales that rightly would occur in a future period. This means that the company records sales revenue that should actually be recorded in the following fiscal year. From an accounting system perspective, it is important that the system properly account for revenue in the proper period. This can become complex when the order, shipment, and payment dates occur near the fiscal year end. The system that records revenue transactions must be designed to include in current period revenues only those items that were actually shipped before year-end. Any shipments occurring after year-end must be recorded in the subsequent fiscal year. The system should be tested to make sure that it handles this sales revenue cutoff correctly.

Management has a responsibility to maintain an accounting system that properly recognizes revenue. If management chooses to act fraudulently, inflating revenues by shifting revenue cutoffs is easy. This emphasizes the fact that the ethics of management and the control environment are the most important factors in accurate and complete financial statements. Without ethical management at the top of a company, financial reports must be suspect.

<sup>4</sup> Andy Zipser, "Cooking the Books: How Pressure to Raise Sales Led MiniScribe to Falsify Numbers." *The Wall Street Journal*, 9/11/1989.

## The Real World

In 2008, the Coca-Cola Company agreed to pay a \$137.5 million settlement related to accusations of channel stuffing. After an eight-year SEC investigation, Coke agreed to the settlement but admitted no wrongdoing. The company had been accused of pressuring bottlers to buy more soft drink concentrate than necessary. This overselling technique added sales, and therefore higher profits, to Coke's financial reports, and it kept the stock price artificially inflated. Those who

purchased Coke stock in a short period in late 1999 to early 2000 were entitled to a portion of the settlement.

In a similar case, the SEC investigated McAfee, Inc. in 2006. McAfee, a software company that is now part of Intel Security, was accused of selling its software products to its distributors in quantities greater than end-consumer demand. The company admitted no wrongdoing but ultimately agreed to a \$50 million settlement.

In many cases where revenue is intentionally overstated, accountants or CFOs have participated in the deception. In the cases of MiniScribe and Sunbeam, the chief financial officers were involved in the fraud. Accountants throughout an organization should try to ensure that the area in which they work does not overstate revenues. Overstated revenues mislead the general public as they make investment decisions regarding stocks to buy. Therefore, accountants must make sure that the accounting systems used to record revenue are accurate. Second, accountants must not allow managers to coerce them into assisting in an overstatement of revenue through the use of accounting tricks or deceptions. Unfortunately, an accountant or CFO can be swayed by arguments advanced by top managers. For example, a CEO might say that the revenue overstatement is only temporary until earnings targets are met. The CEO might even say that the company will have to cut back its workforce if revenues deception is not carried out. These arguments can be very persuasive, and many accountants have agreed to participate in such deceptions involving revenue. Obviously, it is best to be vigilant about resisting involvement in revenue overstatement. Once it begins, it usually seems to snowball into more and more overstatements as pressure mounts to report continued revenue growth.

## The Real World

An example of accountants being involved in revenue misstatement in an accounting fraud scheme occurred at HealthSouth Corp. Richard Scrushy, the CEO, and five different financial officers were accused of inflating profits by \$1.4 billion. The accountants involved claimed that Scrushy held so-called "family meetings" to help devise and cover up earnings falsifications.

In June 2005, to the surprise of federal prosecutors, Scrushy was found not guilty of

all counts against him even though the five other HealthSouth officials had plead guilty and testified that Scrushy ordered the actions. Although a jury found him not guilty, Scrushy's job prospects as a CEO are severely damaged. At a minimum, he tolerated and failed to prevent unethical behavior, even though it was not proven beyond a reasonable doubt that he participated in the events.

## Corporate Governance in Revenue Processes (Study Objective 10)

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Four primary functions of the corporate governance process include management oversight, internal controls and compliance, financial stewardship, and ethical conduct.

The systems, processes, and internal controls described in this chapter are part of the corporate governance structure. When management designs and implements processes for sales, sales returns, and cash collections, it assigns responsibility for executing those functions to various managers and employees. As management assigns and oversees these revenue processes, it is carrying out the corporate governance function of proper management oversight.

As described in this chapter, management should also establish appropriate internal controls for revenue processes to accomplish the objectives of safeguarding assets within those processes and ensuring the accuracy and completeness of the data produced by the processes. These internal controls are also part of the corporate governance structure.

When management has designed and implemented processes and internal controls and then continually manages them, it is helping to ensure proper stewardship of the company's assets. Corporate governance requires proper financial stewardship. The processes, internal controls, and feedback data from these systems help management report to owners and other stakeholders about proper stewardship of assets within the revenue processes. These assets include inventory, cash, receivables, and operating assets.

Finally, good corporate governance requires ethical conduct. This chapter described some of the ethical issues that management must consider and address within the revenue processes. When top management acts ethically and encourages ethical behavior throughout the organization, stronger corporate governance is the result. There are usually fewer cases of frauds, errors, or ethical problems in an organization when top management behaves ethically and encourages ethical behavior.

Perhaps it would be easier to understand the way this chapter's topics fit into corporate governance if you think of it from a negative perspective. For example, if management of a particular organization did not establish sound processes, good internal controls, and ethical policies, it would lack good corporate governance. In that organization, revenue processes would be poorly executed and weakly controlled. Management would not be exercising proper financial stewardship. Therefore, stakeholders such as investors, creditors, and owners would have little or no trust in the resulting financial statements. The organization would not represent the type of organization in which we would wish to invest our own money. On the other hand, when an organization has good corporate governance, the stakeholders can correctly have more confidence that proper stewardship is occurring. Establishing proper processes, internal controls, and ethical guidelines leads to better corporate governance and, therefore, good financial stewardship.

## Summary of Study Objectives

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**An introduction to revenue processes.** The three typical types of processes related to revenues are sales processes, sales return processes, and cash collection processes.

**Sales processes and the related risks and controls.** Sales processes include checking customer credit and authorizing the sale if credit is not exceeded, checking inventory to determine whether goods are in stock, picking the correct goods from the warehouse, shipping goods to the customer, billing the customer, and updating accounting records. Sales process controls can be categorized into authorization, segregation, adequate records, security of assets and records, and independent checks.

**Sales return processes and the related risks and controls.** Sales return processes include receiving returned goods, matching goods to the original invoice, preparing credit memorandum, returning goods to the warehouse, reducing accounts receivable and increasing inventory records, issuing credit or a check to the customer, and updating accounting records. Sales process controls can be categorized into authorization, segregation, adequate records, security of assets and records, and independent checks.

**Cash collection processes and the related risks and controls.** Cash collection processes include receiving checks in the mailroom, comparing checks with the remittance advice, preparing a check prelist and a deposit slip, depositing the funds, updating cash, accounts receivable, and general ledger records, and reconciling the bank records to the organization's records. Cash collection process controls can be categorized into authorization, segregation, adequate records, security of assets and records, and independent checks.

**An overview of IT systems of revenue and cash collection that enhance the efficiency of revenue processes.** As complexity and automation in IT systems increases, there are fewer manual processes and more computerized processes. This is usually true regarding size also; larger IT systems generally have fewer manual processes and more computerized processes. More computerized processes means there would be a greater need for the IT controls to reduce IT risks. IT risks can be categorized into security, availability, processing integrity, and confidentiality risks. General and application IT controls can reduce these risks.

**E-business systems and the related risks and controls.** E-business can include both business-to-business (B2B) and business-to-consumer (B2C) sales. In either case, the advantages include reduced cost through lower marketing, employee, and paperwork costs, shorter sales cycles due to reduced time to place an order, deliver the order, and collect payment, increased accuracy and reliability of sales data, and increased potential market for products and services. The Internet-connected nature of e-commerce sales includes several risks that a company must manage. These risks include security, availability, processing integrity, and confidentiality risks.

**Electronic data interchange (EDI) systems and the related risks and controls.** Electronic data interchange is the intercompany, computer-to-computer transfer of business documents in a standard business format. The network connected nature of EDI sales includes several risks that a company must manage, including security, availability, processing integrity, and confidentiality risks.

**Point of Sale (POS) systems and the related risks and controls.** For retail operations, there is a type of accounting software categorized as point of sale (POS) systems. These systems capture all relevant sales data at the point of sale: the cash register. As items are checked out through a register, the bar codes are scanned on the items purchased, prices are determined by the accessing of inventory and price list data,

sales revenue is recorded, and inventory values are updated. All of these processes occur in real time, and the store can provide its managers or home office with daily summaries of sales by cash register or by product. Some risks, including pricing errors, cash shortages, inventory discrepancies, and erroneous sales invoices or voids, can be lessened by POS systems.

**Ethical issues related to revenue processes.** Revenue processes are very susceptible to unethical revenue inflation schemes. Such schemes include fraudulent or fictitious sales, improper sales cutoff periods, and channel stuffing.

**Corporate governance in revenue processes.** The revenue processes described in this chapter—sales process, sales return process, and cash collection process—are part of the management oversight of corporate governance. The internal controls and ethical tone and procedures within the revenue processes are also part of the corporate governance structure. Establishing and maintaining reliable revenue processes, internal controls, and ethical practices help ensure proper financial stewardship.

## Key Terms

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Acknowledgment	Credit memorandum	Point of Sale (POS)	Sales order
Authentication	Data segments	Price list	Shipping log
Bill of lading	Disaster recovery plan	Programmed data	Trailer data
Business process reengineering (BPR)	E-commerce systems	input checks	Transaction logging
B2B Sales	Electronic data interchange (EDI)	Purchase order	Transaction processing systems (TPS)
B2C Sales	Encryption	Receiving log	Value added network (VAN)
Cash receipts journal	Header data	Receiving report	Virtual private network (VPN)
Channel stuffing	Labeling interchanges	Remittance advice	
Control totals	Packing list or packing slip	Sales allowance	
Credit limit	Picking ticket	Sales invoice	
		Sales journal	

## End of Chapter Material

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### Concept Check

-  1 Within the revenue processes, a signed approval of a sales order indicates all of the following except
- date of delivery
  - sale to an accepted customer
  - approval of the customer's credit
  - correct sales price
- 2 An example of an independent verification in the sales process is
- preparation of packing lists on prenumbered forms
  - initializing the sales order
  - proof of recorded dates, quantities, and prices on an invoice
  - physical controls in record storage areas
- 3 The purpose of tracing shipping documents to prenumbered sales invoices would be to provide evidence that
- shipments to customers were properly invoiced
  - no duplicate shipments or billings occurred
  - goods billed to customers were shipped
  - all prenumbered sales invoices were accounted for
- 4 The purpose of tracing sales invoices to shipping documents would be to provide evidence that
- shipments to customers were properly invoiced
  - no duplicate shipments or billings occurred
  - goods billed to customers were shipped
  - all prenumbered sales invoices were accounted for

- 5 To ensure that all credit sales transactions of an entity are recorded, which of the following controls would be most effective?
- On a monthly basis, the accounting department supervisor reconciles the accounts receivable subsidiary ledger to the accounts receivable control account.
  - The supervisor of the accounting department investigates any account balance differences reported by customers.
  - The supervisor of the billing department sends copies of approved sales orders to the credit department for comparison of authorized credit limits and current customer balances.
  - The supervisor of the billing department matches prenumbered shipping documents with entries recorded in the sales journal.
- 6 Under a system of sound internal controls, if a company sold defective goods, the return of those goods from the customer should be accepted by the
- receiving clerk
  - sales clerk
  - purchasing clerk
  - inventory control clerk
- 7 The source document that initiates the recording of the return and the adjustment to the customer's credit status is the
- pick list
  - sales journal
  - credit memorandum
  - sales invoice
- 8 Which of the following is **not** a document that is part of the cash collection process?
- Remittance advice
  - Cash receipts journal
  - Bank deposit slip
  - Packing slip
- 9 Which of the following would represent proper segregation of duties?
- The employee who has custody of cash also does accounts receivable record keeping.
  - The employee who has custody of cash completes the bank reconciliation.
  - The employee who opens mail containing checks prepares a list of checks received.
  - The employee who opens mail containing checks records transactions in the general ledger.
- 10 Immediately upon receiving checks from customers in the mail, a responsible employee working in an environment of adequate internal control should prepare a listing of receipts and forward it to the company's cashier. A copy of this cash receipts listing should also be sent to the company's
- treasurer for comparison with the monthly bank statement
  - internal auditor for investigation of any unusual transactions
  - accounts receivable clerk for updating of the accounts receivable subsidiary ledger
  - bank for comparison with deposit slips
- 11 If a company does not prepare an aging of accounts receivable, which of the following accounts is most likely to be misstated?
- Sales revenues
  - Accounts receivable
  - Sales returns and allowances
  - Allowance for uncollectible accounts
- 12 When a company sells items over the Internet, it is usually called e-commerce. There are many IT risks related to Internet sales. The risk of invalid data entered by a customer would be a(n)
- availability risk
  - processing integrity risk
  - security risk
  - confidentiality risk
- 13 When a company sells items over the Internet, there are many IT risks. The risk of hardware and software failures that prevent website sales would be a(n)
- availability risk
  - processing integrity risk
  - security risk
  - confidentiality risk
- 14 The use of electronic data interchange (EDI) to conduct sales electronically has both risks and benefits. Which of the following is a benefit of EDI, rather than a risk?
- Incomplete audit trail
  - Repudiation of sales transactions
  - Unauthorized access
  - Shorter inventory cycle time
- 15 An IT system that uses touch screens, bar-coded products, and credit card authorization during the sale is called a(n)
- electronic data interchange system
  - e-commerce system
  - point of sale system
  - e-payables system

- 16** Which of the following is **not** a method of unethically inflating sales revenue?
- Channel stuffing
  - Holding sales open
  - Premature recognition of contingent sales
  - Promotional price discounts

### Discussion Questions

- 17** (SO 2) Why is it important to establish and monitor credit limits for customers?
- 18** (SO 2) Distinguish between a pick list and a packing slip.
- 19** (SO 2) How can an effective system of internal controls lead to increased sales revenue?
- 20** (SO 2) Why should the person responsible for shipping goods to customers not also have responsibility for maintaining records of customer accounts?
- 21** (SO 3) What is the purpose of a credit memorandum?
- 22** (SO 3) How are sales invoices used (in a manual system) in the preparation of credit memos?
- 23** (SO 2) How can a security guard in a warehouse be considered an important component of a company's accounting system?
- 24** (SO 3) How could fraud be perpetrated through the sales returns process?
- 25** (SO 6, SO 7, SO 8) Identify and distinguish between the three types of IT systems used in the sales process.
- 26** (SO 6) Distinguish between B2B sales and B2C sales. Other than those presented in this chapter, name a company from your personal experience that uses B2C sales.
- 27** (SO 6) List the advantages of e-commerce systems.
- 28** (SO 6) Identify two of the biggest risks to companies who use e-commerce, along with controls to prevent these risks.
- 29** (SO 6, SO 7) What controls should a company implement to ensure consistency of sales information between the front end and back end of its systems?
- 30** (SO 6) Why is a redundant server system needed in an e-commerce environment?
- 31** (SO 6) Why should a company continuously monitor the capacity of its e-commerce system?
- 32** (SO 7) What are the three important characteristics of the EDI definition?
- 33** (SO 7) What are the three standard parts of an EDI data transmission?
- 34** (SO 7) How could it be possible for two companies to conduct EDI if they are not directly connected with each other?

- 35** (SO 7) List the advantages of an EDI system.
- 36** (SO 6, SO 7, SO 8) What is the purpose of maintaining transaction logs? Why are they especially important in IT systems?
- 37** (SO 8) List some advantages of a POS system.
- 38** (SO 8) Why are backup systems one of the most important controls for POS systems?
- 39** (SO 9) Describe a popular fraud scheme where company employees misuse the sales revenues cutoff.

### Brief Exercises

- 40** (SO 2, SO 4) Describe what is likely to occur if company personnel erroneously recorded a sales transaction for the wrong customer. What if a cash receipt were applied to the wrong customer? Identify internal controls that would detect or prevent this from occurring.
- 41** (SO 4) Debate the logic used in the following statement: The person responsible for handling cash receipts should also prepare the bank reconciliation because he is most familiar with the deposits that have been made to the bank account.
- 42** (SO 7) Revenue systems are crucial in the health care industry, where hundreds of billions of dollars are spent annually reconciling revenues and billing data from the perspectives of providers (doctors and clinics, etc.) and payers (insurance companies). Briefly describe how EDI would be beneficial in this industry. Describe the purpose of the header data and trailer data.
- 43** (SO 2, SO 3, SO 4) Use the process maps in this chapter to answer the following questions:
- What would a credit manager do if a sales order received caused a customer to exceed its credit limit?
  - What happens after the shipping department verifies that the quantities and descriptions of goods prepared for shipment are consistent with the sales order?
  - What would an accounts receivable clerk do if a \$100 credit memo is issued to a customer whose accounts receivable balance is \$1,000?
  - When is it necessary for an accounts receivable clerk to notify a customer?
- 44** (SO 2) Describe how the matching of key information on supporting documents can help a company determine that its revenue transactions have not been duplicated.
- 45** (SO 2, SO 3) Describe how the use of prenumbered forms for receiving reports and credit memos can

- help a company determine that sales return transactions have not been omitted from the accounting records.
- 46 (SO 8) Describe how a POS system could be useful to a company's marketing managers. How could it be useful to purchasing agents?

## Problems

- 48 (SO 6) In 1990, Luigi Romano opened a pizza restaurant that he named Romano's in St. Louis, Missouri. Over the years, he opened both company and franchise locations and grew the business to include over 40 restaurants that serve the three states around the St. Louis area. In 2015, Romano introduced a centralized phone ordering system with one phone number for customers to use. This meant that the customer did not need to look up the phone number of a local restaurant and call that restaurant to order. Rather, customers call one number, and the employees taking the order can determine the closest Romano's location and process the order. This system also centralized the pricing, ordering, and inventory systems for Romano's. In 2016, Romano's began offering online pizza orders through its website. Romano's advertises this Web ordering as more convenient for the customer. For example, its ads suggest that a customer can examine the entire menu on the website prior to ordering, something that is not possible with phone orders.

While there are many customer advantages of Web ordering, there are also many advantages to the company. From an accounting and internal control perspective, describe the advantages of Romano's system and any risks that it reduces.

- 49 (SO 8) You are the recent heir of \$40,000 cash, with which you are considering opening a sushi bar in the university community. You would accept cash and credit card payments, which would be handled primarily by your servers. You also plan to offer introductory specials to attract customers during the initial months of business. Identify some advantages and disadvantages of investing in a POS system as part of this new business venture. What internal controls should be implemented to reduce the risk of theft or error related to the handling of cash, credit card payments, and coupons?

- 50 (SO 2, SO 4, SO 6) Caleb Westerfield is the owner of CW Sports, a consignment shop for used sporting goods. Caleb accepts consigned goods and offers them for sale to the general public. Caleb rents business space, including a retail store where the

- 47 (SO 8) Briefly describe an example from your personal experience where you purchased something from a company that uses a POS system. How might your experience have been different if the POS system did not exist in the experience you described?

consigned goods are displayed and sold, with adjoining office space where an Internet site is maintained and other administrative functions are performed. The Internet site includes photos and descriptions of items available for sale worldwide. If the goods sell, Caleb's consignment fee is 40 percent of the sale price, and 60 percent is remitted to the consignor. Shipping costs on electronic orders are paid by the customers.

**Required:**

Identify internal control considerations for the following:

- a. The e-commerce portion of the business.
- b. The retail portion of the business, assuming that the accounting systems are mostly manual and handled by Caleb and his wife.

- 51 (SO 2, SO 3, SO 4) Identify an internal control procedure that would reduce each of the risks that follow in a manual system. Also, describe how (or if) an IT system could reduce these risks:

- a. Revenues may be recorded before the related shipment occurs.
- b. Employees responsible for shipping and accounts receivable may collude to steal goods and cover up the theft by recording fictitious sales.
- c. Credit memos may be issued at full price, when the goods were originally sold at a discount.
- d. Sales invoices may contain mathematical errors.
- e. Amounts collected on accounts receivable may be applied to the wrong customer.
- f. Duplicate credit memos may be issued for a single sales return.
- g. Sales invoices may not be prepared for all shipments.
- h. Shipments may contain the wrong goods.
- i. All sales transactions may not be included in the general ledger.

- 52 (SO 2) When an order for inventory items is fulfilled, in Microsoft Dynamics GP the items are reviewed to see if there is available stock to fill the order for the

line item. If there is no available stock, the user may select one of the following options:

- a. Sell the balance
- b. Override shortage
- c. Back order all
- d. Back order balance
- e. Cancel all
- f. Cancel balance
- g. Distribute

**Required:**

Describe what each of these choices would accomplish on the line item (inventory item being ordered) where there are not sufficient quantities to ship all the items ordered. Describe why companies may select to use each of these options.

- 53 (SO 3, SO 4, SO 5) The following list presents various internal control strengths or risks that may be found in a company's revenues and cash collection processes:

- Credit is authorized by the credit manager.
- Checks paid in excess of \$5,000 require the signatures of two authorized members of management.
- A cash receipts journal is prepared by the treasurer's department.
- Collections received by check are received by the company receptionist, who has no additional record-keeping responsibilities.
- Collections received by check are immediately forwarded unopened to the accounting department.
- A bank reconciliation is prepared on a monthly basis by the treasurer's department.

- Security cameras are placed in the shipping dock.
- Receiving reports are prepared on pre-printed, numbered forms.
- The billing department verifies the amount of customer sales invoices by referring to the authorized price list.
- Entries in the shipping log are reconciled with the sales journal on a monthly basis.
- Payments to vendors are made promptly upon receipt of goods or services.
- Cash collections are deposited in the bank account on a weekly basis.
- Customer returns must be approved by a designated manager before a credit memo is prepared.
- Account statements are sent to customers on a monthly basis.
- Purchase returns are presented to the sales department for preparation of a receiving report.

**Required:**

In the space provided, indicate whether each of these items represents a strength (S) or risk (R) related to internal controls in the revenues and cash collection processes. Alternatively, indicate whether the item is not applicable (N/A), meaning that it either has no impact on the strength of internal controls or does not pertain to the revenues and cash collection processes.

- 54 (SO 2) Following is the April 30 Accounts Receivable Subsidiary Ledger of Gabbard, Inc., a retailer of tents and camping equipment.



**Accounts Receivable Subsidiary Ledger**

**Gabbard, Inc.**

**April 30, 20xx Open Receivables**

Customer:	Acme Sporting Goods Central	Account 43985
	4726 Interstate Highway 2L	Credit Terms: 30 days
	Devron, Kansas 76588	Credit Limit: \$15,000
	507-945-8800	

Invoice Number	Invoice Date	Due Date	Amount	Customer Total
77341	April 27	May 27	\$1,366.48	
75118	April 1	May 1	4,975.00	
70698	March 15	April 14	4,017.15	
65287	January 14	February 13	659.59	\$11,018.22

**Accounts Receivable Subsidiary Ledger****Gabbard, Inc.****April 30, 20xx Open Receivables**

Customer:	<b>Brufton Outdoors</b> 623 Main Street NW Devron, Kansas 76588 507-945-1844	Account 41772 Credit Terms: 30 days Credit Limit: \$15,000
	Invoice Number	Invoice Date
	67915	February 20
	61190	January 2
	Due Date	Amount
	March 22	\$1,946.40
	February 1	6,763.10
	Customer Total	\$8,709.50
Customer:	<b>Jafferty Sporting Goods</b> 8466 State Route 33 Elkton, Kansas 76541 507-312-9469	Account 30966 Credit Terms: 15 days Credit Limit: \$5,000
	Invoice Number	Invoice Date
	74555	March 22
	Due Date	Amount
	April 6	\$4,067.99
	Customer Total	\$4,067.99
Customer:	<b>Kansas Department of Recreation and Safety</b> 8466 State Route 33 Gray Mountain, Kansas 76529 507-226-6881	Account 29667 Credit Terms: 30 days Credit Limit: \$25,000
	Invoice Number	Invoice Date
	78021	April 30
	77216	April 16
	77089	April 15
	75663	April 1
	74277	March 15
	73586	March 7
	67644	February 20
	Due Date	Amount
	May 30	\$10,646.20
	May 16	6,653.15
	May 15	975.63
	May 1	299.00
	April 14	1,104.13
	April 6	655.31
	March 22	1,843.83
	Customer Total	\$22,177.25
Customer:	<b>Pup Scouts of Devron</b> 9064 State Route 16 Devron, Kansas 76588 507-312-3126	Account 33117 Credit Terms: 15 days Credit Limit: \$10,000
	Invoice Number	Invoice Date
	77911	April 20
	75559	March 29
	Due Date	Amount
	May 5	\$9,737.91
	April 13	220.04
	Customer Total	\$9,957.95
Customer:	<b>Regents Athletic Club</b> 22 West Adams Way Devron, Kansas 76588 507-945-2149	Account 30846 Credit Terms: 30 days Credit Limit: \$5,000
	Invoice Number	Invoice Date
	66268	January 25
	61119	January 2
	Due Date	Amount
	March 24	\$2,678.59
	February 1	862.35
	Customer Total	\$3,540.94

(continued)

**Accounts Receivable Subsidiary Ledger****Gabbard, Inc.****April 30, 20xx Open Receivables**

Customer:	Buddy's Sports Buff 212 Oak Street Silver Horn, Kansas 76557 507-399-7761	Account 16200 Credit Terms: 30 days Credit Limit: \$10,000
Invoice Number	Invoice Date	Due Date
77115	April 15	May 15
70564	March 15	April 14
	Amount	Customer Total
	\$8,046.40	
	1,774.92	\$9,821.32

**Required:**

Use Microsoft Excel to prepare an electronic spreadsheet of an accounts receivable aging report

for Gabbard for April 30. Organize the spreadsheet with the following column headings:

Customer Name	Total Account Balance	Past Due Balances									
		Current Balance		1-30 days		31-60 days		Over 60 days			
		Invoice #	Amount	Invoice #	Amount	Invoice #	Amount	Invoice #	Amount	Invoice #	Amount

Be sure to include each individual invoice for each customer, and show column totals for each customer. Also show report totals for each column and be certain that the report totals cross-foot and agree with the ending Total Account Balance for all customers.

- 55 (SO 2) Following is a sales order form for Winter's World of Wines, Inc. This form is prepared manually by a sales clerk and based on a telephone order from a customer. This form represents the source document that triggers the revenue process at Winter's World of Wines.

**Sales Order**

Winter's World of Wines, Inc.  
802 Ashmore Ave.  
Weston, CA 95718

No. 35610

Bill to:  
La Cheaux Partners  
412 Bridge Blvd.  
Bridgetown, AK 37616

Ship to:  
La Cheaux Magnique  
8212 Hampton Place  
Bridgetown, AK 37615

Cust. # 42004

Date: 5/27/2013 Preferred Shipping Method:  
Payment Terms: 30 days

2-day UPS

Item Number	Description	Quantity	Unit Price	Extended Price
1046R	Merlot	12	6.99	\$83.88
1047R	Zinfandel	12	7.99	95.88
1049R	Cabernet Sauvignon	24	7.49	179.76
2025W	Pinot Grigio	24	7.49	179.76
2027W	Riesling	12	6.49	77.88
				\$617.16

Authorized by: H.B Clayton

Date: 5/27/13

**Required:**

Use Microsoft Excel to perform the following:

- a. Design an appropriate format for a data entry screen that could be used in the accounting department to enter information from the sales order in the company's revenues software program.
  - b. Prepare a sales journal with appropriate column headings. Enter the relevant information from the preceding sales order into your spreadsheet.
- 56 (SO 2, SO 4) Following are 10 internal control failures related to the revenues and cash collection processes:
- A customer ordered 12 boxes of your product (total of 144 items) for express shipment. Your data entry clerk inadvertently entered 12 individual items.
  - You enter sales and accounts receivable data in batches at the end of each week. Several problems have resulted recently as a result of invoices being recorded to the wrong customer account.
  - In an effort to boost sales, you obtain some unissued (blank) shipping reports and create a dozen fictitious shipments. You submit these documents to the billing department for invoicing.
  - Checks are received by the mail room and then forwarded to the accounts receivable department for recording. The accounts receivable clerk holds the checks until the proper customer account has been identified and reconciled.
  - Several shipping reports have been misplaced en route to the billing department from the shipping department.
  - Several sales transactions were not invoiced within the same month as the related shipment.
  - A sales clerk entered a nonexistent date in the computer system. The system rejected the data and the sales were not recorded.
  - Upon entering sales orders in your new computer system, a sales clerk mistakenly omitted customer numbers from the entries.
  - A computer programmer altered the electronic credit authorization function for a customer company owned by the programmer's cousin.
  - Customer orders were lost in the mail en route from the sales office to the accounting department (located at the company's headquarters).

**Required:**

From the list that follows, select one internal control would be most effective in the prevention of each listed failure. Indicate the letter of the control next to each failure. Letters should not be used more than once, and some letters may not be used at all.

- a. Preformatted data entry screens
  - b. Prenumbered documents
  - c. Programmed edit checks
  - d. 100 percent check for matching of customer orders and sales orders
  - e. 100 percent check for matching of sales orders, pick list, and packing slips
  - f. 100 percent check for matching of sales orders and invoices
  - g. 100 percent check for matching of deposit slip and customer check
  - h. Prompt data entry immediately upon receipt of customer order
  - i. Customer verification
  - j. Independent authorization for shipments
  - k. Independent authorization for billing
  - l. Reasonableness check
  - m. Hash totals
  - n. Data backup procedures
  - o. Program change controls
  - p. Sequence verification
  - q. Periodic confirmation of customer account balances
- 57 (SO 2, SO 3, SO 4) Keller Company is a small company with four people working in the revenue processes. One of the four employees supervises the other three. Some tasks that must be accomplished within the revenue processes are the following:
- a. Accounts receivable record keeping
  - b. Approving credit of customers
  - c. Authorizing customer returns
  - d. Authorizing new customers
  - e. Billing customers
  - f. Cash receipts journal posting
  - g. Entering orders received
  - h. Inventory record keeping
  - i. Maintaining custody of cash
  - j. Maintaining custody of inventory
  - k. Reconciling records to the bank statement

**Required:**

From the preceding list, assign all the duties to each of four employees: supervisor, employee 1, employee 2, and employee 3. No employee should have more than three tasks, no two employees should have any of the same tasks, and there should be a proper separation of duties to achieve appropriate internal control. List the four people, the duties you

assign to each employee, and a description of why those assignments achieve proper separation of duties.

-  58 (SO 6) Refer to the Ethical Dilemma: Mail Order Case presented in Chapter 3. What term introduced in this chapter applies to the type of mail order deceit? What could the mail order company do to avoid a loss resulting from an event, assuming that it uses an e-commerce system?
- 59 (SO 9) Visit the financial education website created by Equade Internet Ltd. at [www.investopedia.com](http://www.investopedia.com). Note the definition for channel stuffing. According

to this site, what is the primary motivation for channel stuffing?

- 60 (SO 6) Using a search engine, locate an article written by Vangie Beal titled “Top 2012 eCommerce Trends.” Briefly describe the main point of this article.
- 61 (SO 9) This chapter mentioned alleged fraudulent revenue reporting at Coca-Cola and McAfee. Using a search engine, search the phrase “SEC Channel Stuffing.” Give one more example of a company that was investigated, or is being investigated, by the SEC. What are the facts and status of the case?

## Cases

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- 62 Sensible CDs is a regional retail chain that sells used CDs. The company has eight stores throughout the Philadelphia region. At each store, customers can bring in used CDs to sell to Sensible or to trade for used CDs already in stock. Also, customers can buy used CDs from the large selection on racks in the stores. Sensible also carries older LP records for collectors.

When a used CD or LP record arrives at a Sensible store, it is checked for damage, labeled with a bar code, and entered into the extensive inventory.

A customer buying a used CD or record takes it to the cash register, where it is scanned through a bar code reader and the customer's cash, check, or credit card payment is processed.

Sensible has decided to establish a website and to begin selling used CDs and records on its website. The company believes there is a niche market for collectors of CDs or records that it can reach via the Web.

**Required:**

- a. Describe any differences in the sales processes of the online sales in comparison with in-store sales processes.
  - b. Describe any data collected about customers in the in-store sales.
  - c. Describe any data collected about customers in the online sales process.
  - d. Describe any data you believe Sensible should collect from online sales to help improve customer service or profitability.
  - e. Describe any data you believe Sensible should collect from online sales to help improve customer service or profitability.
- 63 At Kingston Industries, the revenue processes are conducted by five employees. The five employees are the sales clerk, warehouse clerk, accountant 1, accountant 2, and the collection clerk. A description of their duties is as follows:

- a. The sales clerk receives customer orders by phone. She prepares a four-copy sales order form. She files one copy, one copy goes to the warehouse clerk, one copy goes to accountant 1, and one copy is mailed to the customer.
- b. After receiving a sales order, the warehouse clerk prepares a packing slip, takes the proper items from the warehouse, and ships them with the packing slip enclosed. The sales order is stamped with the ship date, and the shipping log is updated. The sales order is filed by customer number.
- c. After receiving the sales order from the sales clerk, accountant 1 reviews the customer records and either approves or disapproves customer credit. If he approves the customer's credit, he stamps the sales order “approved” and forwards it to accountant 2. Accountant 1 prepares a three-copy invoice. One copy is mailed to the customer, one copy is forwarded to accountant 2, and one copy goes to the collection clerk.
- d. Accountant 2 matches the approved sales order to the invoice and files these by customer number.
- e. After receiving a copy of the invoice, the collection clerk posts the sale to the sales journal and the accounts receivable subsidiary ledger. Daily totals from the sales journal are sent to accountant 1, and she posts these sales summaries to the general ledger.
- f. A mail clerk forwards customer checks to the collection clerk. The collection clerk stamps the check “For Deposit Only” and records it in the accounts receivable subsidiary ledger. The check is also recorded in the cash receipts journal by the collection clerk. The collection clerk deposits checks in the bank account weekly. A weekly summary of cash receipts is forwarded to accountant 2, and she records these summaries in the general ledger.

**Required:**

- a. Draw two process maps to reflect the sales processes and collection processes at Kingston. The student website has a document flowchart in an Excel file for your reference.
  - b. Describe any weaknesses in these processes or internal controls. As you identify weaknesses, also describe your suggested improvement.
  - c. Draw two new process maps that include your suggested improvements. One process map should depict the sales processes, and the second process map should depict the cash collection processes.
- 64** Katrugi, Inc., has five departments that handle all sales, billing, and collection processes. The five departments are sales, billing, accounts receivable, warehouse, and general ledger. These processes occur as follows:
- a. A customer mails a purchase order to Katrugi, and it is forwarded to the sales department.
  - b. A sales clerk in the sales department prepares a four-copy sales order. Two copies are forwarded to billing, one copy to the warehouse, and one copy to general ledger. The sales clerk posts the sale to the sales journal.
  - c. Upon receiving the sales order, the warehouse picks goods from the warehouse, updates the inventory subsidiary ledger, and ships the goods to customers. The copy of the sales order is given to the common carrier to accompany the shipment.
  - d. Upon receiving the sales order, the billing department looks up prices in the price list and adds these prices to the sales order. One copy is sent to the customer as the invoice. The second copy is forwarded to accounts receivable.
  - e. Upon receiving the sales order from billing, the accounts receivable temporarily stores the sales order until the customer mails a check and remittance advice to accounts receivable. The accounts receivable department matches the check to an open sales order, posts to the accounts receivable subsidiary ledger and the cash receipts journal, and deposits checks in the bank daily.
  - f. Upon receiving the sales order from the sales department, the general journal and general ledger are updated.

**Required:**

- a. Draw two process maps to reflect the business processes at Katrugi. One process map should depict the sales processes, and the second process map should depict the cash collection processes.

- b. Describe any weaknesses in these processes or internal controls. As you identify weaknesses, also describe your suggested improvement.
- c. Draw two new process maps that include your suggested improvements. One process map should depict the sales processes, and the second process map should depict the cash collection processes.

**65** Inner Artist is a retailer of arts and craft supplies in the suburban Chicago area. It operates a single retail store and also has extensive catalog sales on account to area schools, churches, and other community organizations. Retail customers pay for supplies with cash, check, or credit card at the time of the sale. Occasionally, a credit customer may come into the store and purchase supplies on account. In such cases, the sales clerk is required to have the sale approved by the manager. The manager will authorize the sale if he or she recognizes the customer. The sales clerk must complete a charge slip for each sale on account.

At the end of each shift, the sales clerk prepares a summary of cash collections. This report is forwarded to the accounting department. The charge slips are forwarded to the accounts receivable department at this time.

The supervisor in the accounts receivable department verifies the information on the charge slip. Prices are matched with an approved price list. If errors are found, they are manually noted on the charge slip. A sales invoice is then prepared by the accounts receivable supervisor. The accounts receivable clerk mails the invoice to the customer.

The accounts receivable supervisor enters invoices in the computer system each afternoon. At this point, the accounts receivable subsidiary ledger is created and details of the sale are forwarded to the accounting department. At month's end, the accounts receivable supervisor prints a monthly report of the accounts receivable subsidiary ledger and list of past-due accounts. These reports are filed and referred to in cases of customer complaints or payment problems.

A cashier supervises the sales clerks and performs the basic cash collection functions. The cashier opens the mail each day and stamps the check "For Deposit Only," with the company's endorsement and bank account number. Checks are compared with any supporting remittance advice received with the check, and a daily listing of mail collections is prepared. Two daily deposits are prepared: one for the mail collections and another for cash register collections. A duplicate copy of all deposit slips is maintained by the cashier for use in the preparation of the monthly bank reconciliation.

In the accounting department, a staff accountant receives documentation of cash collections from sales clerks and the cashier. The staff accountant uses the information to prepare the journal entry for posting to the general ledger. When all of the collections have been entered, the remittance information is transmitted electronically to the accounts receivable supervisor for purposes of updating the accounts receivable subsidiary ledger for the day's collections.

Monthly account statements are prepared by the staff accountant and mailed to all customers. If a customer's account remains unpaid for six months, the staff accountant will notify the accounts receivable supervisor to write off the account as uncollectible. At this time, the credit manager is also notified of the account status so that additional credit will not be granted to this customer.

**Required:**

From the facts of this scenario, describe the internal control risks associated with Inner Artist's internal controls over the revenues and cash collection processes. Prepare a business memo, addressed to Amanda Michelson, the company's owner/operator, describing your recommendations for correcting each of these problems.

- 66** Lewis LLC is in the process of updating its revenues and receivables systems with the implementation of new accounting software. James Holden, Inc., is an independent information technology consultant who is assisting Lewis with the project. James has developed the following checklist containing internal control points that the company should consider in this new implementation:

- Is the sales department separate from the credit office and the IT department?
- Are all collections from customers received in the form of checks?
- Is it appropriate to program the system for general authorization of certain sales, within given limits?
- Are product quantities monitored regularly?
- Will all data entry clerks and accounting personnel have their own PCs with log-in IDs and password protection?
- Will different system access levels for different users be incorporated?
- Will customer orders be received via the Internet?
- Has the company identified an off-site alternative computer processing location?
- Does the project budget include line items for an upgraded, uninterrupted power source and firewall?

- Will the system be thoroughly tested prior to implementation?
- Will appropriate file backup procedures be established?
- Will business continuity plans be prepared?
- Will an off-site data storage exist?
- Will intrusion detection systems be incorporated?

**Required:**

Describe the control purpose of each of the points presented.

- 67** Niagara Pediatrics is a partnership of 6 pediatrician owners, 2 nurse practitioners, 10 nurses, 3 accounting clerks, 2 receptionists, and an office manager. The office manager and all of the accounting clerks have their own PCs, and the receptionists share a PC.

These PCs are connected through a local area network. They are password protected, and the managing partner keeps a record of all passwords. The practice uses a standard medical-services software package that cannot be modified. Following is a description of the revenues and cash collections processes used in this medical practice:

Most patients receive medical attention after insurance coverage has been verified by the office manager. Upon entering the medical office, the patient presents proof of insurance to a receptionist. The insurance documentation is photocopied and immediately forwarded to the office manager for verification (while the patient is in the waiting room). In some situations, the office manager may extend credit on the basis of special circumstances. Approximately 20 percent of the patients pay for services with cash or check at the time of the appointment.

The attending physician must prepare a prenumbered service report at the time services are rendered to patients. Completed service reports are immediately forwarded to the first accounting clerk, who updates the report with pricing information. One copy of this report is given to the patient, and the other copy is retained by the second accounting clerk. Depending upon the patient's form of payment, the second accounting clerk will perform one of the following for each service report:

- File an insurance claim and record the related insurance company receivable for any reports that are signed by the office manager as a verification of the patient's insurance coverage.
- Record a patient receivable for any reports that are designated by the office manager as approved credit.

- Receive the cash or check from the patient and record the related cash collection in a cash receipts listing.

The second accounting clerk prepares a daily summary of patient revenues.

The first accounting clerk opens the mail each day and handles insurance company correspondences. When collections are received in the mail from insurance companies and patients, they are forwarded to the second accounting clerk for deposit. The second clerk stamps each check "For Deposit Only" and prepares a daily cash receipts listing (which also includes collections from patients who received services that day). One copy of this list is retained, and a copy is sent to the third accounting clerk. The third clerk prepares the daily bank deposit slip and retains a copy in a chronological file. This clerk also handles patient correspondences and scheduling and maintains a list of patients whose insurance coverage has been approved by the office manager.

When patient accounts are not collected within 60 days, the second clerk notifies the office manager, who analyzes the reasons for all instance of nonpayment. When the insurance company rejects the claim, the office manager reclassifies the receivable from an insurance account to a patient account. The second clerk adjusts the insurance company and patient account files for reclassifications and write-offs. This clerk maintains a listing of patients with uncollectible balances and provides an updated copy each week to the third clerk, who will not allow patients with this status to schedule new appointments.

Niagara Pediatrics uses a local CPA firm to perform various accounting functions. On a monthly basis, the firm posts the daily revenues summaries to the general ledger and prepares a trial balance and monthly financial statements. In addition, this firm accounts for the numerical sequence of service reports, files tax returns, and payroll forms, and performs the monthly bank reconciliations. The CPA firm reports directly to the managing partner of the practice.

#### **Required:**

Evaluate the information in each of the following situations as being either an internal control (1) strength, (2) weakness, or (3) not a strength or weakness.

1. Niagara Pediatrics' office manager approves the extension of credit to patients and also authorizes write-offs of uncollectible accounts.

2. Niagara Pediatrics' office manager may extend credit based on special circumstances rather than using a formal credit search and established credit limits.
3. Niagara Pediatrics extends credit rather than requiring cash or insurance in all cases.
4. The computer software package cannot be modified by the employees of the practice.
5. None of the employees who generate revenues or record revenues are able to write checks.
6. Computer passwords are known only by the individual employees and the managing partner, who has no record-keeping responsibilities.
7. Individual pediatricians document the services they perform on pre-numbered reports that are used for both recording revenues and patient receipts.
8. Insurance coverage is verified by the office manager before medical services are rendered.
9. The bank reconciliation is prepared by an independent CPA firm.
10. The sequence of prenumbered service reports is accounted for on a monthly basis by an independent CPA firm.
11. The second accounting clerk receives cash and checks and prepares the daily deposit.
12. The second accounting clerk maintains the accounts receivable records and can add or delete receivables information on the PC.
13. The second clerk receives the cash and checks and also records cash receipts.
14. Niagara Pediatrics is involved only in medical services and does not have diversified business operations.

(Excerpt from Adapted CPA Simulation Problem)

- 68 Radleigh, Inc., processes its sales and cash receipts documents in the following manner:

#### **Cash Receipts**

Each morning a mail clerk in the sales department opens the mail containing checks and remittance advices, which are then forwarded to the sales department supervisor, who reviews each check and forwards the checks and remittance advices to the accounting department supervisor. The accounting department supervisor, who also functions as the credit manager, reviews all checks for payments of past-due accounts and then forwards the checks

and remittance advices to the accounts receivable clerk, who arranges the advices in alphabetical order. The remittance advices are posted directly to the accounts receivable ledger. The checks are totaled, and the total is posted to the cash receipts journal. The remittance advices are filed chronologically.

After receiving the cash from the preceding day's cash sales, the accounts receivable clerk prepares a three-copy daily deposit slip. The third copy of the deposit slip is filed by date, and the second copy and the original accompany the bank deposit.

### Sales

Sales clerks prepare a three-copy sales invoice for each sale. The original and the second copy are presented to the cashier, while the third copy is retained by the sales clerk in the sales book. When the sale is paid for with cash, the customer pays the sales clerk, who presents the money to the cashier with the invoice copies.

A credit sale is authorized by the cashier using an approved credit list after the sales clerk prepares the three-copy invoice. After receiving the cash or approving the invoice, the cashier validates the original copy of the sales invoice and gives it to the customer. At the end of each day the cashier recaps

the sales and cash received and forwards the cash and the second copy of all sales invoices to the accounts receivable clerk. The accounts receivable clerk balances the cash received with cash sales invoices and prepares a daily sales summary. The credit sales invoices are posted to the accounts receivable ledger, and then all invoices are sent to the inventory control clerk in the sales department for posting to the inventory control catalog. After posting, the inventory control clerk files all invoices numerically. The accounts receivable clerk posts the daily sales summary to the cash receipts journal and sales journal and files the sales summaries by date.

### Bank Deposits

The bank validates the deposit slip and returns the second copy to the accounting department, where the accounts receivable clerk files it by date. Monthly bank statements are reconciled promptly by the accounting department supervisor and filed by date.

#### Required:

- Prepare a process map of these processes.
- Identify internal control weaknesses in these processes.

(Adapted CPA problem)

## Solutions to Concept Check

- (SO 2) Within the sales processes, a signed approval of a sales order indicates all except **a. the date of delivery**. When a designated employee approves a sales order, it is an indication that the sale is authorized in accordance with company policies. This means that the customer is approved, that the customer's credit status has been verified to indicate that the credit limit is not exceeded, and that the sales price is in accordance with established pricing. The date of delivery is typically beyond the control of the authorizing person, as it is dependent upon the amount of inventory in stock.
- (SO 2) An example of independent verification in the sales process is **c. proof of recorded dates, quantities, and prices on an invoice**. This is the only choice that reflects an independent verification procedure. In option a., preparation of packing lists on prenumbered forms is an example of a control over documents and records; in option b., initialing the sales order is an indication of authorization; and in option d., physical controls in record storage areas is a security measure.
- (CPA Adapted) (SO 2) The purpose of tracing shipping documents to prenumbered sales invoices would be to provide evidence that **a. shipments to customers were properly invoiced**. The forward direction of this testing verifies that the billing process was completed for this shipping transaction. Response b. is incorrect because an entire sequence of such documents would need to be verified in order to determine that there were no omissions. Response c. is incorrect because its direction of the testing is opposite; in other words, the proper starting point would be the invoice for this determination (as in question 4). Response d. is not relevant because it is concerned with the completeness of the accounting records.
- (CIA Adapted) (SO 2) The purpose of tracing sales invoices to shipping documents would be to provide evidence that **c. goods billed to customers were shipped**. The backward direction of this testing serves the purpose of verifying the existence of the transaction. Response a. is incorrect because its direction of the testing is opposite; in other words, the proper

- starting point would be the shipping document for this determination (as in question 3). Response b. is incorrect because a review of all matched invoices and shipping documents would be needed to determine whether any duplicates had occurred. Response d. is not relevant, because it is concerned with the completeness of the accounting records.
- 5 (CPA Adapted) (SO 2) To ensure that all credit sales transactions of an entity are recorded, the most effective control would be that **d. the supervisor of the billing department matches prenumbered shipping documents with entries recorded in the sales journal**. This test addresses the completeness of accounting records. Response a. is incorrect, because agreement of the records does not necessarily ensure that there are no omissions. Responses b. and c. are incorrect, because they address the accuracy and authorization of the account balances, respectively, rather than completeness.
- 6 (CPA Adapted) (SO 3) Under a system of sound internal controls, if a company sold defective goods, the return of those goods from the customer should be accepted by the **a. receiving clerk**. Since the receiving clerk is independent of all related record-keeping functions, this is the correct response. Each of the other responses involves record-keeping functions that would violate internal controls regarding adequate segregation of duties.
- 7 (SO 3) The source document that initiates the recording of the return and the adjustment to the customer's credit status is the **c. credit memorandum**. Option a., a pick list, provides detail of the items to be pulled from inventory to fulfill a customer's order; option b., a sales journal, is the record of sales transactions; and in option d., a sales invoice, provides details of a sale and requests payment from the customer.
- 8 (SO 4) The choice which is not a document that is part of the cash collection process is a **d. Packing slip**. This is part of the sales process. Each of the other options relates to a document that is part of the cash collection process.
- 9 (SO 4) **c. The employee who opens mail containing checks prepares a list of checks received** is the statement that would represent proper segregation of duties. This involves preparation of the daily cash receipts listing, which is typically performed by the person who opens the mail. Each of the other options describes a scenario lacking in proper controls regarding segregation of duties.
- 10 (CPA Adapted) (SO 4) Immediately upon receiving checks from customers in the mail, a responsible employee working in an environment of adequate internal control should prepare a listing of receipts and forward it to the company's cashier. A copy of this cash receipts listing should also be sent to the company's **a. treasurer for comparison with the monthly bank statement**. Response b. is incorrect because internal auditors are not part of a company's routine processing. Response c. is incorrect because the accounts receivable subsidiary ledger should not be updated before a cash receipts journal is prepared and the receipt has been matched with an outstanding invoice. Response d. is incorrect because the bank would not be involved in reconciliation of the company's cash transactions.
- 11 (CIA Adapted) (SO 4) If a company does not prepare an aging of accounts receivable, the account most likely to be misstated is the **d. allowance for uncollectible accounts**. An accounts receivable aging report is used to analyze customer balances according to the respective lengths of time that have elapsed since payment was due. This helps determine the collectibility of customer accounts, which is the foundation of the allowance for uncollectible accounts.
- 12 (SO 6) When a company sells items over the Internet, it is usually called e-commerce. There are many IT risks related to Internet sales. The risk of invalid data entered by a customer would be **b. processing integrity risk**. Option a., availability risk, relates to service denial due to system failures or attacks; options c. and d., security risk and confidentiality risk, relate to unauthorized access, network break-ins, and repudiation of sales.
- 13 (SO 6) The risk of hardware and software failures that prevent website sales would be an **a. availability risk**. Option b., processing integrity risk, relates to invalid, incomplete, or erroneous data; options c. and d., security risk and confidentiality risk, relate to unauthorized access, network break-ins, and repudiation of sales.
- 14 (SO 7) The use of EDI to conduct sales electronically has risks and benefits. **d. Shorter inventory cycle time** is a benefit of EDI, rather than a risk. This makes it possible for the company to reduce its inventory levels and replenish those inventory levels more quickly, as a result of the time savings realized from avoiding keying, keying errors, and mail delays. Option a., incomplete audit trail, is an example of a processing integrity risk associated with EDI; options b. and c.,

- repudiation and unauthorized access, relate to security and confidentiality risks associated with EDI.
- 15 (SO 8) An IT system that uses touch screens, bar-coded products, and credit card authorization during the sale is called a **c. point of sale system**. Option a., EDI, involves inter-company exchanges of standard business documents; option b., e-commerce, uses electronic processing for Internet-based sales
- transactions; and d., e-payables, uses electronic processing of payments.
- 16 (SO 9) **d. Promotional price discounts** are not a method of unethically inflating sales revenue unless the discounts are not part of the company's customary promotions or are used with excessive coercion. Each of the other options is unethical, because it involves the artificial inflation of revenue.

# Expenditures Processes and Controls—Purchases

### STUDY OBJECTIVES

This chapter will help you gain an understanding of the following concepts:

1. An introduction to expenditures processes
2. Purchasing processes and the related risks and controls
3. Purchase return processes and the related risks and controls
4. Cash disbursement processes and the related risks and controls
5. An overview of IT systems of expenditure and cash disbursement processes that enhance the efficiency of expenditures processes
6. Computer-based matching of purchasing documents and the related risks and controls
7. Evaluated receipt settlement systems and the related risks and controls
8. E-business and electronic data interchange (EDI) systems and the related risks and controls
9. E-payables systems
10. Procurement cards
11. Ethical issues related to expenditures processes
12. Corporate governance in expenditures processes

This chapter examines purchase expenditure processes. The Real World example on the next page will help you understand the context of many concepts included in this chapter. Please read that Real World example to begin effective reading and studying of this chapter.

### Introduction to Expenditures Processes (Study Objective 1)

In a large company, there may be thousands of purchasing transactions occurring each day. The company must have systems and processes in place to capture, record, summarize, and report these transactions. The processes are the policies and procedures that employees follow in completing the purchase of goods, services or materials, capturing vendor data and purchase quantities, and routing the resulting purchasing documents to the proper departments within the company. Exhibit 9-1 highlights the expenditures processes section of the overall accounting system.

When a purchase occurs, the information resulting from that purchase must flow into the purchase recording systems, the accounts payable and cash disbursement systems, and the inventory tracking systems. In IT accounting systems, these recording and processing systems are called **transaction processing systems (TPS)**. Thus, there is a set of processes within the company to conduct purchases and route purchasing information, and there is a TPS within the IT system to record, summarize, and report these purchasing transactions.

Every company acquires materials or goods and must therefore have expenditures. It is a fundamental process of all businesses as they buy the resources needed to conduct operations, record the resulting liability, and eventually pay the vendor. This process is somewhat similar to the revenue processes discussed in Chapter 8, except that goods and cash

## The Real World



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Organizations not only pay the purchase price of inventory and supplies that they acquire, but they also pay a cost to conduct purchases and payments for purchases. This cost is the wages and salaries that organizations pay to employees involved in purchasing and payment activities.

Many organizations continuously look for ways to reduce this cost by improving the efficiency of the purchasing and payment processes. General Electric Co. (GE) implemented a Web-based electronic invoice presentment (EIP) system in which its small and midsize vendors send invoices electronically via the Web. This process allowed GE to avoid the time and cost of receiving and entering paper invoices into its IT system. GE agreed to pay its vendors within 15 days in return for a 1.5 percent discount for invoices submitted under the EIP system. On the other hand, any paper invoices would be paid in 60 days. Within six months of implementing the new system, "more than 15,000—or 45 percent—of GE's vendors signed up for electronic presentment."<sup>1</sup> This resulted in a 12 percent reduction in the cost of payables processing.

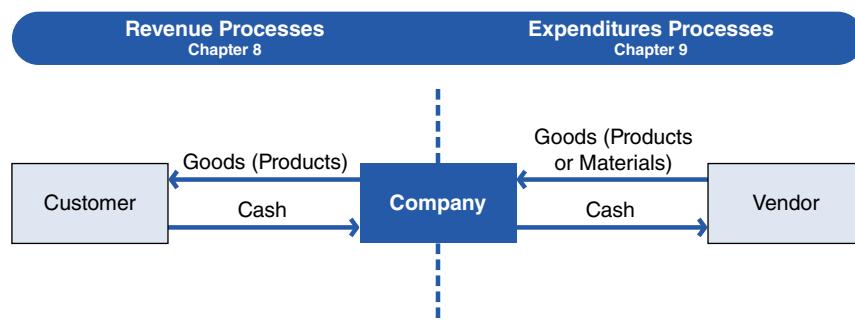
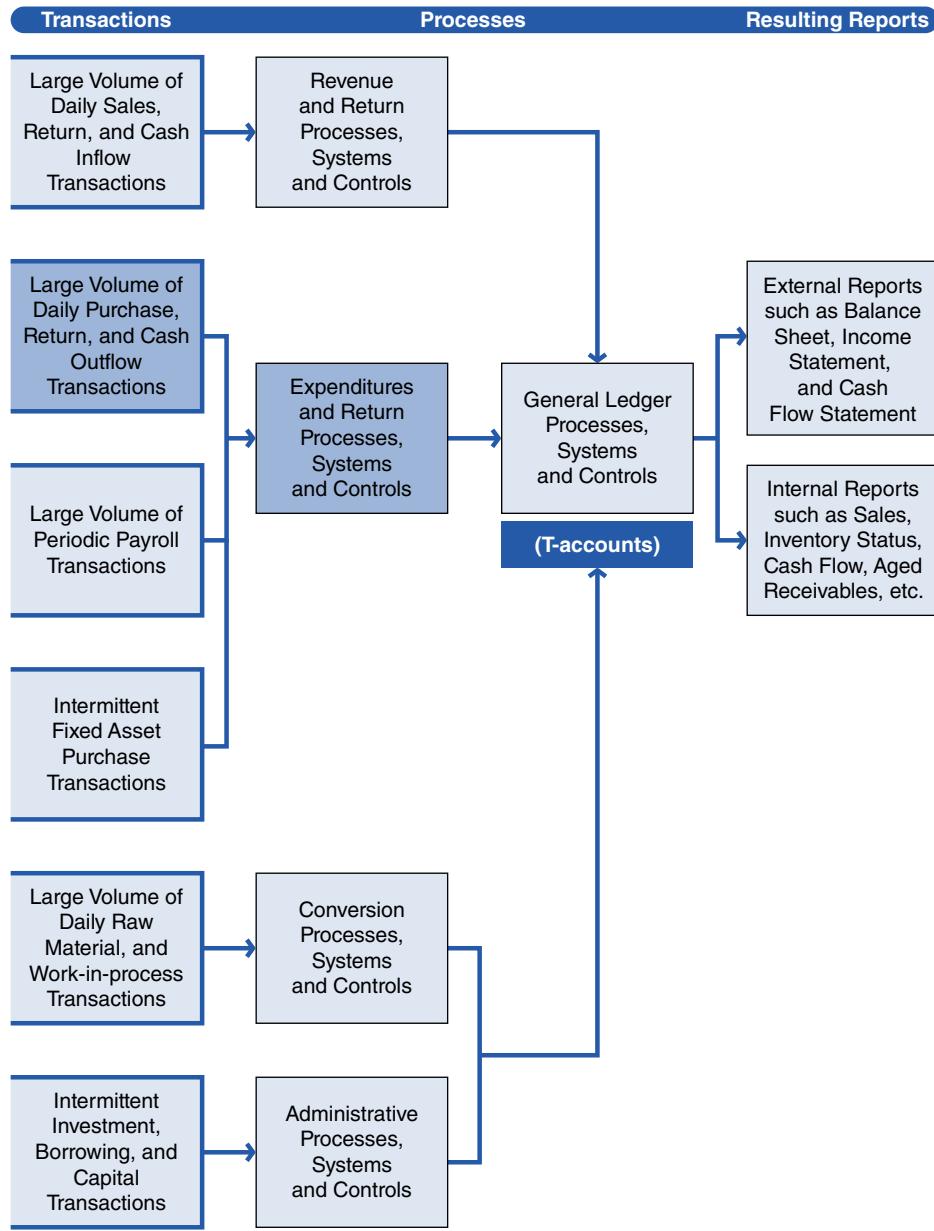
This example demonstrates the importance of well-managed processes for purchasing, receiving, and paying for inventories and supplies.

flow in opposite directions. As shown in Exhibit 9-2, goods flow away from the company in the revenue process, whereas they flow into the company in the expenditures process. Likewise, cash is collected by the company in the revenue process, whereas it is paid out in the expenditures process. Accordingly, the company is a **vendor** from the customer's perspective, and the company is a customer from the vendor's perspective. Accountants must always be mindful of the processing flow of the transaction in order to properly recognize it.

There are many different kinds of resources that may be needed to run a business, such as materials, supplies, equipment, facilities, and a skilled workforce, to name a few. Because of the large volume of expenditures transactions that most companies process and the differing nature of these transactions, this text will divide the expenditures process into two parts. Part 1 addresses purchases of materials and supplies and the related cash disbursements, sometimes known as the procurement or purchasing process. Part 2, which is presented in Chapter 10, examines special procedures related to processing payroll and purchasing property, plant, and equipment.

Much like the methods of earning revenue presented at the beginning of Chapter 8, there is great variety in the purchasing activities of businesses. A merchandising company, such as Banana Republic, will purchase finished merchandise that it will sell to its retail customers, whereas a manufacturing company, such as General Electric, will purchase raw materials that will be transformed into new products. Even companies in the same line of business are likely to have differences in their purchasing habits, as they may have unique characteristics in terms of product features, business practices, storage capacities, and vendor relationships.

<sup>1</sup> Suzanne Hurt, "Why Automate Payables and Receivables?" *Strategic Finance*, April 2003, p. 2.



**EXHIBIT 9-2** Comparison of the Revenue and Expenditures Processes

Most companies acquire their resources on credit terms and pay for them at a later date. This chapter concentrates on purchasing and cash disbursement transactions common to a wide range of companies that acquire an inventory of goods or materials from other companies on account and sell goods or products to other companies. Not every company will carry out its expenditures processes exactly as depicted here, but this chapter provides a practical presentation of a typical approach.

The most common expenditures processes include the following:

- Prepare a purchase requisition and/or purchase order for goods or services needed.
- Notify the vendor (supplier) of goods or services needed.
- Receive goods or services, often via common carrier. A **common carrier** is a trucking, rail, or air freight company.
- Record the invoice and corresponding accounts payable transaction.
- Pay the resulting invoice.
- Update the records affected, such as accounts payable, cash, inventory, and expenses.

The first part of this chapter describes a typical purchasing system, which includes three primary categories of processes: purchasing processes, purchase return processes, and cash disbursement processes (or payments). In addition, controls and risks related to these processes are presented. For each category, the goal of the system's internal controls is to reduce the following types of business risks:

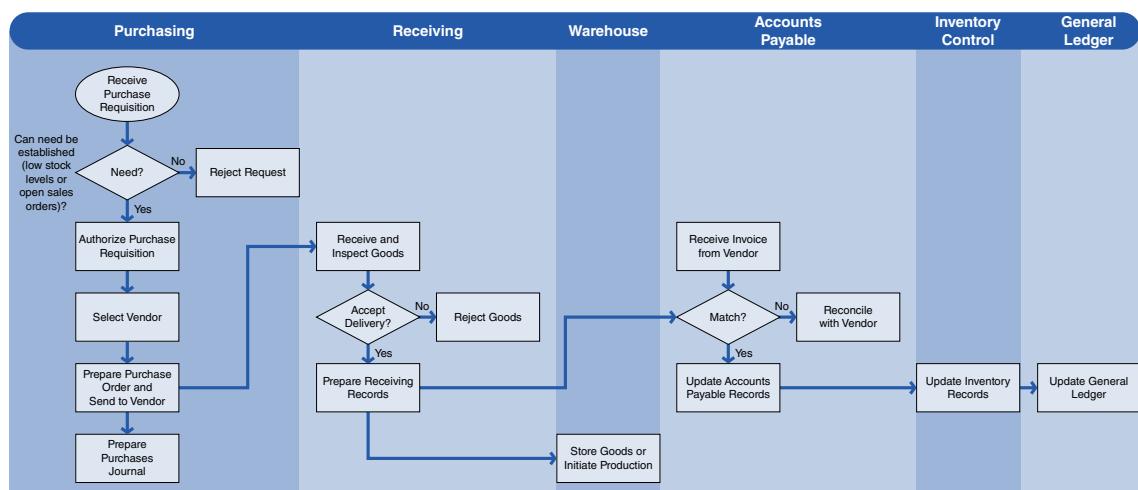
1. Invalid (fictitious or duplicate) transactions may have been recorded.
2. Transactions may have been recorded in the wrong amounts.
3. Actual transactions may have been omitted from the accounting records.
4. Transactions may have been recorded to the wrong vendor account or wrong account number.
5. Transactions may not have been recorded in a timely manner.
6. Transactions may have been accumulated incorrectly or transferred to the accounting records incorrectly.

This chapter also examines computer-based purchasing and cash disbursement systems. Finally, some prevalent business ethics and corporate governance topics related to the expenditures processes are presented in the latter part of the chapter.

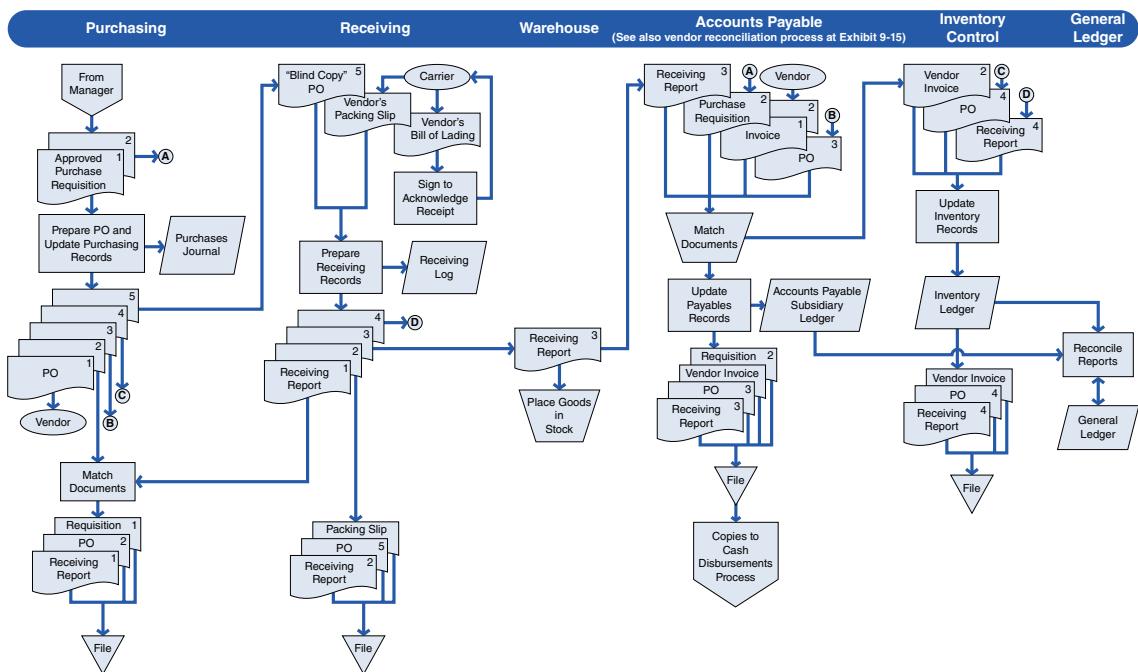
## Purchasing Processes (Study Objective 2)

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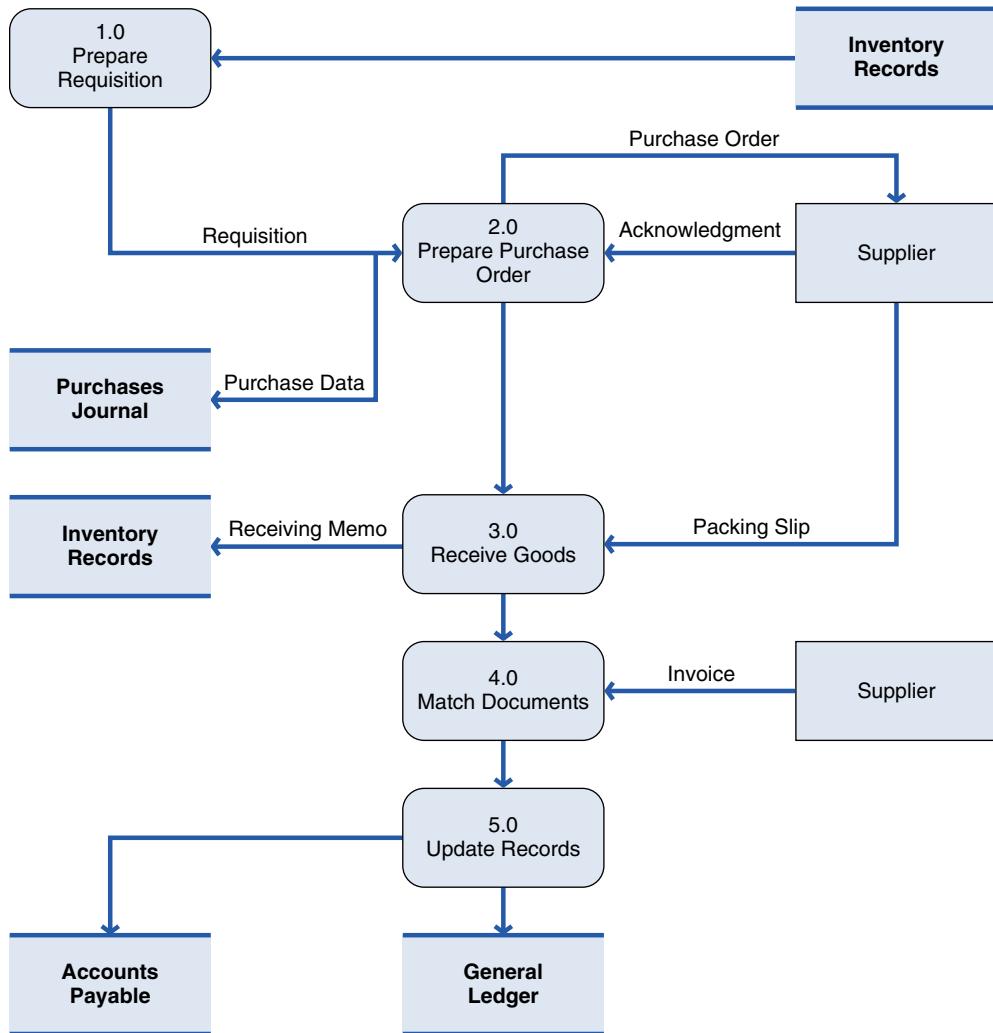
The business process map in Exhibit 9-3 illustrates the flow of activities in a typical purchasing system. Exhibit 9-4 is a document flowchart depicting the related records used in a purchasing system. Exhibit 9-5 is a data flow diagram of the purchasing processes. This process begins when an employee of the company recognizes the need to make a purchase, typically as a result of observing low inventory levels or unfilled sales orders. Purchasing needs may change daily with the occurrence of shipping and receiving transactions, production transfers, and new sales orders. It may be that a warehouse attendant notices a particularly low stock level, an accountant detects potential shortages in documented inventory quantities, an operations manager becomes aware of additional quantities that will be needed to produce upcoming sales orders, or an IT system signals when an order is necessary. Regardless of the manner in which the purchase is initiated, the appropriate **purchase requisition** form should be prepared to document the need and request that the specific items and quantities be purchased. A purchase requisition must then be authorized by a designated member of management. The purchase requisition triggers the next steps in the purchase process.



**EXHIBIT 9-3** Purchasing Process Map



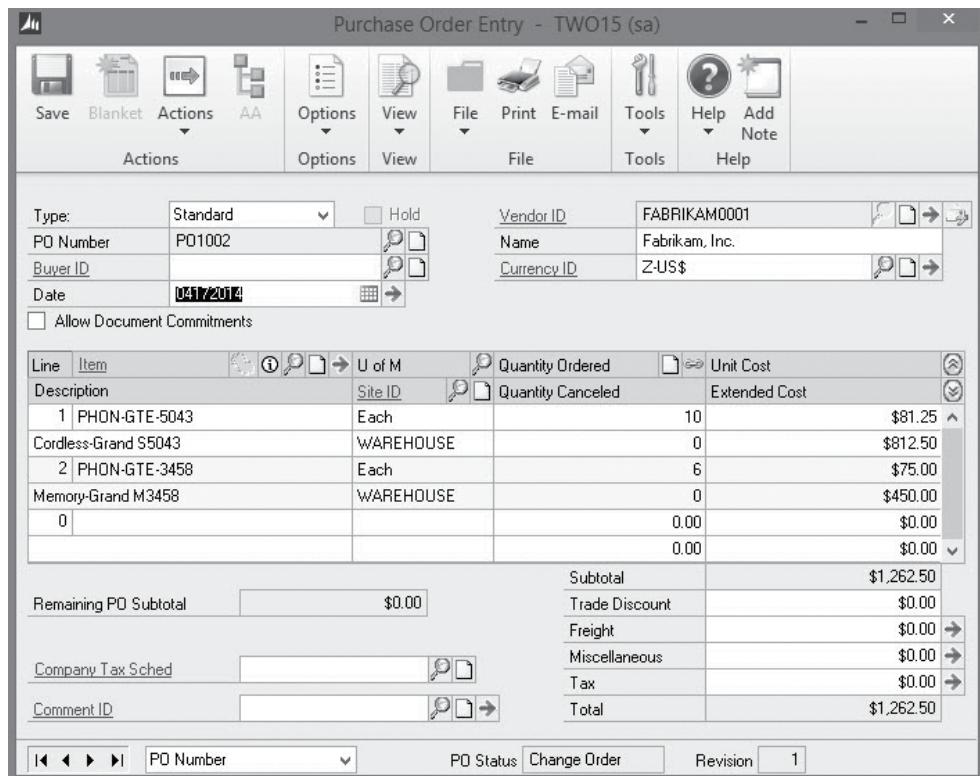
**EXHIBIT 9-4** Document Flowchart of the Purchasing Processes



**EXHIBIT 9-5** Purchasing Processes Data Flow Diagram

Once a purchase requisition has been approved, it will be forwarded to the purchasing department within the company, where a purchase order form is prepared. A **purchase order (PO)** is a document issued to a seller by a buyer that indicates the details—products, quantities, and agreed-upon prices—for products or services that the seller will provide to the buyer. Exhibit 9-6 shows the establishment of a PO in Microsoft Dynamics GP. A designated purchasing agent will determine the vendor to whom the PO will be sent, usually by reviewing vendor records for favorable pricing, delivery, or credit terms. It may also be necessary to check the company's credit status with the chosen vendor to be sure the vendor will accept the order. If the company already has open (unpaid) POs with this vendor, an additional order may cause it to exceed its credit limit. In that case, the company may need to make a prompt payment, prepay the present order, or negotiate increased credit terms.

A PO may be communicated to a vendor via telephone, in hard-copy form via fax or mail, or electronically via e-mail or directly through the computer network. In manual systems, purchasing department personnel record the transaction in a **purchases journal**, which is a chronological listing of all POs issued to vendors.



**EXHIBIT 9-6** Creating a Purchase Order in Microsoft Dynamics GP

Alternatively, software systems, such as Microsoft Dynamics GP, may automatically record the purchases.

When goods are received from the vendor, they generally are delivered via common carrier, such as a trucking or rail company. All goods received should be inspected by company personnel in the receiving area. The quantity should be counted, and the usable condition of the goods should be assessed to determine any damage or substitutions. The receiving clerk is responsible for counting and inspecting all items received and documenting the details of the receipt before the carrier leaves. The receiving clerk can help reduce the risk of error or fraud related to purchases by performing special procedures designed to determine the propriety of goods received. The purchasing department can prepare a “blind” copy of each PO. A **blind purchase order** includes information from the PO, but it omits data about the price and quantity of the item(s) ordered. It may also contain critical information such as quantity limits and quality specifications. With a blind PO, the receiving clerk can make sure that the receipt represents a valid PO, yet it still forces the performance of an independent check of the quantity and quality of the delivery. Even when blind copies of POs are not provided, a receiving clerk should not have access to the original POs. When receiving clerks are denied access to PO prices and quantities, it becomes nearly impossible for them to hurriedly accept a delivery without taking time to verify its accuracy.

A copy of the vendor’s bill of lading typically accompanies goods received from the common carrier. A **bill of lading** provides details of the items included in the delivery, and the receiving clerk must sign that form as verification of receipt. The vendor’s packing slip may also accompany the shipment. The **packing slip** is intended to show quantities and descriptions of items included in the shipment, but it does not generally include prices. A **receiving report** is then prepared by the

receiving clerk, detailing the contents and condition of the receipt. A **receiving log** should also be maintained as a sequential listing of all receipts. When accounting software is used to record purchasing and receiving transactions, the software maintains a receiving log and updates inventory balances. Exhibit 9-7 shows the receiving screen in Microsoft Dynamics GP.

In Microsoft Dynamics GP, the receiving report can be entered without reentry of the details and items on a PO. The PO can be viewed on the screen and items received from that order can be recorded. This electronically matches the PO with the receiving report and creates necessary adjustments if the PO and receiving report do not match. Later when the invoice is received, the PO and receiving report can then be matched with the vendor invoice electronically. This automated match saves time and reduces errors in the purchasing process. While many fully integrated accounting/ERP systems like Microsoft Dynamics GP have automated matching functionality, companies who purchase, receive, and sell inventory should make sure they select a system that includes this functionality.

Theoretically, as soon as a company receives goods, it is obligated to pay for those goods. In practice, however, many companies wait to record the liability until the related invoice is received from the vendor. This is typically not a problem when the vendor is prompt in sending its invoice. However, there may be a lag in timing. When a receipt of goods occurs before the end of the period, but the related invoice is delayed until after the end of the period, a problem arises related to recording the liability in the correct period. This is called a **cutoff** is the date for the end of the

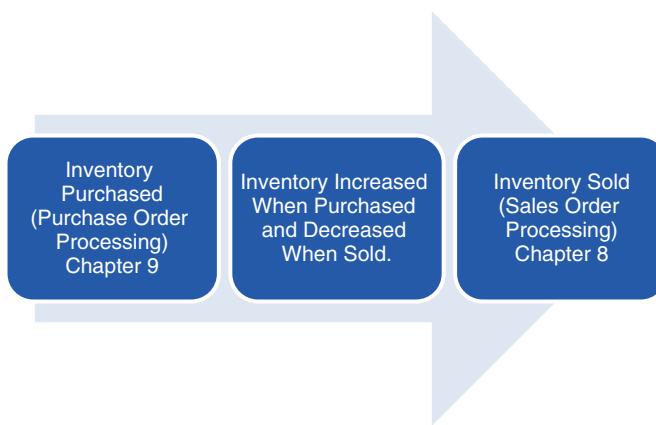
**EXHIBIT 9-7** Entering Purchase Receipts in Microsoft Dynamics GP

accounting period. The accounts payable department should establish specific procedures to avoid cutoff issues. The liability and the inventory receipt must be recorded in the same period as the physical receipt of goods. If goods have arrived, but the related invoice is still outstanding at the end of the period, the accounts payable department should determine (or estimate) the amount owed to the vendor, in order to accrue the liability and recognize the receipt of these items in the proper period.

The accounts payable department is responsible for recording the liabilities for goods received in the accounting records. Caution must be exercised to be certain that vendor invoices represent goods that were actually ordered and received. The accounts payable department maintains copies of purchase orders and receiving reports so that the documents can be compared before the accounting records are updated. This comparison helps ensure that invoices represent goods actually ordered and received. Also, the accounts payable department will ensure that the correct vendor account is immediately adjusted for each purchase transaction so that the company will know the correct amount owed to the vendor. An **accounts payable subsidiary ledger** includes the detail of amounts owed to each vendor. Finally, the accounts payable department maintains a file of outstanding invoices awaiting payment. This file is usually organized in alphabetical order by vendor name. A copy of the invoice is also given to the cash disbursements department, where it is filed by due date or by the discount date, such as 10 days after invoicing for 2/10, n/30 terms.

In many organizations, the purchasing and procurement process involves the purchase and distribution of inventory. Many of the items a company purchases and receives often involve inventory items. Therefore, the inventory control process is considered to be a part of the purchasing process. A company maintains inventory control by keeping inventory records, which must be increased for the proper item, quantity, and dollar amount each time an inventory purchase occurs.

Increasingly, firms are finding that a fully integrated ERP system is required to efficiently manage the purchase and distribution of inventory. Often referred to as Supply Chain Management (SCM), the purchasing and procurement function addresses the purchasing of inventory, supplies, and services. In Microsoft Dynamics GP, this functionality is found in the purchase order processing module, where purchase orders are created and later automatically matched with receiving reports (when inventory is received) and then a vendor invoice (when the vendor bills for the inventory purchased). When a company sells inventory, customer quotes, orders, and invoices are processed in the Sales Order Processing Module. This functionality was discussed in Chapter 8. The SCM process, as it relates to inventory purchases and sales, is described in Exhibit 9-8.



**EXHIBIT 9-8** The SCM Process, as it Relates to Inventory Purchases and Sales

It is critical for companies that purchase and distribute inventory to utilize a fully integrated ERP solution so that all related transactions can be updated as each transaction occurs. Companies that do not have a fully integrated system are finding they are at a competitive disadvantage, as manual or disparate process are time consuming, error prone and fail to provide sufficient visibility to important information needed.

The following Real World example describes how City Harvest, a New York City food rescue organization was able to double its deliveries without increasing costs as a result of implementing a fully integrated ERP system (Microsoft Dynamics GP) and a Customer Relationship Management (CRM) system. City Harvest's utilization of Microsoft Dynamics GP to manage inventory in its SCM processes was a critical component of its success in doubling the distribution of inventory while not increasing costs.

## The Real World

### **City Harvest—New York City food rescue organization doubles deliveries without increasing costs**

Packaging food for victims of Hurricane Sandy



David Joel / Getty Images

City Harvest has 30 years of experience making the fastest connection between a donor with excess food and a person in need. Now, it's making an even bigger difference. By improving

internal efficiencies and external relationships using Microsoft Dynamics software, City Harvest has nearly doubled its rescued food deliveries while keeping costs the same.

Ending hunger for more than one million people in the Big Apple: it's a vision that City Harvest is pursuing with passion. In Fiscal Year 2013, the food rescue organization estimated that it would collect more than 42 million pounds of excess food from 2,500 donors including restaurants, grocers, corporate cafeterias, manufacturers, and farms. Using trucks and bicycles, City Harvest delivers the food, usually the same day or the next day, free of charge to some 600 community food programs, which then distribute food to hungry people throughout the New York City. Produce constitutes 60 percent of the food that City Harvest distributes, and nutrient-dense food (including produce, protein, and low-fat dairy) constitutes about 70 percent. The organization must move these perishables rapidly, efficiently, and strategically from donors to recipients.

In 2011, City Harvest embarked on a five-year plan to double the amount of food it distributed annually while significantly expanding its work in high-need communities. Goals included delivering an additional 30 million pounds of food a year and raising \$30 million more in financial donations by 2016. The organization's leaders recognized that achieving these aggressive growth goals would require significant process and efficiency improvements, so they set out to identify technology tools that could help them more efficiently track food donations (the company's inventory), oversee operations, and set a course to fulfill the organization's strategic objectives.

### **Getting Equipped for its Mission of Growth**

To accommodate growth without increasing costs, City Harvest worked with a Microsoft Dynamics Value Added Reseller to deploy Microsoft Dynamics GP (Great Plains) on-premises and Microsoft Dynamics CRM (Customer Relationship Management) Online.

City Harvest chose Microsoft Dynamics software because of its financial, supply chain, and customer relationship management (CRM) capabilities, as well as its flexibility and ease of configuration. City Harvest uses Microsoft Dynamics software out of the box, with no customization. The Microsoft Dynamics

CRM-to-GP Adapter and the extenders available in the Microsoft Dynamics application programming interfaces (APIs) connect components to create a unified enterprise resource planning (ERP) and CRM solution that includes:

- General ledger and inventory management capabilities in Microsoft Dynamics GP.
- Integrated donor and CRM powered by Microsoft Dynamics CRM.
- Food allocation software to automate food distribution across emergency food programs.
- Roadnet Route Planning Software to guide drivers on delivery routes.

### **Twice the Food Distributed, More Food Donors Engaged, No Increase in Cost**

During its busiest season in 2012, City Harvest doubled donations compared to the same period in 2011, yet it was able to keep delivery costs from increasing. That is a significant accomplishment. Matt Reich, City Harvest's VP of Operations, outlined that Microsoft Dynamics GP and CRM allowed the organization to handle the doubling of food donations extremely efficiently. He argued that the company wouldn't have been able to grow that quickly without the system and technology improvements added by Microsoft Dynamics GP and CRM.

Its success is built on relationships, and effectively sourcing more food hinges on City Harvest's ability to develop a thriving donor support system. City Harvest is succeeding with Microsoft Dynamics CRM; in fact, the donor development team uses the marketing module to track prospective food donors. Since it began using Microsoft Dynamics CRM, City Harvest has added 2,000 new food donors to its records.

A dashboard with a prospect pipeline helps the team track opportunities and project donations for the coming year. "Microsoft Dynamics CRM is pivotal in our drive to increase food donors and food donations, and maintain and deepen relationships," says Reich, VP of Operations.

### **Streamlined Processes, Better Stewardship**

To onboard new agencies and to document audits for regulatory compliance, City Harvest

personnel use forms in Microsoft Dynamics CRM running on tablet computers. This data is then exported to Microsoft Dynamics GP. "New online electronic records and data are easily searchable and accessible from anywhere," says Reich.

As a result, Microsoft Dynamics GP and CRM have increased data visibility and improved communication across the donor and customer chain. More efficient route scheduling enables City Harvest to retrieve and deliver more food per trip on its daily routes. The organization plans to extend inventory management to delivery drivers on Windows 8-based handheld devices to give them real-time access to the system from anywhere.

### Strategic Distribution, Informed Decisions

Armed with real-time inventory data, City Harvest can make decisions about the most effective use of food donations. When butternut squash comes off the vine in late summer, City Harvest wants to ensure that it doesn't end up with more than people will consume, explains its VP of Operations. "With our inventory management tools, we can make the decision to accept or refer a donation based on facts—real-time information stored in Microsoft Dynamics GP. After implementing Microsoft Dynamics GP, the food managers have access to inventory and outstanding sales orders and can see their current needs as well as expected future needs.

### Managing a Growing Inventory

In 2013, City Harvest expanded its use of Microsoft Dynamics GP from core financials, to also include inventory management. At any given time, the organization had 600,000–700,000 pounds of food in inventory. Microsoft Dynamics GP improved the accuracy of inventory counts and categorization. Microsoft Dynamics GP also maintains food expiration dates and other critical inventory details. Insight into inventory enabled City Harvest staff to allocate food to meet the

dietary needs of specific groups and to avoid overages and supply deficits at emergency food programs.

### End-to-End Solution, Less to Manage

In 2013, over 60 percent of City Harvest's employees directly used the Microsoft Dynamics GP and CRM solution. All employees however rely on it for their jobs in some way. One of the biggest benefits of having a unified solution has been the integration, immediacy, and automated sharing of information among people and departments.

"Microsoft Dynamics touches every aspect of our operation, from finance to inventory management, to communications with our emergency food programs and food donors," says Reich. "When we create an order in Microsoft Dynamics GP for an inbound donation, Microsoft Dynamics CRM generates an email to a whole group of people who can see pending arrivals of a particular product or food type, and plan accordingly."

By choosing to deploy Microsoft Dynamics CRM Online, Reich and his colleagues avoided the initial outlay of expense for infrastructure and gained peace of mind. "The fact that CRM is running on the Microsoft servers made me much more comfortable in terms of backup, recovery, and risk avoidance," says Reich. "I like the fact that people can access it from anywhere without VPN access. The fact that it is in the Microsoft cloud is comforting and reassuring."

### Enabling Strategic Food Allocation

As of 2013, City Harvest was one year ahead of schedule on its five-year goals. That's a good thing, because hunger in New York City affects more than one million people each year according to City Harvest's Vice President of Operations. He outlined that the Microsoft Dynamics solution enabled the company to manage growth efficiently and strategically, while enabling the organization to be excellent stewards of cash and food donations.

Adapted from Microsoft City Harvest Case Study (2014)

<https://customers.microsoft.com/Pages/CustomerStory.aspx?recid=13>

In case of City Harvest, inventory was donated instead of purchased and distributed to other organizations free of charge. The organization utilized procurement, inventory control, and sales order processing modules to complete its distribution of inventory. A fully integrated ERP solution, coupled with a CRM system was critical to the efficiency and success of this process.

In the purchasing process, once transactions are completed in the purchasing modules and accounts payable and inventory subsidiary ledgers, the details of these transactions are then transferred and posted to the general ledger. The totals in the payables and inventory subsidiary ledgers can then be compared to the accounts payable and inventory control balance to ensure transactions were processed correctly and control over inventory is maintained.

## Risks and Controls in the Purchasing Process (Study Objective 2, Continued)

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As described in previous chapters, the management is responsible for implementing internal controls over each business process. Accordingly, the purchasing process needs special attention to reduce the risk of fraud or errors specific to these types of transactions. The next section identifies common procedures, organized according to the five internal control components discussed in Chapter 3.

### **Authorization of Transactions**

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Specific individuals within the company should be given authoritative responsibility for preparing purchase requisitions and POs, including approving specific items to purchase, order quantities, and vendor selection. Only those designated individuals should have the opportunity to carry out these tasks. The company should establish specific procedures to ensure that POs have been properly authorized before an order is officially placed with a vendor. The designated individual may include his or her signature or initials on a purchase requisition to indicate proper authorization. In an automated system, specific authorization for purchase transactions can be controlled by limiting access to the authorization function. This is a critical control in that no purchasing events should begin until the initial authorization occurs. In most organizations, the approval of a purchase requisition is the initial activity that triggers the remaining purchasing processes.

A company should have established guidelines for managing vendor relationships, including securing competitive bids for purchase requisitions, negotiating payment terms, and maintaining current price lists. Responsibility for these functions should be limited to designated individuals within the company.

### **Segregation of Duties**

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Within the purchasing process, the accounting duties related to requisitioning, ordering, purchase approval, receiving, inventory control, accounts payable, information systems, and general accounting should be segregated in order to meet the objectives of internal controls. In general, responsibilities for authorization, custody, and record-keeping functions should each be separated in order

to prevent the possibility of error or fraud. The authority function includes approval of purchasing transactions and certain information systems tasks such as data entry, programming, IT operations, and security. The custody function includes inventory handling and receiving, as well as the related cash disbursement duties. The record-keeping function includes preparation of POs, as well as the general accounting reports such as the purchases journals, the accounts payable subsidiary ledger, the inventory ledger, the general ledger, and financial statements.

Ideal internal controls involve complete separation of inventory custody from inventory accounting. With respect to the purchasing process, this control is especially important in reducing instances of fraud. If, on the other hand, individuals have an opportunity to both handle inventory and access the related records, theft could occur and be concealed by altering the records. If custody and record keeping are segregated, the person having access to the goods may have an opportunity to conduct the theft, but will not have the capability to alter records.

## **Adequate Records and Documents**

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Accounting personnel should ensure that adequate supporting documentation is maintained for purchasing transactions. Files should be maintained for purchase requisitions, POs, receiving reports, invoices, and so forth. These files should be organized either in chronological order by due date, in numerical sequence by form number or inventory item number, or in alphabetical order by vendor name. When documentation is well organized, a company can establish the validity of its transactions and determine whether omissions have occurred. For instance, if the purchase requisition, PO, receiving report, and invoice are each retained and matched, accounting personnel can determine that each purchasing transaction is carried out properly with respect to quantity, quality, price, vendor, timing, etc. Proper documentation also establishes an audit trail and facilitates the performance of independent checks and reconciliations.

Increasingly, companies with updated ERP systems are going paperless, with documents and transaction data being created and stored electronically. Paperless systems present a challenge for internal and external auditors who seek to ensure that sufficient documentation exists to support the transactions. This is especially true in the inventory purchasing process. The City Harvest Real World example provides an example of a paperless system in a company utilizing the Microsoft Dynamics GP purchasing process. A company utilizes a document imaging and storage application that integrates with Microsoft Dynamics GP. The automated process begins when a PO is created in Dynamics GP. It is electronically approved in the system by the purchasing supervisor and then sent to the vendor electronically. When newly-purchased inventory is received, the receiving report is completed online and automatically matched against the initial PO. When the vendor invoice is received, it is scanned into the system (or received electronically). The document imaging system retrieves the necessary information in Dynamics GP and records the vendor invoice and matches it electronically against the PO and receiving report already entered. Exceptions are noted and adjusted for by the system. The matched PO, receiving report and invoice are then filed electronically, providing an electronic audit trail. Thus, auditors must audit with the computer in this case to adequately and efficiently review supporting documentation.

## Security of Assets and Documents

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Purchasing records and programs must be protected from unauthorized access through the use of electronic controls, such as passwords, and physical controls, such as locked storage cabinets. Physical controls should also be used in the company's storage warehouse and receiving area to protect purchased items from theft.

Companies with updated ERP systems tend to have the majority of their documents and transactional data stored electronically. There are many benefits to this including cost savings from decreased storage requirements and improved access to information. Companies adopting a paperless option, or any aspect of electronic storage, must make sure the data is securely stored electronically, properly backed up, and able to be accessed and retrieved when needed. Locked storage cabinets are now becoming the exception as opposed to the norm, so companies may need to update their policies and procedures on the security of documents.

## Independent Checks and Reconciliation

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Specific internal control procedures have to be performed to achieve accountability for the purchasing process are presented next. The performance of these functions by someone independent of the related authority, custody, and record-keeping functions for the purchasing process will enhance their effectiveness. For example, periodic physical inventory counts should be reconciled with the inventory ledger and general ledger control account to make sure inventory is being properly accounted for. Significant differences may indicate that purchases have been omitted or theft may have occurred. Independent reconciliation of the accounts payable subsidiary ledger to the general ledger control account also helps ensure that transactions have been properly posted.

## Cost-Benefit Considerations

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We know from previous chapters that companies will implement internal controls only if the corresponding benefit exceeds the cost of implementation. Accordingly, the company should evaluate risks prevalent in its system before determining the mix of controls to execute. Some high-risk characteristics that might warrant the need for extensive internal controls are as follows:

1. Goods received are especially difficult to differentiate, count, or inspect.
2. High volumes of goods are often received, or the goods are of high value.
3. Inventory pricing arrangements are complex or based on estimates.
4. Frequent changes occur in purchase prices or vendors.
5. The company depends on one or very few key vendors.
6. Receiving and/or record keeping are performed at multiple locations.

When any of these circumstances exist, management should be especially mindful of related controls that could effectively prevent or detect errors or fraud that could occur.

Exhibit 9-9 summarizes examples of internal controls and the related risks that are minimized in the purchasing process. This exhibit does not include all the possible risks and controls surrounding purchasing transactions, but provides some common problems that may be encountered.

**EXHIBIT 9-9****Purchasing Controls and Risks**

<b>Control:</b>	<b>Minimizes the Related Risk of:</b>
<b>Authorization:</b> Approval of purchase transaction prior to placing an order	Invalid vendors, over-extended credit limits, unapproved pricing or quantities
<b>Segregation:</b> Separation of authorization of purchases and new vendors from custody of inventory in the receiving area	Fictitious purchases
Separation of inventory custody from the accounts payable record keeping	Fictitious purchases
Segregation of the ordering, receiving, inventory control, amounts, accounts payable, information systems, and general accounting functions	Fictitious purchases, omitted purchases, wrong vendor, timing issues
<b>Records and Documents:</b> Timely updating of the purchases journal for all purchasing transactions	Fictitious purchases, omitted purchases
Preparation of receiving reports on prenumbered forms so that the sequence of receipts can be reviewed for proper recording	Omitted purchases
Immediate preparation of receiving reports for all actual receipts of goods	Timing issues, omitted transactions, invalid purchases
Prior to recording, matching of vendor invoices with related PO and receiving report for verification of vendors, authorized prices, mathematical accuracy, account coding, quantities, and descriptions of goods	Fictitious purchases, duplicate purchases, incorrect amounts or accounts, wrong vendor, timing issues
Monthly review and reconciliation of vendor statements with accounts payable records	Omitted purchases, fictitious purchases, incorrect amounts, wrong vendor, timing issues
Requirement for accounts payable records to be updated only when receiving report verifies actual receipt of goods	Fictitious purchases, duplicate purchases, incorrect amounts, wrong vendor, timing issues
Performance of end of period review to determine whether purchases are recorded in the proper period	Timing issues, duplicate purchases, omitted purchases
<b>Security:</b> Physical controls in the warehouse, receiving, and areas with access to inventory items	Stolen goods
Physical and electronic controls covering the purchases and accounts payable records	Fictitious purchases, duplicate purchases, incorrect amounts, omitted transactions, wrong vendor, timing issues, accumulation problems
<b>Independent Checks:</b> Comparison of receiving reports with the purchases journal	Omitted purchases, duplicate purchases, incorrect amounts, wrong account numbers, timing issues
Matching of purchase records and verification for item descriptions, quantities, dates, authorized prices, and mathematical accuracy	Incorrect amounts, invalid purchases, timing issues
Review of purchases journal for mathematical accuracy, reconciliation to the accounts payable records, and correct posting to the general ledger	Incorrect amounts, incorrect accumulation or posting, omitted purchases, wrong account numbers, duplicate purchases

(continued)

**EXHIBIT 9-9** (Continued)

<b>Control:</b>	<b>Minimizes the Related Risk of:</b>
Requirement for receipts to be inspected, counted, and compared with “blind copy” POs	Fictitious purchases, duplicate purchases, incorrect quantities
Performance of physical inventory counts and reconciliation with the inventory records	Stolen goods, omitted purchases, fictitious purchases, wrong amounts, duplicate purchases, timing issues
Verification of accounts payable subsidiary ledger for mathematical accuracy and proper posting to the general ledger	Incorrect amounts, incorrect accumulation or posting, omitted purchases, wrong account numbers, duplicate purchases

## Purchase Return Process (Study Objective 3)

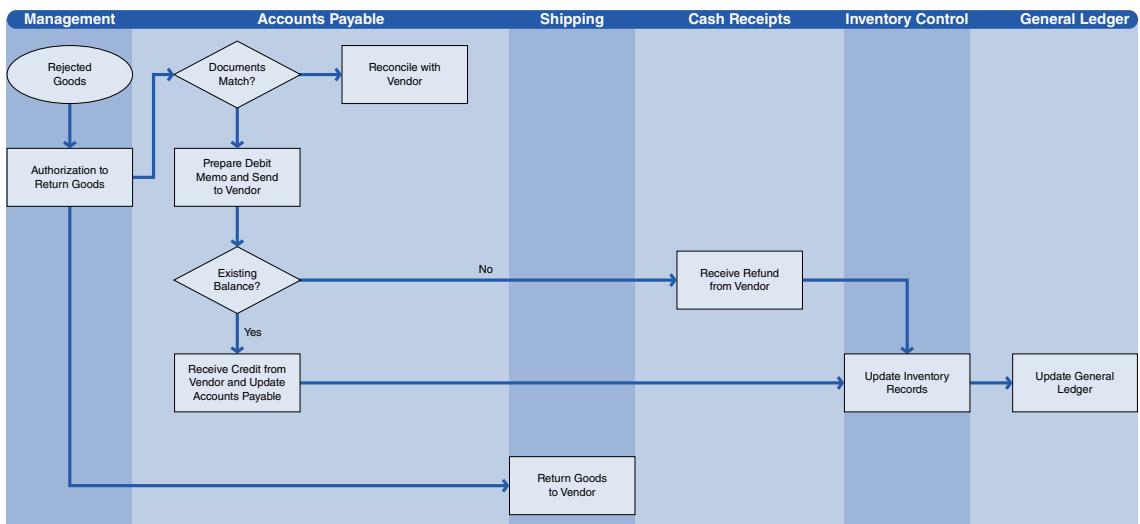
Occasionally, the company may reject goods received and initiate the purchase return process. This may occur for a variety of reasons, including the following:

1. Goods received are unacceptable due to these situations:
  - Quantity or quality discrepancies
  - Damage or defects
  - Errors in the type of goods delivered or ordered
  - Discrepancies in the terms of the purchase
  - Timing issues
2. Changes in the company’s needs regarding future sales or production.

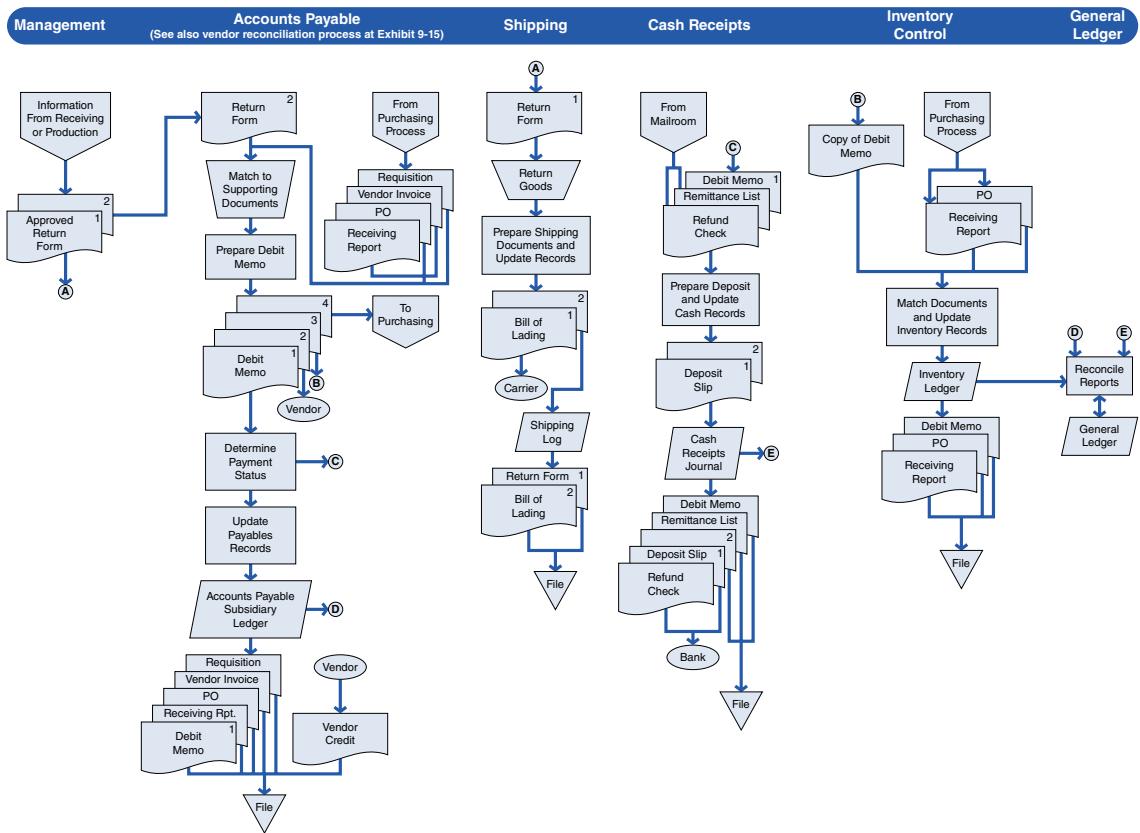
The unacceptable-goods circumstances noted in the first item listed are typically detected immediately, since goods are inspected upon receipt. Sometimes, however, unacceptable goods may be discovered at a later date, especially in the case of defective goods, quality discrepancies, and purchase terms discrepancies. Changes in company needs, the second item, may occur at any time, as the company may have unforeseen changes in its business activities. Regardless of the reason for rejecting a purchase or the timing of the return, a company must have specific procedures in place for handling its returns to a vendor. Exhibit 9-10 presents a business process map of the activities related to purchase return transactions. Exhibit 9-11 is a document flowchart showing the records used in the purchase return process, and Exhibit 9-12 shows a data flow diagram of purchase returns. These exhibits depict a return process where the items being returned had been previously received and accepted, rather than being rejected immediately upon receipt.

Once rejected goods are identified, management approval must be obtained to formally return the purchase. A debit memo should then be prepared. A **debit memo** identifies the items being returned, along with relevant information regarding vendor, quantity, and price. This form should be prepared by the accounts payable department on the basis of information from the related purchasing records, such as the PO, receiving report, and/or invoice. Exhibit 9-13 shows the processing of a purchase return in Microsoft Dynamics GP.

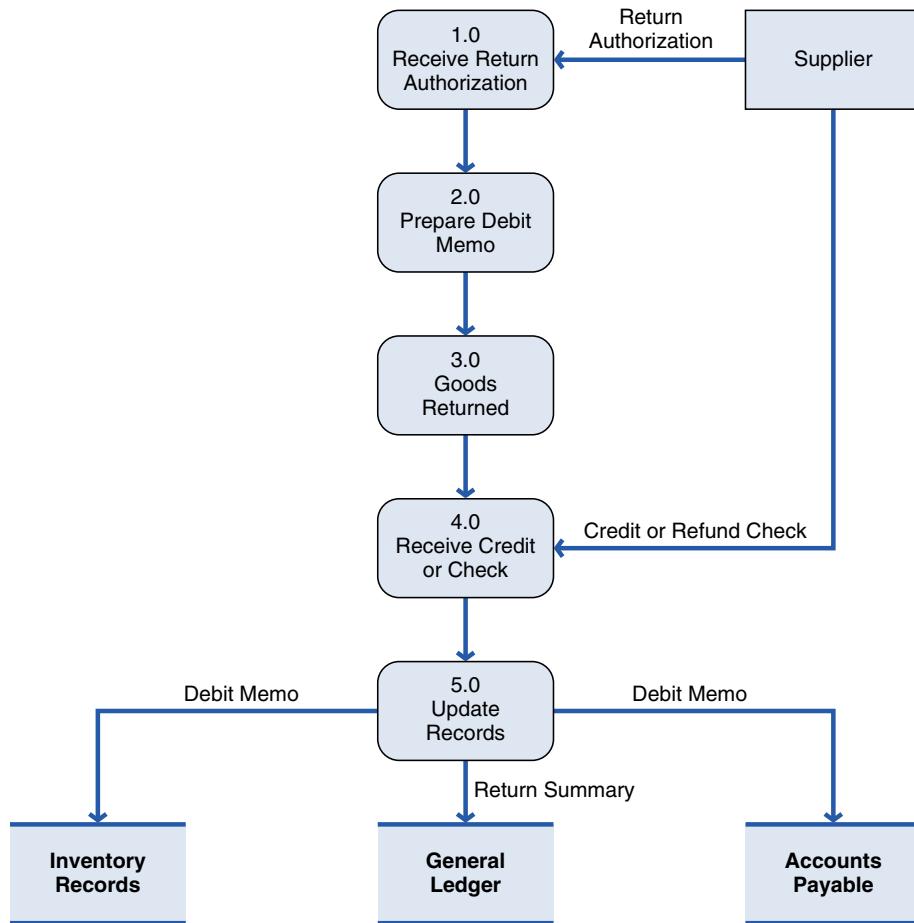
After the debit memo is prepared, the goods can be physically returned to the vendor. At that point, the company should prepare a record of the return shipment,



**EXHIBIT 9-10** Purchase Return Process Map



**EXHIBIT 9-11** Document Flowchart of the Purchase Return Processes

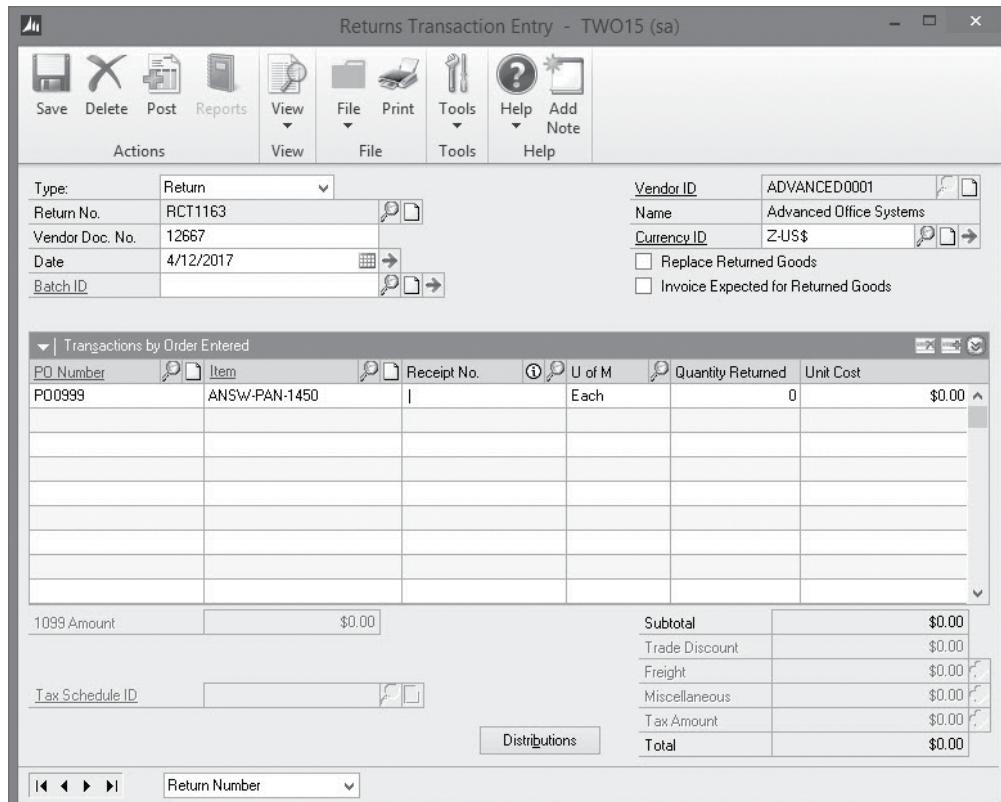


**EXHIBIT 9-12** Purchase Return Processes Data Flow Diagram

similar to the procedures described in Chapter 8 for shipments related to the sales process. It is a good practice to keep a record of all shipping activity, whether it relates to sales or purchase return transactions. It is also necessary to update inventory records so that the returned goods are no longer recorded as company assets. (Note that the accounts affected will depend on the type of inventory system used by the company, either perpetual or periodic.)

Occasionally, communications with the vendor regarding purchase returns indicate that there is no need to physically return the goods. In the case of defective goods, for example, a vendor may wish to avoid the costs of shipping the items and may therefore instruct the company to dispose of the goods rather than return them. When this happens, the company may need to implement additional controls to be sure that the disposal is not overlooked in the accounting records. Because there will be no shipping report for this item, company personnel may need to make an extra effort to be sure the debit memo is properly prepared and recorded.

Finally, the company will receive a refund or credit from the vendor for the returned (or disposed) goods. If a cash refund is received, the cash receipts procedures described in Chapter 8 should be implemented. If a credit is received, accounts payable records must be adjusted to reflect a reduction in the amount owed to the vendor.



**EXHIBIT 9-13** Entering Purchase Returns in Microsoft Dynamics GP

## Risks and Controls in the Purchase Return Processes (Study Objective 3, Continued)

### Authorization of Transactions

Whenever problems are noted with purchases, special authorization should be required to officially reject and return the items and initiate the preparation of a debit memo. All debit memos must be approved by a member of management or other designated individual within the company before the goods are physically returned to the vendor.

### Segregation of Duties

The accounts payable employee who prepares debit memos should not also be responsible for performing duties in the custody or authorization functions of the purchasing process. Accordingly, these individuals should not handle inventory or cash, or approve purchasing or purchase return transactions.

### Adequate Records and Documents

The debit memo is the most significant document in the purchase return process. It is important that debit memos include thorough descriptions of items being returned, including quantities and prices, as well as reference to the original purchase invoice.

Debit memos should be issued in numerical sequence to enable the verification of complete accounting for purchase return transactions. When debit memos are issued on prenumbered forms, company personnel can account for the sequence and evaluate whether or not the entire sequence has been accounted for.

Debit memos should be filed along with supporting documentation such as the original purchase records. They should also be matched with the refund or credit documentation received from the vendor.

## **Security of Assets and Documents**

Accounts payable records and data files should be restricted to those who are specifically authorized to approve or record the related purchase return. Custody of the returned goods should be controlled and limited to those in the shipping function or others specifically designated to handle the goods.

## **Independent Checks and Reconciliation**

Companies should have in place specific internal control activities to achieve accountability for purchase returns. Especially important are controls that check for the possibility of unrecorded purchase returns. Physical inventory counts can help detect unrecorded returns. In addition, someone independent of the accounting function should review supporting documents to verify that debit memos represent actual returns.

## **Cost-Benefit Considerations**

Internal controls should always be a part of a company's accounting system. However, certain exposures may exist within a company that may warrant the need to implement more extensive internal control procedures. A company should evaluate whether the benefits achieved from its internal controls are worthwhile, given the related risks and costs of implementation. In addition to the risks noted under the cost-benefits discussion for the purchasing process, a company might also consider the need for extensive internal controls related to purchase returns when a large volume of debit memos are processed.

Exhibit 9-14 presents some common control procedures related to the purchase return process, along with the related risks that they address.

### **EXHIBIT 9-14**

#### **Purchase Return Controls and Risks**

<b>Control:</b>	<b>Minimizes the Related Risk of:</b>
<b>Authorization:</b> Approval of purchase return transaction prior to preparation of a debit memo	Invalid returns, incorrect amounts
<b>Segregation:</b> Separation of authorization of purchase returns from accounts payable record keeping and custody of inventory	Fictitious returns
Segregate the ordering, shipping, inventory control, accounts payable, information systems, and general accounting functions	Fictitious returns, omitted returns, wrong amounts, wrong vendor, timing issues

(continued)

**EXHIBIT 9-14** (Continued)

<b>Control:</b>	<b>Minimizes the Related Risk of:</b>
<b>Records and Documents:</b>	
Preparation of a debit memo for all purchase return transactions	Fictitious returns, omitted returns
Preparation of debit memos on prenumbered forms	Omitted purchase returns
Preparation of shipping reports on prenumbered forms so that the sequence of returns can be reviewed for proper recording	Omitted purchases
Immediate preparation of shipping reports for all returns of goods	Timing issues, omitted transactions, invalid purchase returns
Prior to preparation of a debit memo, matching of supporting documents (vendor invoices, PO, and receiving report) for verification of vendors, authorized prices, mathematical accuracy, account coding, quantities, and descriptions of goods	Fictitious returns, duplicate returns, incorrect amounts or accounts, wrong vendor, timing issues
Monthly review and reconciliation of vendor statements with accounts payable records	Omitted returns, fictitious returns, incorrect amounts, wrong vendors, timing issues
Updating of accounts payable records for returns only when shipping report and debit memo verify actual return of goods	Fictitious returns, duplicate returns, incorrect amounts, wrong vendor, timing issues
Performance of end-of-period review to determine whether returns are recorded in the proper period	Timing issues, duplicate returns, omitted returns
<b>Security:</b>	
Physical controls in the warehouse and shipping areas with access to inventory items	Stolen goods
Physical and electronic controls covering access to the purchase returns and accounts payable records	Fictitious returns, duplicate returns, incorrect amounts, omitted transactions, wrong vendor, timing issues, accumulation problems
<b>Independent Checks:</b>	
Comparison of shipping logs with debit memo activity	Omitted returns, duplicate returns, invalid returns, timing issues
Verification of debit memo listing for mathematical accuracy and posting to the accounts payable records and general ledger	Invalid returns, omitted returns, incorrect amounts, wrong vendor, timing issues, incorrect accumulation or posting
Matching of purchase return records with original purchase documentation and verification for item descriptions, quantities, dates, authorized prices, and mathematical accuracy	Incorrect amounts, invalid purchase returns, timing issues
Performance of physical inventory counts and reconciliation with the inventory records	Stolen goods, omitted returns, fictitious returns, wrong amounts, duplicate returns, timing issues
Verification of accounts payable subsidiary ledger for mathematical accuracy and proper posting to the general ledger	Incorrect amounts, incorrect accumulation or posting, omitted returns, wrong account numbers, duplicate purchase returns

## Cash Disbursement Processes (Study Objective 4)

The processing flow related to procurement activities requires that payments be made for purchase obligations that have been incurred. The cash disbursements process must be designed to ensure that the company appropriately processes payments to satisfy its accounts payable when they are due.

Cash disbursements may include payments made by check or with currency. Many companies conduct business transactions with checks so that a written record is established of the cash disbursement. Because the practice of writing checks enhances internal control, here we will describe cash disbursements made by check. Exhibit 9-15 presents a business process map of a typical cash disbursement system, while Exhibit 9-16 shows the document flowchart for that process. Exhibit 9-17 is a data flow diagram of cash disbursements.

The accounts payable department is generally responsible for notification of the need to make cash disbursements and the maintenance of vendor accounts. Before payment is made to a vendor, specific steps should be taken to enhance the effectiveness and efficiency of the process. These steps include vendor account reconciliation, cash management techniques, and payment authorization. **Cash management** is the careful oversight of cash balances, forecasted cash payments, and forecasted cash receipts to insure that adequate cash balances exist to meet obligations.

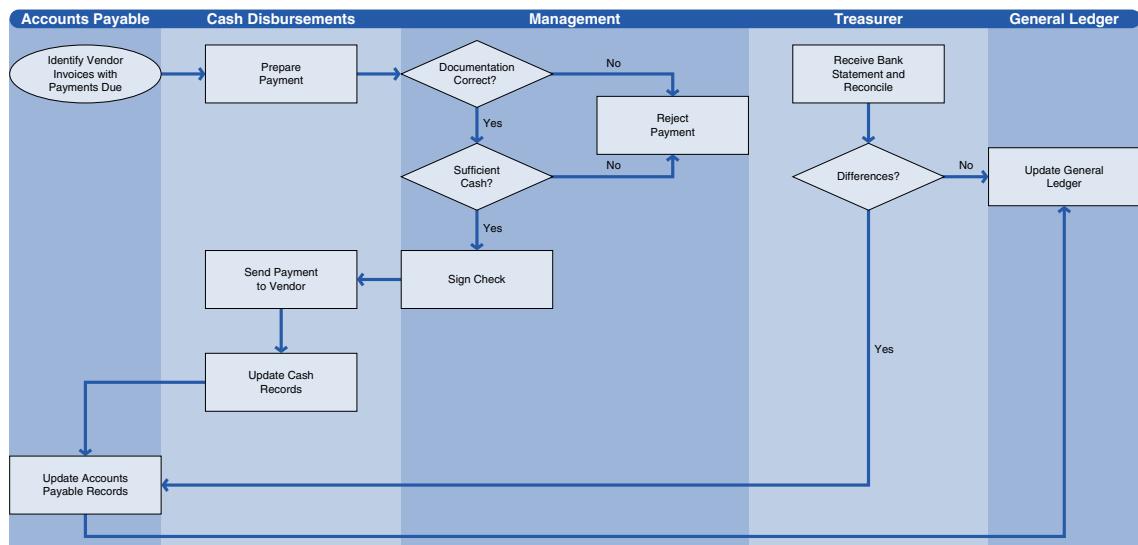
An important aspect of the cash disbursements document flowchart as shown in Exhibit 9-16 is that the documentation must support or agree with the invoice before payment is approved and a check is prepared. The PO, receiving report, and invoice must be matched to make sure that a valid order was placed, the goods were received in good condition, and that the vendor billed the correct quantities and prices. The process of matching these documents is extremely important in cash disbursements. No payments should be made until the documents are properly matched.

Accounts payable records need to be reviewed for accuracy on a regular basis. Many vendors send account statements to their customers each month to provide detail of amounts owed and paid. Accounts payable personnel should reconcile these statements with the company's accounts payable records. Accounts should be reviewed for agreement of amount and due date for each transaction. Any discrepancies should be resolved as soon as possible. Even if a vendor statement is not received, the company should have records of its obligations to each vendor (established during the purchasing process upon receipt of goods and the related purchase invoice). Some companies streamline the process by using a voucher system, whereby multiple transactions involving the same vendor may be combined into a single cash disbursement.

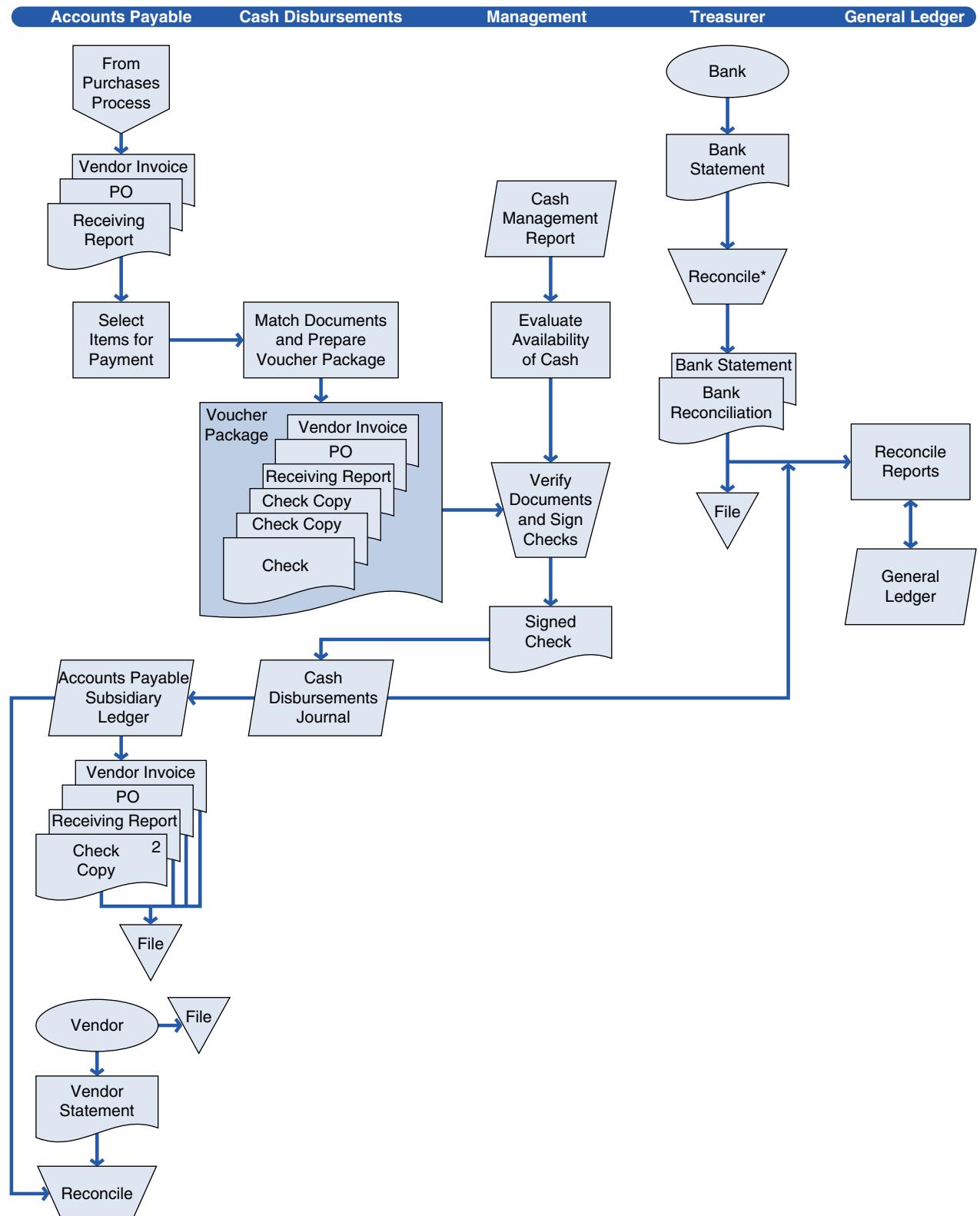
Copies of invoices should be filed in the accounts payable department in chronological order by due date. Accounts payable personnel should review this file regularly so that disbursements can be initiated in a timely manner. This provides for efficient cash management. A company typically desires to keep its cash for as long as possible. However, it must also be mindful of paying by the due date in order to avoid late payment fees, to establish trust, and to stay on good terms with its vendors.

It is often the case that vendors offer price reductions for prompt payment. When this type of cash discount is offered, it is the responsibility of the accounts payable department to make sure that the company has the opportunity to take advantage of these discounts. If the files are arranged chronologically, the system should consider any accelerated due dates warranted by discounts. The cash disbursements department must be notified to make the payment by the discount date. This is an added responsibility in the cash management process. The company should always weigh the advantages of a discount against the advantages of holding on to its cash in order to meet other operating needs, earn interest, or avoid borrowing. Controlling the timing of payments is therefore a very important managerial task, and accounts payable procedures are fundamental to the company's ability to manage its cash flow.

Full functioning accounting and ERP systems such as Microsoft Dynamics GP often provide automated functionality ensuring that companies can efficiently manage and take advantage of cash discounts offered. For example, in Microsoft Dynamics GP when an AP invoice is entered, the terms of payment can be selected.

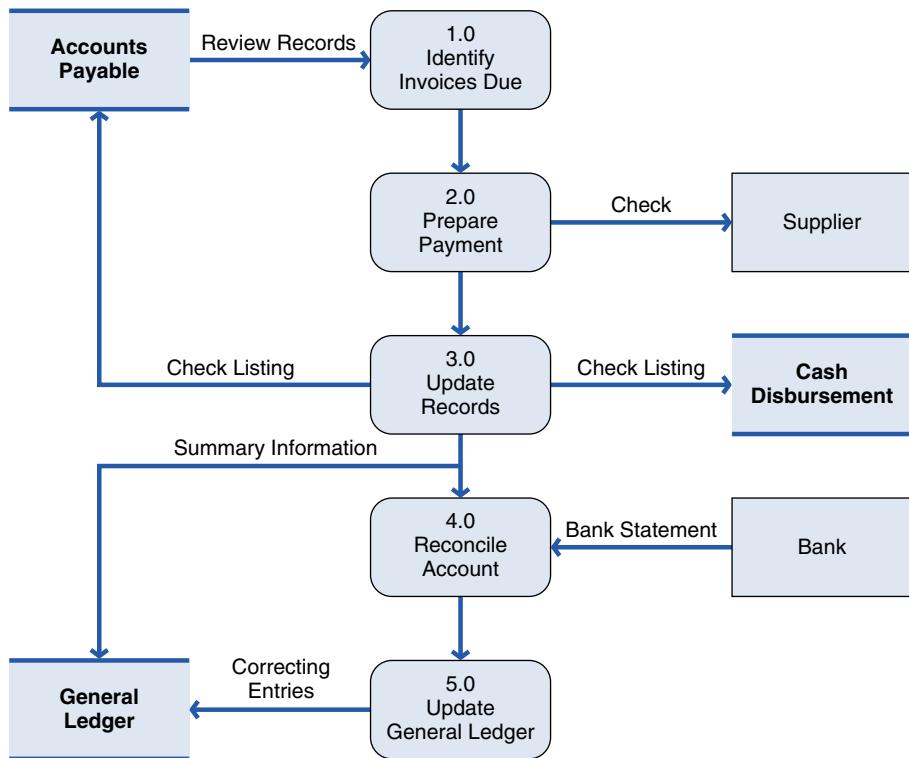


**EXHIBIT 9-15** Cash Disbursement Process Map



\* Involves comparisons of voucher packages and cash disbursements journal with information reported on bank statement.

**EXHIBIT 9-16** Document Flowchart of the Cash Disbursement Processes



**EXHIBIT 9-17** Cash Disbursement Processes Data Flow Diagram

Terms such as 2/10, n/30 mean that if the company pays the invoice within 10 days, it can deduct a 2 percent discount from the payment. If a company does not pay during the discount period, the net of the invoice is due in 30 days. When a term is selected that includes a cash discount such as 2/10, n/30, the system automatically calculates and stores the cash discount due date, the nondiscount due date, the amount due if the discount is taken, and the amount due if the payment is not made within the discount period. Dynamics GP then provides a report of all invoices that need to be paid to receive the discount as well as invoices that need to be paid based on the due date. Invoices can be automatically selected for payment to take advantage of discount dates if the company selects to take advantage of the cash discounts offered. Once a selection is made, the accounts payable manager can select to include all the invoices eligible for the discount or pick and choose which to include. Once the invoices to be paid are selected, any invoice that falls within the discount period, when paid, is properly recorded net of the discount. The payment amount as well as the general ledger entry are automatically adjusted to reflect the discount. In the general ledger entry, most companies would show the Accounts Payable account being reduced for the nondiscounted payable amount, cash being reduced by the amount of the payable less the discount and a credit to the purchases or purchases discounts taken account to reflect the amount of the discount taken. This automated functionality is another example where a full functioning accounting/ERP system can save considerable time and money when processing transactions.

When an invoice is due for payment, the cash disbursements department is responsible for preparation of the check detail. Supporting documentation should be available, including the PO and receiving report. Business checks often include a check stub, or remittance advice, where the invoice number and other relevant

information can be documented. A **remittance advice** is usually a tear-off part of a check that provides a simple explanation of the reasons for the payment, including invoice numbers and transaction line-item descriptions. Exhibit 9-18 shows the payment screen in Microsoft Dynamics GP.

Although a cash disbursements clerk prepares checks, responsibility for signing checks is reserved for members of management. The authorized check signer can verify the propriety of the disbursement by reviewing the check in comparison with its supporting documentation. Once a check is signed, it will be sent to the vendor. A copy of the check and supporting documentation will be returned to the cash disbursements and accounts payable departments.

Many companies have added automated check signing functionality and Electronic Funds Transfer (EFT) capabilities to their cash disbursements processing. When these types of changes occur, internal controls need to be updated to ensure there is adequate security over cash disbursements.

Functionality can be included in Microsoft Dynamics GP to allow for both automated check signing and EFTs. Companies that have added automated check signing capabilities are able to print checks on blank paper, eliminating the need to have preprinted checks on hand. Checks can also be processed much quicker because the authorized signature is automatically printed at the time of the check printing. Internal control procedures can be put in place to ensure that check processing and control of cash is secure. These procedures are described in the internal controls section of the chapter.

Once a payment is made, the related invoice should be canceled to indicate that it has been paid. To cancel an invoice, a cash disbursements clerk will clearly mark the invoice with information pertaining to the payment and check number used to satisfy this obligation. Alternatively, a copy of the check or remittance advice can be

The screenshot shows the 'Edit Payables Checks - TWO15 (sa)' window in Microsoft Dynamics GP. The window has a toolbar with icons for Save, Delete, Auto Apply, Options, File, Print, Tools, Help, Add Note, and a question mark. Below the toolbar are several input fields:

Payment Number	00000000000000265	<input type="button" value=""/>	Checkbook ID	UPTOWN TRUST
Batch ID	COMPUTER CHECK1	<input type="button" value=""/>	Currency ID	Z-US\$
Batch Total	\$990.89		Apply Date	4/12/2017

Vendor ID	WESTJUNC0001	<input type="button" value=""/>	Amount:	\$0.00
Check Name	West Junction Service	<input type="button" value=""/>	Unapplied	\$0.00
Comment			Applied	\$990.89
			Check	\$990.89

Below these are dropdown menus for 'List Documents on Remittance:' (All Documents) and 'Sort Documents on Remittance by:' (Date), and a checkbox for 'Electronic'.

Terms Discount Taken	\$0.00	Writeoff	\$0.00
Terms Discount Available	\$0.00		

At the bottom are buttons for 'Check Stub', 'Apply', 'Distribution', and 'Print Checks'. The status bar shows 'by Batch ID' and 'Status Unposted'.

**EXHIBIT 9-18** Establishing a Payment in Microsoft Dynamics GP

attached to the invoice to accomplish this task. Either method provides evidence of the disbursement and prevents the likelihood of duplicate payments. These documents are filed in the accounts payable department in check-number sequence. The accounts payable department will then update its vendor accounts to reflect the current payment activity.

Cash disbursements should be recorded in the accounting system as soon as the payment is made. A cash disbursements clerk will prepare a **cash disbursements journal**, which is a chronological listing of all payments. This listing is sometimes called a check register and is similar to the record kept for a personal checking account. The cash disbursements journal is used to prepare a daily journal entry, whereby the cash and accounts payable accounts are updated to reflect the day's payments. Accounting software, such as Microsoft Dynamics GP, automatically maintains records of checks issued, and updates cash and accounts payable balances as checks are processed. It is important that the accounting records reflect the actual date of the cash disbursement, as shown on the check. Later in the period, the records can be reconciled. Cash and accounts payable records are periodically verified by comparison with bank statements and vendor statements, respectively.

## Risks and Controls in the Cash Disbursement Processes (Study Objective 4, Continued)

### Authorization of Transactions

Only the accounts payable department should authorize the processing of a cash disbursement transaction, according to the need to satisfy a vendor obligation. The authorization occurs when the accounts payable department matches the PO, receiving report, and invoice, and then forwards these matched documents to the cash disbursements department. In addition, designated members of management should be given responsibility for authorizing the actual payments by their signatures on the face of the check. This means that only one or a few people should have check-signing authority. The bank will keep records of the signatures of those authorized check signers and should not pay a check unless it bears the signature of an authorized party. Finally, all bank accounts that are established in the company's name should be authorized by the board of directors.

Many companies establish special authorization policies and procedures applicable to large cash disbursements whereby dual signatures are required for checks over a specified dollar amount. **Dual signature** means that two people sign the check. This additional control requires the approval and signature of two authorized persons, thus reducing the risk of a significant fraud or error. The company's bank plays a crucial role in enforcing this policy, as it must not pay checks over the threshold amount unless two authorized signatures are present.

In Microsoft Dynamics GP, an approval process that is password protected can be established that requires the accounts payable supervisor to approve a check run before it can be processed. Another control requires that a second password be input after the check run has been reviewed by the controller, treasurer, or other check signer. Thus, only authorized checks will print. A third layer of control can be added by requiring a manual dual signature on checks exceeding a specified dollar amount. While these controls may not appear to be better than traditional controls

accompanying manual check signing, they are actually more secure due to the elimination of preprinted checks (that someone could steal) and the elimination of completed checks that may be lying around awaiting signature or being run through a check signing machine (that is not password protected). To ensure that high security features are maintained in automated check signing systems, it is crucial that passwords be changed routinely, and that the passwords not be shared or left sitting out where others might see them. Similar controls should be established for processing EFT transactions.

## **Segregation of Duties**

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Effective segregation of duties reduces the likelihood of undetected errors or fraud by providing accounting control over the cash disbursement processes. If the purchasing, receiving, accounts payable, and cash disbursement functions are segregated, then the opportunity for theft or error within the processes should be minimized. No person should have the ability to initiate a false purchase transaction and simultaneously pay for it and account for it. Ideally, individuals within the cash disbursements department should not have check-signing authority and should not have access to the cash account or to the company's accounts payable records. In addition, information systems operations and programming related to the cash disbursements and accounts payable departments should be separate from those having responsibility for custody, authorization, or record keeping within those functions.

## **Adequate Records and Documents**

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An accounts payable subsidiary ledger and a cash disbursements journal are fundamental records in the cash disbursement process. Also, the practice of issuing checks on prenumbered forms creates a record of the sequence of transactions. And the orderly maintenance of accounts payable records facilitates effective cash management techniques.

## **Security of Assets and Documents**

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Access to cash should be limited to the authorized check signers. Physical controls should be in place in the areas where cash is retained and disbursed. Similarly, the company's supply of unused checks should be protected and controlled. Access to the records should be limited to designated persons within the accounts payable and cash disbursements functions.

## **Independent Checks and Reconciliation**

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The cash disbursements journal and accounts payable subsidiary ledger should be reconciled to the general ledger control accounts on a regular basis. Also, someone separate from the cash disbursements and accounts payable functions should be responsible for reconciling the bank statement every month. Procedures for adequate reconciliation of the bank account include the direct receipt of the bank statement by the designated employee so that no others may have an opportunity to alter the document. If copies of checks are included with the bank statement, these checks should be completely reviewed for dates, payees, and signatures.

## Cost-Benefit Considerations

When a company processes a large volume of cash disbursements, it should consider implementing internal control procedures to ensure the accuracy of those transactions. Other situations that may warrant increased controls include:

1. Vendor arrangements or discount terms are complex.
2. Cash disbursement activities are widely dispersed or decentralized.
3. Cash disbursements are made by currency rather than by check.
4. High volumes of purchase returns exist.
5. Cash disbursements are denominated in foreign currencies.

Exhibit 9-19 is a summary of certain controls and risks related to the cash disbursement process.

### EXHIBIT 9-19

#### Cash Disbursement Controls and Risks

Control:	Minimizes the Related Risk of:
<b>Authorization:</b>	
Board of Directors' authorization for all company bank accounts	Invalid payments, stolen cash
Approval of cash disbursement transaction prior to preparation of a check	Invalid payments, incorrect amounts
Dual signature requirement for disbursement of large sums of cash	Invalid payments, incorrect amounts
<b>Segregation:</b>	
Separation of check-signing authority from accounts payable and cash disbursements record keeping and custody of cash	Invalid payments, incorrect amounts, stolen cash
Separation of the ordering, shipping and receiving, inventory control, accounts payable, cash disbursements, information systems, and general accounting functions	Fictitious payments, omitted payments, wrong amounts, wrong vendor, timing issues
<b>Records and Documents:</b>	
Preparation of checks on prenumbered forms	Omitted payments
Prior to preparation of a check, matching of supporting documents (vendor invoices, PO, and receiving report) for verification of vendors, authorized prices, mathematical accuracy, account coding, quantities, and descriptions of goods	Fictitious payments, duplicate payments, incorrect amounts or accounts, wrong vendor, timing issues
Updating of the cash disbursements journal and accounts payable records as soon as checks have actually been disbursed	Invalid payments, duplicate payments, incorrect amounts, timing issues
Cancellation of supporting documentation once payment has been made	Duplicate payments
Monthly review and reconciliation of vendor statements with accounts payable records	Omitted payments, fictitious payments, incorrect amounts, wrong vendors, timing issues
<b>Security:</b>	
Physical controls covering cash and the company's supply of checks	Stolen cash
Physical and electronic controls over access to the cash disbursement and accounts payable records	Fictitious payments, duplicate payments, incorrect amounts, omitted transactions, wrong vendor, timing issues, accumulation problems

(continued)

**EXHIBIT 9-19** (Continued)

Control:	Minimizes the Related Risk of:
<b>Independent Checks:</b>	
Monthly performance of bank reconciliation	Invalid payments, incorrect amounts, omitted payments, timing issues
Matching of checks with original purchase documentation and verification for item descriptions, quantities, dates, authorized prices, and mathematical accuracy	Incorrect amounts, invalid payments, timing issues
Verification of cash disbursements journal for mathematical accuracy and proper posting to the general ledger	Incorrect amounts, incorrect accumulation or posting, omitted payments, wrong account numbers, duplicate payments
Verification of accounts payable subsidiary ledger for mathematical accuracy and proper posting to the general ledger	Incorrect amounts, incorrect accumulation or posting, omitted payments, wrong account numbers, duplicate payments

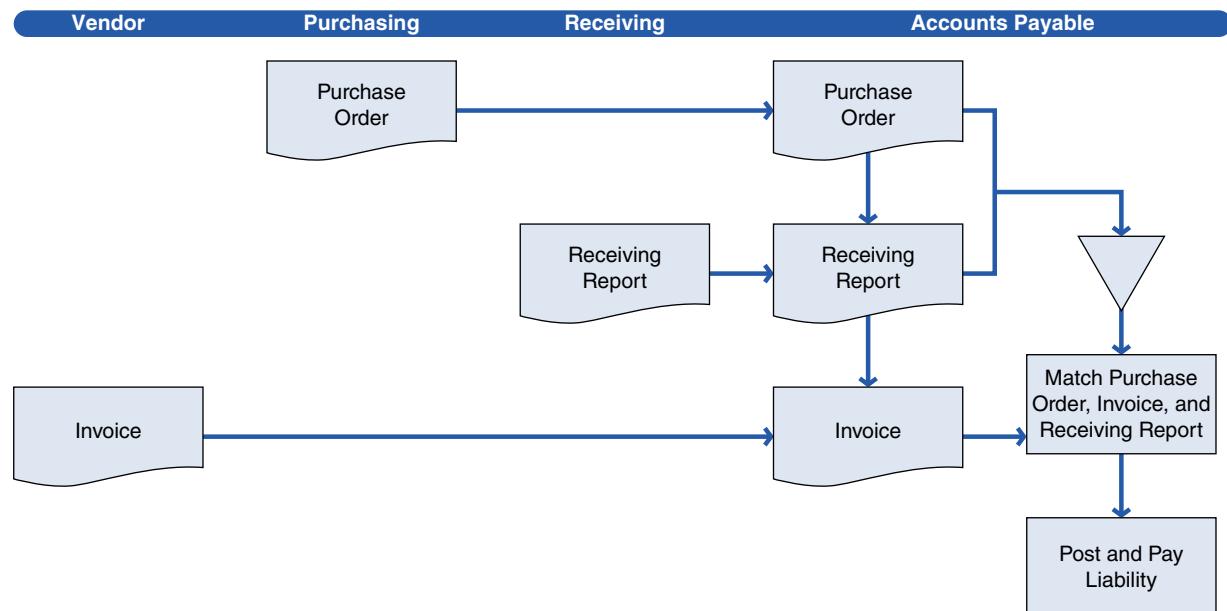
## IT Systems of Expenditures and Cash Disbursement Processes (Study Objective 5)

Even in computerized accounting systems, there can be many manual tasks. This is usually true for small or midsize companies with small-scale IT systems. The examples shown in the early parts of this chapter of screen captures from Microsoft Dynamics GP accounting software are examples of an accounting/ERP system where manual processes can be minimized if automated functions within the system are adopted. For example, in purchasing systems, the document matching is often called a three-way match. A **three-way match** is the matching of a PO to the related receiving report and invoice. In some companies, the person operating the computer software must still physically match the PO to a receiving report and invoice, deciding which invoices match which POs and receiving reports. The computer automates much of the record keeping and check writing, but a human must still make decisions regarding this matching process, depicted in Exhibit 9-20.

In more efficient companies with fully integrated accounting/ERP systems, such as Microsoft Dynamics GP, this matching can be automated. In Microsoft Dynamics GP, a purchase order is generated and sent to a vendor. When the items purchased are received, the receiving clerk can retrieve the PO and record the number of units received for each item on the purchase order. Adjustments can be made automatically for any unreceived items. When the vendor invoice is received, the matched PO and receiving report can then be retrieved in the system and the items invoiced compared to what was included on the PO and later received. If any discrepancies exist, adjustments can be made automatically. This automated matching in Microsoft Dynamics GP significantly reduces the time and errors that occur in a traditional process for recording inventory purchases and receipts.

Within small or midsize organizations with accounting software such as Microsoft Dynamics GP, the following tasks must be completed by employees:

1. The purchasing department orders items from a vendor, and an employee must enter a PO into the accounting software by keying data into the fields of a PO form on the screen.



**EXHIBIT 9-20** Flowchart of Document Matching to Approve and Pay for Purchases

2. The receiving department receives the goods and compares the packing slip with the PO to confirm part numbers and quantities.
3. A receiving report is prepared by an employee filling in the appropriate fields in a receiving screen in the software. The person completing this screen must choose the PO that matches this receiving report. When the vendor name or ID number is entered, the system will list open POs with that vendor.
4. After the vendor has provided an invoice, the invoice must also be entered into an invoice entry screen in the accounting software. Again, the proper PO must be chosen from a list of open POs.
5. If the PO, receiving report, and invoice match as to part numbers, quantities, and prices, the liability is approved for payment.
6. At the discount date or due date of the invoice, a designated person must select certain invoices to pay and have the system generate a batch of checks.

This manual entry and matching system is extremely time consuming and expensive. It is time consuming due to the complexities of purchases. Purchasing and payments can become complex because a vendor may occasionally substitute items, ship a different quantity (undership or overship), notify the buyer of back orders, or fill a partial order. Thus, matching takes a large amount of human time to reconcile and approve for payment. This is true even if the accounting system is maintaining records and generating checks electronically. The problems with this system are as follows:

1. The total salaries or wages paid to employees who match these three documents can be very expensive.
2. Mismatches as to part numbers, quantities, or prices can take much time to investigate and reconcile, which causes the cost of this manual processing to be even higher.
3. Employees must manually key into the software the details of purchasing, receiving, and invoicing. This also is expensive and time consuming. In addition, keying errors might be made.

Many organizations are using advances in IT systems to reduce the time and expense of purchase and payment processing. With technology, processes can be changed to lessen or eliminate the aforementioned problems. The process undertaken to change processes to enhance efficiency is called business process reengineering. Recall from Chapter 1 that **business process reengineering (BPR)** is an organized change in business processes for the purpose of improving efficiency and effectiveness. BPR aligns business processes with the IT systems in order to accomplish these improvements. In the case of purchasing and paying for purchases, BPR facilitates reductions in paperwork, manual processing, and processing costs. In many cases, IT systems are used to enhance the efficiency of purchasing and payment processes. Implementing these IT systems usually entails BPR to make the processes fit the IT system.

Examples of IT systems that usually involve BPR in purchasing and payments include the following:

- Computer-based matching and checking of purchasing documents
- Evaluated receipt settlement (ERS), an invoice-less processing technique
- Electronic forms of purchase and payments such as e-business, e-payables, and EDI

For example, EDI reduces or eliminates the manual keying of invoices because the invoice is communicated electronically between the buyer and the vendor. The next section describes these IT systems that allow organizations to reduce the time and cost of processing purchases and payments.

## Computer-Based Matching (Study Objective 6)

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The IT system used for purchasing and payments can be used to automate the document matching process. **Automated matching** is a computer software technique in which the computer software matches an invoice to its related PO and receiving report. Traditional systems rely on a person to do this matching, whereas an automated matching system does not. To institute an automated matching system, all of the relevant files must be available and constantly ready for processing. This means that PO and receiving files and records must be online or in databases. When an invoice is received from a vendor, an employee enters the details into the accounting system by completing fields in the invoice entry screen. The PO number usually appears on the invoice, and this number is entered as the invoice is entered. The system can then access the online PO and receiving files and check the match of items, quantities, and prices. The system will not approve an invoice for payment unless the items and quantities match with the packing slip, and the prices match the PO prices. This ensures that the vendor has billed for the correct items, quantities, and prices.

During the matching process, the system will also check for mathematical errors and determine whether a previous payment has been made. Without this procedure, overpayments or duplicate payments to vendors may be made. Vendors can accidentally or intentionally invoice the same order twice. The system checks for duplicate invoices by examining the invoice number, the vendor number, and the dollar amount. The system can signal any instances of potential duplicate payments or overpayments, and this notification can be reviewed by a manager prior to payment. In addition, the automated system can evaluate the discount terms and select the most advantageous timing of the actual payment. For example, if

## The Real World

Frymaster Corporation, of Shreveport, Louisiana, manufactures food-service equipment such as frying systems, food dispensing equipment, pasta cookers, and toasters. Frymaster uses an automated document-matching system for invoice payment. With only four people in its accounts payable department, Frymaster has a cost per vendor payment processed that is extremely low.

Frymaster has such low costs because the majority of invoices it receives usually match

the other documents the first time. These matched invoices are paid automatically by the system so that no employee time is needed. Therefore, fewer staff members are needed to process payments, so the staff can focus on exceptions—those invoices that do not initially match. Documents that are properly matched are processed automatically, and only those with differences require manual steps to reconcile.

payment terms are 2/10, n/30, the system can be programmed to determine whether the 2 percent discount is advantageous when compared with the company's cost of funds.

An automated matching system can reduce time, costs, errors, and duplicate payments in invoice processing. These improvements over manual matching can decrease the amount of time required to enter invoices and therefore give management more timely information to forecast future cash outflows for paying invoices. In addition, the system can summarize detailed transactional data into summary amounts that are posted to general ledger accounts. Thus, management receives more complete feedback in a much more timely manner, enabling management to better plan and control cash disbursements. While there are many advantages to automated matching, there are also risks, including system errors in the matching process, unauthorized access, fraud, and inadequate backup of files.

## Risks and Controls in Computer-Based Matching (Study Objective 6, Continued)

### Security and Confidentiality Risks

Applying automated matching processes means that people do not perform the matching and authorizing functions, because these take place within the system. Therefore, unauthorized access to the system increases the danger of fraudulent or fictitious payments. Someone who gains unauthorized access to the system's ordering and matching functions could insert fictitious vendors and invoices, and thus receive fraudulent payment. This risk can be lessened by authenticating users and limiting the access of authorized users. Passwords and user IDs should be used for any employee accessing the system. If the dollar amounts involved are extremely large or the data is sensitive, the use of biometrics, security tokens, or smart cards might be necessary to improve the strength of user authentication. In addition, authority tables should be established to limit access of authorized users to those subsystems necessary to their jobs. For example, a user who logs in to enter invoices should not be allowed to order goods. Computer logs should be maintained so that a complete record exists of users and their usage histories. The computer log will allow monitoring and identification of unauthorized accesses or uses.

## Processing Integrity Risks

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Since the system authorizes payment of invoices, it is critical to ensure that it is programmed to correctly accomplish this matching. Errors in system logic can cause systematic and repetitive errors in matching. In simpler terms, if the system mistakenly matches documents, it will mistakenly match documents repetitively. Thus, erroneous system logic can quickly cause cash flow problems. This is also true of the logic used to find duplicate payments, where the system must be preprogrammed with the appropriate identifying criteria. If the criteria are too tightly defined, the system may not properly detect all duplicate payments. Alternatively, if the criteria are too loose, it may flag transactions that are not really duplicates. For example, if a company were to regularly and frequently order the same items at the same cost, it would become harder to determine which are duplicate invoices and which are not, because the quantities and prices would be the same. These risks of systematic errors in matching or duplicate payments can be lessened by routine tests of the system and through regular management review of reports of invoice payments.

## Availability Risks

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As is always true of IT systems, the more reliance is placed on the system, the more critical it becomes to make sure that the system is available. Any system breakdowns or interruptions can stop or slow the processing of invoices and payments. Extreme delays in paying invoices could lead to lost discounts, late fees, interest charges, or loss of a vendor. Therefore, it is important to maintain backup systems and backup files. Since the matching is done within the system rather than manually, there may not be a paper trail of transactions processed. Therefore, backup files must be maintained to ensure a complete audit trail. In addition, uninterruptible power supplies and disaster recovery plans should be in place to allow continued operations even in the event of power outages or natural disasters.

## Evaluated Receipt Settlement (Study Objective 7)

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In the mid-1990s, some companies, including those in the automotive industry, began implementing invoiceless matching systems for purchasing and paying vendors. For instance, General Electric Co. began using an invoiceless system for direct material purchases and wished to move other purchases to an invoiceless system. Changing document matching to an invoiceless system is more a process change than it is an application of new technology. However, the capability to achieve an invoiceless matching system depends on having extensive IT systems with online, purchase-related files. Invoiceless match compares a PO with the goods received. If the PO matches the goods, payment is made to the vendor. This eliminates the need for the vendor to send an invoice, since payment is approved as soon as goods are received (when they match a PO). Thus, **evaluated receipt settlement (ERS)** is an invoiceless system. The ERS name signifies that the receipt of goods is carefully evaluated and, if it matches the PO, settlement of the obligation occurs through this system.

When the purchasing department initiates a purchasing process, a PO is entered in the online database of open orders. When goods arrive at the receiving dock, employees

## The Real World

The information that follows was excerpted from a large company's website for its vendors to see the company's policies about ERS. For this illustration, the name of the company has been changed to "Example Company," but the other details are real. The list may provide a better understanding of how ERS works.

Example Company has implemented ERS—Evaluated Receipt Settlement. With ERS we will pay suppliers based upon the quantity we receive and our purchase order price. Invoices are no longer necessary.

### Requirements:

1. Example Company's purchase order, part number, prices, terms, and shipping methods must be 100 percent accurate.
2. Packing slips must be 100 percent accurate with correct items, part number, purchase order number, and correct quantities in the purchase order's unit of measure.
3. Goods must be received accurately. Accordingly, packing slips must be
4. No invoices are to be received. Suppliers are to put the invoices on hold in their system.
5. Charges for supplementary items such as set up, plating, drum charges, etc. must be included in the unit price of the item or must be added as an individual line item on the purchase order.
6. Example Company requires the use of its preferred freight carrier. Example Company provides its carrier account numbers to its suppliers.
7. The supplier's invoice number, packing slip number, or receipt date will be included on remittance advices. Example Company's standard transaction codes will be used on remittance advices.
8. Suppliers must accept electronic fund transfers as payment.
9. Specific questions concerning, orders, receivers, rejects, and payments should be directed to the Example Company buyer who placed the order.

clear and easy to read, with bar coded packing slips preferred.

in the receiving department will check the online database for the PO that matches the vendor, part numbers, and quantities. This means that employees must be able to access online POs immediately, while the delivery person is still at the receiving dock. Thus, extensive IT systems with online purchasing files are necessary. If there is no matching PO, the goods are refused and returned to the vendor. If there is a matching PO, receiving employees enter a receiving record into the online database and payment is processed according to the payment terms previously negotiated with the vendor.

## Risks and Controls in Evaluated Receipt Settlement (Study Objective 7, Continued)

Unfortunately, eliminating parts of a manual matching process also eliminates some of the internal controls inherent in a three-document match of a PO, receiving report, and invoice. Since some internal controls are eliminated, it becomes necessary to compensate for this loss of controls by strengthening other controls or implementing additional controls. First, the receiving procedures must be established to ensure that goods are accepted only when part numbers and quantities match

exactly. There is no reconciliation process later for substitutions, overshipments, or partial shipments. Thus, an organization that wishes to institute an invoiceless matching process must also establish close working relationships with vendors and negotiate firm prices prior to ordering. Since goods are accepted only when quantities match, the vendors must understand that receiving personnel will not accept a shipment unless it matches exactly. Payment is based on those prior negotiated prices, not on an invoice. This speeds the entire receiving and paying process and eliminates much time and cost in processing payments. The organization and the vendor must work together to minimize exceptions such as substitutions of product, damaged products, and partial shipments. The organization should also have established procedures to quickly handle the few exceptions that may arise.

There are also IT risks inherent in an invoiceless system. These risks are in the categories of security, confidentiality, processing integrity, and availability.

## **Security and Confidentiality**

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It is necessary to authenticate user controls in order to prevent unauthorized access to purchase-related files and to prevent fraudulent or fictitious vendor payments. User IDs and passwords should be required of all users of the purchasing and payment systems. Authority tables establish the access levels of authorized users. This prevents unauthorized users from initiating purchase transactions. Computer logs can assist management in monitoring user access and in detecting unauthorized access or misuse of purchase and payment systems.

## **Processing Integrity**

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As described in the previous discussion on automated matching system risks, errors in system logic can lead to repetitive errors in authorizing payments. Therefore, the system must be monitored and tested to ensure the accuracy and completeness of the matching and payment approvals. This monitoring and testing should also ensure that duplicate payments are appropriately avoided.

## **Availability**

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Since the system relies heavily on an IT system that can quickly access online PO files, a system interruption or slowdown can halt all receiving activity. Receiving processes could not operate without the ability to view online PO files. Therefore, backup systems and backup data are crucial to ensuring availability of the system at all times. The general controls should also include uninterruptible power supplies and extensive disaster recovery plans to allow continued operations without interruptions.

# **E-Business and Electronic Data Interchange (EDI) (Study Objective 8)**

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Chapter 8 described e-business and EDI advantages, risks, and controls from the perspective of the seller. In addition, it was explained earlier in this chapter that the buyer and the seller exchange goods and cash with each other; the buyer receives

## The Real World

The federal government of the United States is a strong advocate of e-invoicing. Its Invoice Processing Platform (IPP) has been credited with reducing waste in 74 federal agencies, resulting in millions of dollars in savings. With some 86,000 vendors already enrolled

in IPP, the U.S. Treasury projects that it has the ability to eventually process up to 30 million invoices per year—over 10 times more than its current capacity. As its IPP continues to grow, additional cost savings are expected.<sup>2</sup>

goods and pays cash in the exchange, while the seller receives cash and ships goods. When these exchanges are viewed from the buyer's perspective, a mirror image of the seller's perspective can be seen. The electronic exchange of transaction information is much the same for the buyer as for the seller. You should find it useful at this point to reexamine Chapter 8, Exhibit 9-18, regarding EDI exchanges. The similarity in processes between buyer and seller means that most of the previous description of advantages, risks, and controls from the seller's perspective applies to the same features from the buyer's perspective, as addressed in this chapter. To avoid repeating those entire sections, the description here will focus only on the risks and controls and will cover both e-business and EDI in the following section.

## Risks and Controls in E-Business and EDI (Study Objective 8, Continued)

Exhibit 8-20 in Chapter 8 summarized the risks and controls from the seller's perspective. That exhibit is presented here as Exhibit 9-21 to summarize risks and controls of electronic purchase transactions from the buyer's perspective.

### **Security and Confidentiality**

When conducting purchase and payment transactions electronically, there must be an electronic link between buyer and seller IT systems. This electronic link might be in the form of private leased lines, third-party networks, or the Internet. No matter which type of electronic link is employed, the use of electronic links between buyer and seller exposes risks of unauthorized access and hacking or other network break-ins. Therefore, it is important that all users, including trading partners such as vendors, be authenticated when they access the system or records. User IDs, passwords, and authority tables are used to limit access to authorized users and to limit authorized users to only those files or records they must access to perform their assigned duties. Computer logs help management monitor user access and to discover whether any instances of unauthorized access and any resulting security breaches have occurred. Firewalls and encryption of data can limit unauthorized access by hackers or other outsiders.

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<sup>2</sup> Bob Cohen, "How automating accounts payable unlocks financial value," *Strategic Finance*, February 2015, pp. 31–34.

Risk	Controls
<b>Security and Confidentiality</b>	
Unauthorized access Hackers or other network break-ins Repudiation of purchase transactions	<ul style="list-style-type: none"> <li>Authentication: user ID, password, log-in procedures, access levels, authority tables</li> <li>Firewall, encryption, vulnerability assessment, intrusion detection, penetration testing</li> <li>Computer logs</li> </ul>
<b>Processing Integrity</b>	
Invalid data entered by vendors Incomplete audit trail Errors integrating into back-end systems	<ul style="list-style-type: none"> <li>Input controls such as field check, validity check, limit check, reasonableness check</li> <li>Computer logs</li> <li>Software testing</li> </ul>
<b>Availability</b>	
System failures Virus and worm attacks Denial of service attacks by hackers	<ul style="list-style-type: none"> <li>Business continuity planning, backup data and systems</li> <li>Firewall, encryption, vulnerability assessment, intrusion detection, penetration testing</li> </ul>

**EXHIBIT 9-21** E-Business and EDI Risks and Controls

Vulnerability testing and penetration testing allow the company to regularly test for possible weaknesses in the network connections used for e-business or EDI.

**Vulnerability testing** is examining the system to determine the adequacy of security measures and to identify security deficiencies. **Penetration testing** is intentionally attempting to circumvent IT system access controls to determine whether there are weaknesses in any controls. This testing can help uncover vulnerabilities so that these problems can be fixed before they are exploited by outsiders or hackers. **Intrusion detection software** alerts the organization to hacking or other unauthorized use of the system or network.

Strong authentication controls that validate users and computer logs that record transactions can also help prevent repudiation of transactions by the seller. For example, a seller could claim that the electronic payment for a purchase was not received. Authentication of users and computer logs allow the organization to maintain an electronic audit trail that confirms that the electronic check was sent to the valid and authorized vendor, which can help avoid repudiation of this payment transaction.

## Processing Integrity

In e-business or EDI purchase transactions, vendors may be accessing files and records on the buyer's computer system and may be entering or transmitting data. Therefore, there are risks that the vendor's IT system can introduce erroneous or incomplete data. Data entered or transmitted by the vendor should be subject to input validation controls to ensure the accuracy and completeness of the data. These input validation checks include field checks, validity checks, limit checks, and reasonableness checks. In addition, the data entered into EDI translation software, or e-business Web forms must be integrated into the backoffice systems such as the receiving and accounts payable systems. These same input validation checks can assist in reducing errors as data is integrated into other systems within the organization. Finally, computer logs of all transactions conducted with sellers can serve as part of the audit trail to help trace or re-create transactions.

## Availability

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Interruptions to the system can cause critical problems for companies that purchase and pay electronically. System slowdowns or failures can cause the company to be unable to purchase or pay as needed, which can cause the flow of products to be interrupted and thereby slow or stop manufacturing or sales. Anytime the Web systems or EDI connections are unavailable, there may be resulting interruptions in manufacturing and thus a possible failure to have products available to sell. Therefore, the company should put controls in place to minimize service disruptions, such as redundant systems, disaster recovery plans, testing of software changes, and capacity planning and testing.

Redundancy is needed for servers, data, and networks. A redundant server system requires maintaining one or more computers as extra, backup Web servers that can operate if the main server goes down. Redundant data as a control is usually accomplished by having data stored in redundant array of inexpensive disks (RAID). A RAID storage maintains one or more disk drives that mirror each other. As a result, one or more exact duplicates of the data are maintained. A backup network structure should be in place if communication is lost through the regular network.

Disaster recovery plans must be in place to ensure uninterrupted access to EDI or e-business processing even through natural disasters such as fire, flood, or earthquake. The company must have plans to enable continued service when disasters occur.

As changes are made to the purchasing website or the underlying software that processes e-business or EDI purchases, it is important that the changes be tested before they are implemented. If such changes are not tested, they may fail and disrupt operations.

Managers must properly plan for sufficient capacity in the e-business or EDI system and servers to ensure that the system is not overwhelmed by the number of users accessing it or the number of transactions conducted. Managers should ensure that there are regular steps to monitor, test, and adjust the capacity of the system to meet its needs.

Controls that prevent or detect viruses or system intrusion must also be in place. These controls are necessary because hackers, intruders, or viruses can slow or interrupt system operations. Intrusion detection and vulnerability testing can help prevent or detect these types of problems.

## E-Payables (Study Objective 9)

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Accounting managers within organizations are usually interested in new systems and software that reduce costs or increase the efficiency of payables processing. The newest technologies related to invoicing and payables are generally referred to as **e-payables**. However, a more specific name for these electronic invoicing and payment systems is **electronic invoice presentment and payment**, or **EIPP**. Most EIPP systems take advantage of the connectivity of the Internet to electronically send invoices or payments. This means that an accounts payable process in an organization could receive invoices electronically via the Internet and make payment via the Internet. Such systems usually utilize Web browsers as the interface for accounts payable employees to receive and view invoices and make payments.

Although these systems are newer in technology and software, they have the same advantages and risks as those already described. That is, they improve the efficiency

of invoice and payment processing, but they pose security, confidentiality, processing integrity, and availability risks. The Real World Example at the beginning of this chapter describes some advantages that General Electric experienced by using EIPP.

## Procurement Cards (Study Objective 10)

Within the past couple of decades, many companies have instituted procurement cards as a method to eliminate or reduce the time-consuming steps in purchase and payment transactions. **Procurement cards**, often called p-cards, are credit cards that the organization gives to certain employees to make designated purchases. Procurement cards are normally not used to purchase raw materials or products, but are used for small-dollar-amount purchases such as supplies or maintenance, and to pay for travel and entertainment expenses.

### The Real World

General Electric Co. (GE) uses p-cards for all purchases under \$2,500. GE switched to p-cards after an investigation of its accounts payable processing revealed that 82 percent of its invoices were for less than \$2,500 and that it took 25–40 days to process an invoice. This caused GE to miss 77 percent of early payment discounts. It is common for many large companies to have a relatively small number of large-dollar-amount invoices from the purchase of raw materials or products for resale, and a huge volume of low-dollar-amount invoices for other purchases. This means that the accounts payable staff spends the bulk of its time processing and matching invoices for small-dollar purchases.

Using a p-card can eliminate much time and cost associated with this processing of small-dollar purchases. The p-card accomplishes the following improvements:

- Employees have more control over their purchases than when things are

purchased by a centralized purchasing department.

- Many activities are reduced or eliminated, such as soliciting bids, negotiating with suppliers, keying or entering purchase order and invoice data, matching documents, managing orders that do not match, and writing checks for small-dollar purchases.
- The company can receive one large, consolidated bill from the credit card issuer.
- The information from the credit card issuer can be sorted or examined by employee name, purchase type, or other key needs.
- Managers can place limits on credit cards to control purchasing activity.
- Credit cards can be restricted to certain types of vendors, thereby reducing the chance that the card could be used at an amusement park or strip club, or for some other fraudulent purpose.

## Ethical Issues Related to Expenditures Processes (Study Objective 11)



In the absence of a strong ethical “tone at the top,” encouragement of ethical behavior by all employees, and strong internal controls, there are many opportunities for ethical lapses or fraud to occur in the expenditures processes. Ethical lapses may occur at the upper levels of management when corporate funds are used for

## The Real World

There are many examples of frauds related to the expenditures process committed by upper level managers. In addition to the earnings manipulation fraud committed at Phar-Mor as described in Chapter 3, Michael Monus, as Phar-Mor's President and Chief Operating Officer, made fraudulent payments on typewritten checks drawn on a special Phar-Mor checking account. The checks supported the World Basketball League (WBL) that Monus founded. The use of a special checking account allowed Monus to bypass the normal purchase order controls, invoice matching system, and computer check writing policies that apply to Phar-Mor's main operating account, so that he could use Phar-Mor funds to keep the financially troubled

WBL afloat. His fraud diverted nearly \$10 million to the WBL over a period of three years.

Mr. Monus specifically established a separate checking account that avoided the internal control structure. Since top management is above the level of internal control, proper internal control systems may not prevent expenditure fraud conducted by the top officials. However, the board of directors and upper level management should ensure that the corporate managers adhere to a code of ethical conduct. Ethics codes are not guarantees of fraud prevention either, but when ethical conduct is expected and rewarded, an environment is created in which such management fraud is more difficult to conceal.

personal purchases, as well as at the lowest employee levels when fake travel and entertainment expenses are submitted for reimbursement. While it is not likely that all such ethical problems will be completely eliminated, management can reduce the chances of expenditure fraud or ethics violations by maintaining good internal controls and enforcing ethical conduct.

Many internal control policies should have been in place to help prevent frauds such as those committed by Michael Monus and Paul Pigeon. Even simple policies such as accepting only valid original receipts for travel would have

## The Real World

Lower level employees or managers may conduct expenditure related fraud by submitting fictitious invoices or creating fictitious vendors. As an example of fraud in accounts payable, consider the case of Paul Pigeon. Pigeon worked for a Canadian company of about 3,000 employees. As the manager of employee training, he regularly hired consultants to conduct training programs for employees. These consultants were paid through a traditional accounts payable system after submitting an invoice. When one of the consultants informed Pigeon that he was retiring, Pigeon used the opportunity to begin a fraud scheme. He began submitting fictitious invoices in the consultant's name. Since Pigeon was in a position of expenditures authority, he approved the invoices and they were paid

through the accounts payable system. Over a two year period, he submitted false invoices totaling \$490,000.

Interestingly, Paul Pigeon was apparently not satisfied with just one fraud scheme, as he was perpetrating another fraud at the same time: He was submitting his own travel expenses in duplicate. For the first submission he used his original receipts, and for the second submission he used his credit card receipts. On the second submission, he always added a very small invoice at the bottom so that the amount would be different from his previous submission. He also changed dates to lessen possible suspicion about duplicate payments. He defrauded his employer of \$32,923 by this duplicate travel-expense fraud.

## The Real World

Walmart has an extensive "Statement of Ethics" policy available on its website at [www.walmartethics.com](http://www.walmartethics.com). The policy addresses many areas within the organization, including sections directed to those who conduct purchasing for Walmart. A portion of that policy prohibits employees from accepting gifts from suppliers, including free merchandise, meals, tickets to entertainment events, tips, kickbacks, and personal favors. Specifically, the policy states "Accepting gifts and entertainment can

cause a conflict of interest, or the appearance of a conflict, between personal interests and professional responsibility. Walmart's culture is to never accept gifts or entertainment from any supplier, potential supplier, government agent or other third party the associate has reason to believe may be seeking to influence business decisions or transactions." This is an example of how management can help prevent purchasing agents from favoring certain suppliers and benefiting personally from doing so.

helped prevent the duplicate travel-expense fraud. In the case of the fictitious invoice fraud, controls such as periodic verification of the existence of vendors, examining expenditures over budget (variances), and training accounts payable personnel to look for suspicious documentation may have prevented this fraud. These examples illustrate that when the tone at the top is not focused on good internal controls and high ethical standards, fraud and ethical lapses are much more likely to occur.

An organization's board of directors and management have an ethical obligation to establish the proper tone at the top. If they do not, owners of the organization will be harmed when the company is defrauded. In addition, employees and those who conduct business with the organization will also be harmed when changes (such as failure to grant pay raises and increased sales prices) are implemented in efforts to recover losses from fraud. It is important to establish internal control policies and IT controls to help prevent or detect such fraud, ethical lapses, or errors. By establishing controls and a code of ethics, the board and management are protecting the assets entrusted to them by owners and shareholders.

## Corporate Governance in Expenditure Processes (Study Objective 12)

The four primary functions of the corporate governance process include management oversight, internal controls and compliance, financial stewardship, and ethical conduct. While corporate governance is important for all business processes, it is particularly necessary in the expenditures processes. Funds expended by an organization do not belong to managers. Managers are stewards, or temporary directors, of those funds. Corporate governance policies and procedures must be in place to ensure that funds are expended only to benefit the organization and its owners, not to benefit the managers or employees personally. For example, corporate governance policies should prevent managers and employees from using company funds to purchase items for their personal use. In other words, strong corporate governance should help prevent fraud, theft, and mismanagement within expenditure processes.

The systems, processes, and internal controls described in this chapter are part of the corporate governance structure. When management designs and implements processes for purchases, purchase returns, and cash disbursements, it assigns responsibility for executing those functions to various managers and employees. As management assigns and oversees these expenditure processes, it is carrying out the corporate governance function of proper management oversight.

Management should also establish appropriate internal controls for expenditures processes, such as those controls described in this chapter, which accomplish the objectives of safeguarding assets within expenditures processes and ensuring accuracy and completeness of expenditures data. These internal controls are also part of the corporate governance structure.

When management has designed, implemented, and continually monitors processes and internal controls, it is helping to ensure proper stewardship of the company's assets. Corporate governance requires proper financial stewardship. The processes, internal controls, and feedback data from these systems help management report to owners and other stakeholders about proper stewardship of assets within the expenditures processes. These assets include inventory, raw materials, supplies, cash, and operating assets.

Finally, good corporate governance requires ethical conduct. This chapter describes some ethical issues that management should consider and address within the expenditures processes. When top management acts ethically and encourages ethical behavior throughout the organization, stronger corporate governance results. There are usually fewer cases of frauds, errors, and ethical problems in an organization when top management behaves ethically and encourages ethical behavior.

Perhaps it would be easier to understand the way this chapter's topics fit into corporate governance if you think of it from a negative perspective. For example, if management of a particular organization did not establish sound processes, good internal controls, and ethical policies, it would lack good corporate governance. In that organization, expenditures processes would be poorly executed and poorly controlled. Management would not be exercising proper financial stewardship. Therefore, stakeholders such as investors, creditors, and owners would have little or no trust that funds were expended in a manner that would benefit the organization and its owners. The organization would not represent the type of organization in which we would wish to invest our own money. On the other hand, when an organization has good corporate governance, the stakeholders can properly have more confidence that proper stewardship is occurring. Establishing proper processes, internal controls, and ethical guidelines leads to better corporate governance and, therefore, to good financial stewardship.

## Summary of Study Objectives

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**An introduction to expenditure processes.** There are five typical types of processes related to expenditures. The three that are covered in this chapter are purchasing processes, purchase return processes, and cash disbursement processes.

**Purchasing processes and the related risks and controls.** Purchasing processes include obtaining a purchase requisition; comparison of the requisition with stock levels; authorizing the purchase request; selecting the vendor; preparing a PO; receiving goods at the receiving department; counting, inspecting, and preparing a receiving order for goods received; and updating accounts payable, inventory, and

general ledger records. Purchasing process controls can be categorized into authorization, segregation, adequate records, security of assets and records, and independent checks.

**Purchase return processes and the related risks and controls.** Purchase return processes include rejecting goods already received, matching goods to be returned to the original PO, preparing a debit memorandum; receiving credit and/or a check from the vendor, and updating accounts payable, inventory, and general ledger records. Purchase return process controls can be categorized into authorization, segregation, adequate records, security of assets and records, and independent checks.

**Cash disbursement processes and the related risks and controls.** Cash disbursement processes include determining which invoices are due; matching the PO, invoice, and receiving report; preparing payment; signing and mailing the check; and updating cash, accounts payable, and general ledger records.

**An overview of IT systems of expenditure and cash disbursement processes that enhance the efficiency of expenditures processes.** Manual tasks of entering and matching documents are extremely time-consuming and expensive. Purchasing and payments can become complex because a vendor may occasionally substitute items, ship a different quantity (undership or overship), notify the buyer of back orders, or partially fill an order. Thus, it takes a large amount of human time and effort to reconcile and approve expenditures for payment. IT systems can be used to reduce or eliminate these manual, time-consuming tasks. IT systems for purchasing related processes are computer-based matching, evaluated receipt settlement (ERS), e-business and electronic data interchange (EDI), and e-payables or electronic invoice presentment and payment (EIPP).

**Computer-based matching of purchasing documents and the related risks and controls.** A computer software system can match an invoice to its related PO and receiving report to approve payment of an invoice. To institute an automated matching system, all of the purchasing and receiving files must be online and constantly ready for processing. The system can then access the online PO and receiving files and check the match of items, quantities, and prices. The system will not approve an invoice for payment unless the items and quantities match with the packing slip and the prices match the PO prices. This ensures that the vendor has billed for the correct items, quantities, and prices. An automated matching system exposes several risks that a company must manage, including security, availability, processing integrity, and confidentiality risks.

**Evaluated receipt settlement systems and the related risks and controls.** An ERS system conducts a comparison by matching the PO to the goods received. If the PO matches the goods, payment is made to the vendor. This eliminates the need for the vendor to send an invoice, since payment is approved as soon as goods are received (when they match a PO). Thus, it is an invoiceless system. An ERS system poses several risks that a company must manage, including security, availability, processing integrity, and confidentiality risks.

**E-business and electronic data interchange (EDI) systems and the related risks and controls.** E-business and EDI systems were covered in Chapter 8 from the seller's

perspective. This chapter describes only the difference from the buyer's perspective. The buyer receives goods and pays cash in the exchange, while the seller receives the cash and ships the goods. When these exchanges are viewed from the buyer's perspective as opposed to the seller's, the processes, risks, and controls are very similar. E-business and EDI systems carry with them several risks that a company must manage, including security, availability, processing integrity, and confidentiality risks.

**E-payables systems.** EIPP systems take advantage of the connectivity of the Internet to electronically send invoices or payments. This means that an accounts payable process in an organization could receive invoices electronically via the Internet and make payment via the Internet. These systems typically utilize Web browsers as the interface across which accounts payable employees receive and view invoices and make payments.

**Procurement cards.** Procurement cards or p-cards are essentially credit cards that the organization gives to certain employees to make designated purchases. These cards are normally not used to purchase raw materials or products, but are used for small-dollar-amount purchases such as supplies or maintenance, and to pay for travel and entertainment expenses.

**Ethical issues related to expenditure processes.** The board of directors and management of an organization have an ethical obligation to establish the proper tone at the top, strong internal controls, and high ethical standards. If they do not, owners of the organization are harmed when the company is defrauded through management fraud, fictitious vendor payments, and expense reimbursement fraud. It is important to establish internal control policies and IT controls to help prevent or detect such fraud, ethical lapses, or errors.

**Corporate governance in expenditure processes.** Corporate governance policies are critically important within expenditure processes, as they help to ensure that funds are expended only in an approved manner. Corporate governance policies should incorporate the four areas of management oversight, internal controls, financial stewardship, and ethical behavior. A strong form of corporate governance should help prevent fraud, theft, and misuse of corporate assets.

## Key Terms

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Accounts payable subsidiary ledger	Cash management	Evaluated receipt settlement (ERS)	Purchase requisition
Automated matching	Common carrier	Intrusion detection software	Receiving log
Bill of lading	Cutoff	Packing Slip	Receiving report
Blind purchase order	Debit memo	Penetration testing	Remittance advice
Business process reengineering (BPR)	Dual signature requirement	Procurement card (p-card)	Three-way match
Cash disbursements journal (or check register)	e-payables	Purchase invoice	Transaction processing systems
	Electronic invoice presentment and payment (EIPP)	Purchase order (PO)	Vendor
			Vulnerability testing

# End of Chapter Material

## Concept Check



- 1 Within the purchasing processes, which of the following is the first document prepared and thereby the one that triggers the remaining purchasing processes?
  - a. The invoice
  - b. The receiving report
  - c. The purchase order
  - d. The purchase requisition
- 2 Personnel who work in the receiving area should complete all of the following processes except
  - a. counting the goods received
  - b. inspecting goods received for damage
  - c. preparing a receiving report
  - d. preparing an invoice
- 3 Which of the given departments will immediately adjust the vendor account for each purchase transaction so that the company will know the correct amount owed to the vendor?
  - a. Purchasing
  - b. Receiving
  - c. Accounts payable
  - d. Shipping
- 4 One of the most critical controls to prevent theft of inventory purchased is to
  - a. require authorization of the purchase requisition
  - b. segregate inventory custody from inventory record keeping
  - c. compare the PO, receiving report, and invoice
  - d. segregate the authorization of purchases from the inventory record keeping
- 5 Internal control is strengthened by the use of a blind purchase order, upon which the quantity of goods ordered is intentionally left blank. This blind copy is used in which department?
  - a. The department that initiated the purchase request
  - b. The receiving department
  - c. The purchasing department
  - d. The accounts payable department
- 6 Which of the following questions would most likely be included in an internal control questionnaire concerning the completeness of purchase transactions?
  - a. Is an authorized PO required before the receiving department can accept a shipment or the accounts payable department can record a voucher?
  - b. Are prenumbered purchase requisitions used, and are they subsequently matched with vendor invoices?
  - c. Is there a regular reconciliation of the inventory records with the file of unpaid vouchers?
  - d. Are prenumbered POs, receiving reports, and vouchers used, and are the entire sequences accounted for?
- 7 Which of the following controls is not normally performed in the accounts payable department?
  - a. The vendor's invoice is matched with the related receiving report.
  - b. Vendor invoices are selected for payment.
  - c. Asset and expense accounts to be recorded are assigned.
  - d. Unused purchase orders and receiving reports are accounted for.
- 8 In a system of proper internal controls, the same employee should not be allowed to
  - a. sign checks and cancel the supporting voucher package
  - b. receive goods and prepare the related receiving report
  - c. prepare voucher packages and sign checks
  - d. initiate purchase requisitions and inspect goods received
- 9 The document prepared when purchased items are returned is a(n)
  - a. debit memo
  - b. invoice
  - c. receiving report
  - d. sales journal
- 10 Within cash disbursements, all of the following should be true before a check is prepared, except that
  - a. The PO, receiving report, and invoice have been matched
  - b. The purchased goods have been used
  - c. Sufficient cash is available
  - d. The invoice discount date or due date is imminent

- 11 A manager suspects that certain employees are ordering merchandise for themselves over the Internet without recording the purchase or receipt of the merchandise. When vendors' invoices arrive, one of the employees approves the invoices for payment. After the invoices are paid, the employee destroys the invoices and related vouchers. To trace whether this is actually happening, it would be best to begin tracing from the
- cash disbursements
  - approved vouchers
  - receiving reports
  - vendors' invoices
- 12 Within accounts payable, to ensure that each voucher is submitted and paid only once, each invoice approved to be paid should be
- supported by a receiving report
  - stamped "paid" by the check signer
  - prenumbered and accounted for
  - approved for authorized purchases
- 13 For proper segregation of duties in cash disbursements, the person who signs checks also
- reviews the monthly bank reconciliation
  - returns the checks to accounts payable
  - is denied access to the supporting documents
  - is responsible for mailing the checks
- 14 Which of the following internal controls would help prevent overpayment to a vendor or duplicate payment to a vendor?
- Review and cancellation of supporting documents after issuing payment
  - Requiring the check signer to mail the payment directly to the vendor
  - Review of the accounts where the expenditure transaction has been recorded
  - Approving the purchase before the goods are ordered from the vendor
- 15 Which of the following is not an independent verification related to cash disbursements?
- The cash disbursements journal is reconciled to the general ledger.
  - The stock of unused checks should be adequately secured and controlled.
  - The bank statement is reconciled on a monthly basis.
  - The accounts payable subsidiary ledger is reconciled to the general ledger.
- 16 Which of the following IT systems is designed to avoid the document matching process and is an "invoiceless" system?
- Computer-based matching system
  - Electronic data interchange
  - Evaluated receipt settlement
  - Microsoft Dynamics GP
- 17 Input controls such as field check, validity check, limit check, and reasonableness check are useful in IT systems of purchasing processes to lessen which of the following risks?
- Unauthorized access
  - Invalid data entered by vendors
  - Repudiation of purchase transactions
  - Virus and worm attacks
- 18 Which of the following is most likely to be effective in deterring fraud by upper-level managers?
- Internal controls
  - An enforced code of ethics
  - Matching documents prior to payment
  - Segregating custody of inventory from inventory record keeping

### Discussion Questions

- 19 (SO 2) Name the first document that should be prepared when a production employee recognizes that the quantity of goods on hand is insufficient to meet customer demand.
- 20 (SO 2) How does the maintenance of a receiving log enhance internal controls?
- 21 (SO 2) Why should a receiving clerk be denied access to information on a purchase order?
- 22 (SO 2) Under what circumstances would it be necessary to manually update accounts payable prior to the receipt of a vendor's invoice?
- 23 (SO 4) Which department is responsible for making sure that payments are made in time to take advantage of vendor discounts?
- 24 (SO 4) Why would some checks need to include two signatures?
- 25 (SO 4) During the process of reconciling the bank account, why is it necessary to review the dates, payees, and signatures on the canceled checks?
- 26 (SO 4, 6) What specifically does a cash disbursements clerk do when he or she "cancels" an invoice? How does this compare with the procedures followed when computer-based matching in the system is utilized?
- 27 (SO 4) Why should accountants periodically review the sequence of checks issued?
- 28 (SO 2, SO 4) What accounting records are used by accounts payable personnel to keep track of amounts owed to each vendor?

- 29 (SO 5) Identify some inefficiencies inherent in a manual expenditures processing system.
- 30 (SO 5) What are the advantages of BPR?
- 31 (SO 5, SO 6, SO 7, SO 8) List three examples of BPR used in the expenditures processes.
- 32 (SO 6) Explain how system logic errors could cause cash management problems.
- 33 (SO 6) Explain how system availability problems could cause cash management problems.
- 34 (SO 8) How is an audit trail maintained in an IT system where no paper documents are generated?
- 35 (SO 6) What can a company do to protect itself from business interruptions due to power outages?
- 36 (SO 7) What paper document is eliminated when ERS is used?
- 37 (SO 7) Identify compensating controls needed for an effective ERS system.
- 38 (SO 5) What is typically the most time-consuming aspect of the expenditures process?
- 39 (SO 8) Identify each category of risk that can be reduced by using authority tables, computer logs, passwords, and firewalls.
- 40 (SO 6) Explain why the availability of computer systems in the receiving department is such an important component of an automated expenditures process.
- 41 (SO 5, SO 8) Identify three ways that buyers and sellers may be linked electronically.
- 42 (SO 8) What techniques can a company use to reveal problems concerning potential exposure to unauthorized access to its systems?
- 43 (SO 9) How are Web browsers used in e-payables systems?

- 44 (SO 10) Explain how procurement cards provide for increased efficiencies in the accounts payable department.

### Brief Exercises

- 45 (SO 2, SO 4) Describe what is likely to occur if company personnel erroneously recorded a purchase transaction for the wrong vendor. What if a cash disbursement were posted to the wrong vendor? Identify internal controls that would detect or prevent this from occurring.
- 46 (SO 4) Debate the logic used in the following statement: "The person responsible for approving cash disbursements should also prepare the bank reconciliation because he is most familiar with the checks that have been written on that bank account."
- 47 (SO 8) Expenditures systems are crucial in the automobile manufacturing industry, where hundreds or thousands of parts must be purchased to manufacture cars. Briefly describe how EDI would be beneficial in this industry.
- 48 (SO 2, SO 4) Describe how the matching of key information on supporting documents can help a company determine whether purchase transactions have been properly executed.
- 49 (SO 2, SO 3) Describe how the use of prenumbered forms for debit memos can help a company ascertain that purchase return transactions have not been omitted from the accounting records.
- 50 (SO 5, SO 7) Describe how an ERS system could improve the efficiency of expenditures processes.
- 51 (SO 10) Describe how a procurement card improves the efficiency of purchasing supplies.

## Problems

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- 52 (SO 2, SO 5, SO 6, SO 7, SO 8) Refer to the Real World example for City Harvest and the details in the chapter. Outline the business process improvements that can occur in the inventory and purchasing processes when a manual or nonintegrated system is replaced with a fully integrated ERP system to efficiently manage the purchase and distribution of inventory.
- 53 (SO 2, SO 3, SO 4) Identify an internal control procedure that would reduce the following risks in a manual system:
- The purchasing department may not be notified when goods need to be purchased.
  - Accounts payable may not be updated for items received.
  - Purchase orders may be prepared on the basis of unauthorized requisitions.
  - Receiving clerks may steal purchased goods.
  - Payments may be made for items not received.
  - Amounts paid may be applied to the wrong vendor account.
  - Payments may be made for items previously returned.
  - Receiving clerks may accept delivery of goods in excess of quantities ordered.
  - Duplicate payments may be issued for a single purchase transaction.
- 54 (SO 2, SO 3, SO 4, SO 5, SO 6) Identify an internal control procedure that would reduce the following

risks in automated fully integrated ERP system such as Microsoft Dynamics GP:

- a. The purchasing department may not be notified when goods need to be purchased.
  - b. Accounts payable may not be updated for items received.
  - c. Purchase orders may be prepared on the basis of unauthorized requisitions.
  - d. Receiving clerks may steal purchased goods.
  - e. Payments may be made for items not received.
  - f. Amounts paid may be applied to the wrong vendor account.
  - g. Payments may be made for items previously returned.
  - h. Receiving clerks may accept delivery of goods in excess of quantities ordered.
  - i. Duplicate payments may be issued for a single purchase transaction.
  - j. The accounts payable clerk has a check out to himself (assume the company utilizes automated check signing functionality).
- 55 (SO 2, SO 6) Compare how a company with a manual process of matching a PO, receiving report and vendor invoice would differ from a company that uses Microsoft Dynamics GP or other integrated ERP solution where automated (electronic) matching of a

PO, receiving report and vendor invoice occurs. Explain how the audit of the manual and automated systems may differ.

- 56 (SO 1, SO 10) Joy Tucker started a new business: a coffee and pastry cart located at the local library. Joy hired her brother, Eric, as her assistant. Joy and Eric personally make all the purchases of items needed to stock the cart, using procurement cards issued in the name of the company. Because Joy is personally liable for payments made on the procurement cards, she recognizes the need to establish policies for her brother to follow for the use of this card. Suggest some controls that should be in place. Identify some resources that need to be purchased for this business.
- 57 (SO 1, SO 5) Holsten Company is considering a business process reengineering (BPR) project whereby its current (mostly manual) expenditures processing would be converted to an automated system. Brainstorm ideas for this project. Specifically, what processes could be redesigned? What current IT developments should Holsten consider implementing? You may find it helpful to use the Internet to locate information on BPR related to the expenditures process.
- 58 (SO 2) The following figure shows a packing list received by Frazier Stamping, Inc. When a packing slip arrives at the receiving dock with a shipment,



#### Frazier Stamping Corporation

10493 North Oak Street  
Gainesville, FL  
Phone (625) 555-9988  
Fax (625) 555-9989

**Order Date:** September 25, 2013  
**Order Number:** 75489  
**Purchase Order:** PO549364  
**Ship To:** Laser, Inc.  
Attn: Research Department  
5242 Main Street  
Haverhill, FL 33422

#### Packing Slip

<b>Date:</b>	September 30, 2013
<b>Customer Contact:</b>	Erin Smithers
<b>Customer Account:</b>	5404
<b>Bill To:</b>	Laser, Inc. Attn: Accounts Payable 5242 Main Street Haverhill, FL 33422

Part #	Description	Unit Type	Order Quantity	Ship Quantity	Backorder Quantity
918-0142	Pulley end, 5/8"-18 splined	Each	50	50	0
725-1396	Solenoid	Each	80	80	0
725-0267	Starter switch	Each	50	40	10

a worker prepares a receiving report. The receiving report triggers the process for payment in accounts payable.

**Required:**

Assume that Frazier Stamping, Inc., is preparing to computerize the manual input processes such as completing a receiving report. Use Microsoft Excel to design an appropriate format for a data entry screen that could be used at the receiving dock to enter information from the packing slip in the company's expenditures system.

- 59 (SO 2, SO 4) The following list presents statements regarding the expenditures processes. Each statement is separate and should be considered to be from a separate company. Determine whether each statement is an internal control strength or weakness; then describe why it is a strength or weakness. If it is an internal control weakness, provide a method or methods to improve the internal control.

- a. A purchasing agent updates the inventory subsidiary ledger when an order is placed.
- b. An employee in accounts payable maintains the accounts payable subsidiary ledger.
- c. Purchasing agents purchase items only if they have received an approved purchase requisition.
- d. The receiving dock employee counts and inspects goods and prepares a receiving document that is forwarded to accounts payable.
- e. The receiving dock employee compares the packing list with the goods received and if they match, forwards the packing list to accounts payable.
- f. An employee in accounts payable matches an invoice to a receiving report before approving a payment of the invoice.
- g. A check is prepared in the accounts payable department when the invoice is received.



- 60 (SO 4) Since the accounts payable system of matching POs, invoices, and receiving reports can often be complex, organizations must routinely check to ensure that they are not making a duplicate payment. The textbook website contains a spreadsheet titled "invoices.xls." Using your knowledge of spreadsheets and the characteristics of duplicate payments, identify any payments within the spreadsheet that appear to be duplicate or problem payments.
- 61 (SO 2, SO 3, SO 4) Kittner, Inc., is a small company with three people working in the expenditures processes. One of the three employees is the supervisor of the other two. Some tasks that must be accomplished within the expenditures processes are the following:

- a. Accounts payable record keeping
- b. Authorization of new vendors
- c. Authorization of purchase returns
- d. Authorization of purchases
- e. Cash disbursements record keeping
- f. Check-signing authority
- g. Custody of inventory in the receiving area
- h. Maintaining custody of cash
- i. Preparation of a debit memo for a purchase return

**Required:**

Consider the duties you would assign to each of the three employees (supervisor, employee 1, and employee 2). No employee should have more than three tasks, and there should be a proper separation of duties to achieve appropriate internal control. List the three people, the duties you assigned to each, and a description of why those assignments should achieve proper separation of duties.

- 62 (SO 5, SO 6, SO 7, SO 8) As noted in the chapter, increasingly companies with updated ERP systems are going paperless and documents and transactional data are being stored electronically. Outline the changes that would need to occur to ensure that there were adequate controls within the companies adopting a paperless option or any aspect of electronic storage.

- 63 (SO 7) Using a search engine, search the Internet for information about evaluated receipt settlement, or ERS. You may have more success searching for the terms "ERS" and "invoices" together in one search. From what you read about ERS on the Web, what do you think appear to be the difficulties encountered when a company chooses to implement ERS?

- 64 (SO 8) Koler Manufacturing Company operates two plants that manufacture shelves and display units for retail stores. To manufacture these items, the purchasing agents purchase raw materials such as steel, aluminum, plastic, lexan, and miscellaneous screws, rubber end caps, bolts, and nuts. Two purchasing agents work at the first, and original, plant location. They do all the purchasing for both plants, which are located in Minneapolis, Minnesota. Each purchasing agent has a PC that is connected to a company network consisting of a server at the first plant and PCs in both plants. The company has always used mailed POs to purchase items, but they are now considering the installation of an Internet EDI system to place purchases.

**Required:**

Describe the IT controls that Koler should include when it implements an Internet EDI system. For each control you suggest, describe the intended purpose of the control.

- 65 (SO 9) Using a search engine, search the Internet for information about electronic invoice presentment and payment. You may have more success searching for the terms “EIPP” and “invoices” together in one search. On some websites, it may be called EIP rather than EIPP. From what you read about EIPP on the Web, what would you say are the advantages and disadvantages of EIPP? One of the concepts about EIPP is that it should benefit both the buying company and the selling company. What do you think the benefits are to the buyer and to the seller?
- 66 (SO 9) Using a search engine, search the Internet for an article titled “The advantages of customer self-service for B2B Electronic Invoice Presentment and Payment (EIPP)” Briefly explain what the article describes as the advantages of adopting EIPP.



- 67 (SO 11) Suppose you are an accounts payable clerk for a small home-improvements contractor. This morning one of the site supervisors submitted an invoice requesting immediate payment to a new vendor for items he claims were delivered directly to a work site. The supervisor attached a note to the invoice asking that the check be returned to him upon issuance so that he could personally deliver it to

the vendor. This would ensure the timeliness of future deliveries. He claims that unless the payment is made immediately, there will be delivery delays on items needed to complete this job, as well as delays on items for another contract in progress. Although you are suspicious of this unusual request, you are tempted to accommodate it. You know that timely completion and collection on these contracts is critical to the company’s production scheduling and cash management. Moreover, the company president is on vacation and therefore not available to grant special authorization for this payment. Speculate on the type of fraud that could be in process here. What (if anything) could you do to ascertain the propriety of the transaction and still make the payment today?

- 68 (SO 11) Two of the most common ways that employees commit fraud against their employers is the misstatement of reimbursable expense accounts and the misuse of office supplies for personal purposes. Although these schemes are usually not individually significant, their magnitude can be damaging if these practices are widespread. Develop suggestions for internal controls that could curb the occurrence of such fraudulent activities.

## Cases

- 69 Notting, Inc., has the following processes related to purchasing: When it is determined that an item should be ordered, the purchasing department prepares a three-copy PO. The first copy is mailed to the vendor, the second copy is filed by PO number in the purchasing department, and the third copy is forwarded to inventory control. Inventory control updates the inventory ledger with the quantities that were ordered and files the PO copy by date.

When ordered items arrive at the receiving dock, the packing slip is inspected and a two-copy receiving report is prepared. The first copy is forwarded to the purchasing department, where it is filed with the PO. The second copy is filed in the receiving department by date. The packing slip is forwarded to the accounts payable department.

Vendors mail invoices directly to the accounts payable department. The accounts payable department reviews the invoice and related packing slip, prepares a cash disbursement voucher, updates the accounts payable ledger, and files the invoice by date. The cash disbursement voucher is forwarded to the cash disbursements department. The packing slip is returned to the receiving department. The cash disbursements department prepares a two-copy check, mails the first copy to the vendor, and forwards the second copy to the general ledger

department. The cash disbursement voucher is forwarded to the accounts payable department where it is filed with the invoice.

The general ledger department updates the general ledger accounts, using the second copy of the check, and then forwards the check copy to cash disbursements to be filed by check number.

**Required:**

1. Draw a document flowchart of the purchase processes of Notting.
2. Identify any weaknesses in internal controls within the purchase processes and indicate the improvements you would suggest.

- 70 Melcher Enterprises is a wholesaler that purchases consumer merchandise from many different suppliers. Melcher then sells this merchandise to many different retail chain stores. The following paragraphs describe the expenditures processes at Melcher:

Warehouse employees constantly monitor the level of each merchandise item by assessing how many remaining boxes of items are on warehouse shelves. When a warehouse worker sees the need to order a particular product, he fills out a postcard-size order requisition form with the product name and item number. The number is Melcher’s item number.

When the purchasing department receives a requisition from the warehouse employee, a buyer looks up the last purchase of that item and completes a PO to buy the item from that vendor. The manager of the purchasing department approves the PO before it is mailed to the vendor. One copy of the PO is mailed to the vendor, one copy is filed in the purchasing department, one copy is forwarded to the receiving department, and one copy is forwarded to the accounts payable department.

When the receiving department receives an order, it compares the packing slip with the PO. If no PO exists, the item is returned to the vendor. A receiving report is prepared for the number of items indicated on the packing slip. One copy of the receiving report is filed in the receiving department, one copy is forwarded to the purchasing department, and one copy is forwarded to the accounts payable department. Items received are then transported to the warehouse.

When the accounts payable department receives an invoice from the vendor, an employee in the accounts payable department compares the PO, receiving report, and invoice. If the three documents match correctly, a cash disbursement voucher is prepared. If it does not match, the employee contacts the vendor to try to reconcile the differences. The cash disbursement voucher is reviewed by the manager of the accounts payable department. If it appears correct to her, she writes a check and forwards the check to the treasurer to be signed and mailed to the vendor.

**Required:**

1. List any strengths and weaknesses in the internal control procedures of Melcher Enterprises.
  2. Draw a document flowchart of the expenditure processes.
  3. Describe any benefits that Melcher may receive by installing a newer, IT system to process purchases, goods received, accounts payable, and checks. Be specific as to how IT systems could benefit each of the processes described.
- 71 Krandolph Metals, Inc., is a manufacturer of aluminum cans for the beverage industry. Krandolph purchases aluminum and other raw materials from several vendors. The purchasing process at Krandolph occurs as follows:
- When inventory of any raw material seems low, a purchasing agent examines the records to determine the vendor who supplied the last purchase of that raw material. The purchasing agent prepares a three-copy PO and mails the top copy to the vendor. One copy is filed in the purchasing department, and one copy is forwarded to the inventory control department (inventory record keeping). Inventory control personnel update the inventory subsidiary ledger and file the PO by number in the inventory control files.
- When the goods arrive at the receiving dock, a receiving report is prepared from information on the packing slip. One copy of the receiving report is filed in the receiving department, and one copy is forwarded to purchasing so that the purchasing department is informed of the receipt of goods.
- The vendor mails an invoice for the raw materials directly to the accounts payable department. When the invoice is received, accounts payable personnel prepare a cash disbursement voucher to approve payment. The voucher is forwarded to the cash disbursements department. The accounts payable department also updates the accounts payable subsidiary ledger and files the invoice by invoice number.
- Upon receiving the cash disbursement voucher, an employee in the cash disbursements department prepares a two-copy check. The top copy of the check is mailed to the vendor, and the second copy is forwarded to the general ledger department. The cash disbursement voucher is stamped "paid" and returned to the accounts payable department. The voucher is filed with the invoice in the accounts payable department.
- The general ledger department records the check in the general ledger and returns the check copy to the cash disbursements department, where it is filed.
- Required:**
- a. Draw two process maps to reflect the business processes at Krandolph. One process map should depict the purchasing processes, and the second process map should depict the cash disbursements processes.
  - b. Draw two document flowcharts to reflect the records and reports used by these processes at Krandolph. One flowchart should depict the purchasing processes, and the second flowchart should depict the cash disbursements processes.
  - c. Describe any weaknesses in these processes or internal controls. As you identify weaknesses, also describe your suggested improvements.
  - d. Draw two new process maps that include your suggested improvements. One process map should depict the purchasing processes, and the second process map should depict the cash disbursement processes.
- 72 The United States General Accounting Office (GAO) Office of Special Investigations was responsible for investigating a potential purchase fraud case. The man who allegedly committed the fraud was Mark J. Krenik, a former civilian employee of the U.S. Air Force.
- Mr. Krenik was the Air Force's technical representative on contracts with Hughes STX. Hughes STX provided hardware, software maintenance, technical

support, and training to the Air Force. Part of Mr. Krenik's alleged fraud included opening accounts under his control at banks in Maryland. The accounts were opened under the names Hughes STX and ST Systems Corporation. A section of the GAO report on this fraud investigation reads as follows<sup>3</sup>:

On December 15, 1992, Mr. Krenik opened post office box 215 in Vienna, Virginia, in his own name. On December 24, 1992, Mr. Krenik delivered to the Air Force Finance Office 11 bogus invoices totaling \$504,941.19. Accompanying the invoices were the respective DD-250s, on which Mr. Krenik had falsely certified that work had been performed and deliveries made. Special instructions on the invoices directed that payments be remitted to ST Systems Corporation at the Vienna, Virginia post office box.

Mr. Krenik deposited the checks in the accounts he controlled at the Maryland banks. His fraud was unsuccessful because bank employees became suspicious when he tried to withdraw large sums from the accounts.

**Required:**

Describe internal controls that should have been in place at the Air Force to help prevent such fraud.

- 73 The document flowchart on the next page shows part of the purchasing and cash disbursement processes for Wilson, Inc., a small manufacturer of gadgets and widgets. Some of the flowchart symbols are labeled to indicate operations, controls, and records.

**Required:**

For each of the symbols in the flowchart (numbered 1–12), select one response (lettered A–T) from the

answer lists. Each response may be selected once or not at all.

- |          |          |           |
|----------|----------|-----------|
| 1. _____ | 5. _____ | 9. _____  |
| 2. _____ | 6. _____ | 10. _____ |
| 3. _____ | 7. _____ | 11. _____ |
| 4. _____ | 8. _____ | 12. _____ |

**Operations and controls:**

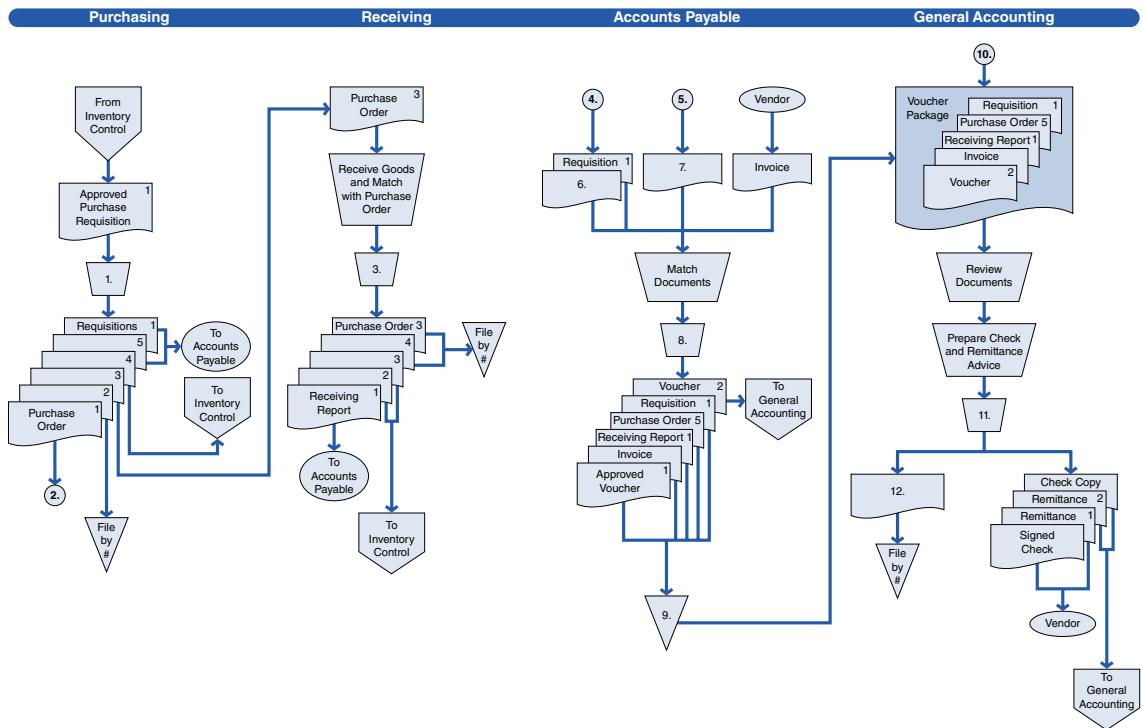
- A. Approve receiving report
- B. Prepare and approve voucher
- C. Prepare purchase order
- D. Prepare purchase requisition
- E. Prepare purchases journal
- F. Prepare receiving report
- G. Prepare sales journal
- H. Prepare voucher package
- I. Sign check and cancel voucher package
- J. Accounts payable

**Connectors, documents, departments, and files:**

- K. Canceled voucher package
- L. From purchasing
- M. From receiving
- N. From accounts payable
- O. Purchase order no. 5
- P. Receiving report no. 1
- Q. Inventory control
- R. To vendor
- S. Treasurer
- T. Unpaid voucher file

(Excerpt from Adapted CPA Simulation Problem)

<sup>3</sup> Report to the Chairman, Subcommittee on Administrative Oversight and the Courts, Committee on the Judiciary, U.S. Senate. General Accounting Office, September 1998, p. 10.



## Solutions to Concept Check

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- 1 (SO 2) Within the purchasing processes, the first document prepared, and thereby the one that triggers the remaining purchasing processes, is **d. the purchase requisition**. When a determination has been made that more supplies or inventory must be purchased, a purchase requisition is prepared and then forwarded to other departments to begin the purchasing processes.
- 2 (SO 2) Personnel who work in the receiving area should complete all of the following processes except **d. preparing an invoice**. When goods arrive at the receiving department, workers should inspect the goods for damage, count the goods, and prepare a receiving report. The invoice is prepared by the vendor.
- 3 (SO 2) The department that will immediately adjust the vendor account for each purchase transaction so that the company will know the correct amount owed to the vendor is **c. accounts payable**. Accounts payable maintains records of the amounts owed to vendors, in the form of an accounts payable subsidiary ledger. When purchase transactions occur, accounts payable should update the accounts payable subsidiary ledger to show the new amount owed to the vendor.
- 4 (SO 2) One of the most critical controls to prevent theft of inventory purchased is to **b. segregate inventory custody from inventory record keeping**. Each of the remaining options are good internal controls, but not all of them help deter theft of inventory. The best control to prevent theft of inventory is to segregate custody from record keeping. Segregating these makes it much more difficult for a person to steal inventory *and* alter inventory records.
- 5 (CPA Adapted) (SO 2) Internal control is strengthened by the use of a blind purchase order, upon which the quantity of goods ordered is intentionally left blank. This blind copy is used in **b. the receiving department**. This control allows the goods to be independently inspected and counted upon receipt. Receiving department employees must actually count the goods rather than just check off an amount. Each of the other options are for departments that need to know the quantity of goods in order to complete their responsibilities.
- 6 (CPA Adapted) (SO 2) The following question would most likely be included in an internal control questionnaire concerning the completeness of purchasing transactions: **d. Are prenumbered purchase orders, receiving reports, and vouchers used, and are the entire sequences accounted for?** Accounting for an entire sequence of prenumbered documents provides preventive control against record omissions. In other words, it helps ensure the completeness of the records. Option a. is incorrect because it is concerned with the assertion regarding authorization. Although options b. and c. each have some relevance to the completeness assertion, b. is not the best response because purchase requisitions may not always result in a purchase transaction (rather, POs and receiving reports are better indicators that a purchase transaction occurred) and c. is incorrect because vouchers represent purchase transactions that should have already been recorded; accordingly, this control would be more likely to address completeness of the inventory records.
- 7 (CPA Adapted) (SO 2, SO 4) The following control is not normally performed in the accounts payable department: **d. Unused purchase orders and receiving reports are accounted for**. In order to enhance the effectiveness of internal controls via segregation of duties, this task is normally performed by an employee who does not have access to the accounts payable records. This prevents the opportunity to create a fictitious purchase transaction and record it in the company's accounting records. Each of the other options represent accounts payable department tasks.
- 8 (CPA Adapted) (SO 2, SO 4) In a system of proper internal controls, the same employee should not be allowed to **c. prepare voucher packages and sign checks**. This violates the segregation of duties principles in that it would permit record keeping (preparation of voucher packages) and custody (check-signing authority) functions to be carried out by the same employee. Each of the other options represents tasks that ARE typically performed by the same employee or within the same department.
- 9 (SO 3) The document prepared when purchased items are returned is the **a. debit memo**. When purchased items are to be returned, a debit memo is prepared. An invoice is prepared by the vendor. A receiving report is prepared when purchased goods are received. A sales journal is part of the revenue processes, not the purchasing processes.
- 10 (SO 4) Within cash disbursements, all of the given statements should be true before a check is prepared, except for **b. The purchased goods have been used**. Prior to approving payment for purchased goods, the processes in the company should ensure that the PO, receiving report, and invoice have been matched; sufficient cash is available; and either the invoice due date or discount date warrants payment. A company could not wait until the goods are used to pay, since vendors want payment upon the due date.

- 11 (CPA Adapted) (SO 4) A manager suspects that certain employees are ordering merchandise for themselves over the Internet without recording the purchase or receipt of the merchandise. When vendor's invoices arrive, one of the employees approves the invoices for payment. After the invoices are paid, the employee destroys the invoices and related vouchers. To trace whether this is actually happening, it would be best to begin tracing from the **a. cash disbursements**. The record of payment would be the only option for possibly uncovering this scheme. Since these fraudsters are not recording the receipt of merchandise and they are destroying invoices and vouchers, options b., c., and d. would each be incorrect.
- 12 (CPA Adapted) (SO 4) Within accounts payable, to provide assurance that each voucher is submitted and paid only once, each invoice approved to be paid should be **b. stamped “paid” by the check signer**. This represents the cancellation of the invoice, which should prevent a duplicate payment. Although each of the other options represents an internal control, they are not effective at preventing duplicate payments.
- 13 (CPA Adapted) (SO 4) For proper segregation of duties in cash disbursements, the person who signs checks also **b. returns the checks to accounts payable**. This allows for the recording of the payments (separate from the custody and authorization functions). Option c. is incorrect because check signers typically review supporting documentation to determine the propriety of the payment. Options a. and d. are incorrect because they would represent violations of proper segregation of duties.
- 14 (CIA Adapted) (SO 4) The internal control that would help prevent overpayment to a vendor or duplicate payments to a vendor is **a. review and cancellation of supporting documents when a check is issued**. Option b. is incorrect because it represents a violation of segregation of duties and would not necessarily prevent a duplicate payment. Although options c. and d. are internal controls, neither is effective in the prevention of duplicate payments.
- 15 (SO 4) The following is not an independent verification related to cash disbursements: **b. The stock of unused checks should be adequately secured and controlled**. This is a security control, not an independent verification. Independent verifications are independent checks on accuracy and completeness, such as reconciliations.
- 16 (SO 5, SO 7) The IT system designed to avoid the document-matching process and that is an “invoiceless” system is **c. evaluated receipt settlement (ERS)**. In an ERS system, there is an invoiceless match that takes place by matching the PO to the goods received. If the PO matches the goods, payment is made to the vendor. This eliminates the need for the vendor to send an invoice, since payment is approved as soon as goods are received (when they match a PO). Thus, it is an invoiceless system.
- 17 (SO 5, SO 8) Input controls such as field check, validity check, limit check, and reasonableness check are useful in IT systems of purchasing processes to lessen the risk of **b. invalid data entered by vendors**. IT controls such as field check, validity check, limit check, and reasonableness check are input validation controls. They are intended to prevent or detect the invalid input of data. These controls are of little or no value in preventing unauthorized access, repudiation of transactions, or virus and worm attacks.
- 18 (SO 11) The option most likely to be effective in deterring fraud by upper-level managers is **b. an enforced code of ethics**. Upper-level managers are above the level of internal controls; therefore, internal control systems, matching documents, or segregating duties have little impact on the prevention of fraud by upper-level management. Having and enforcing a code of ethics sets the proper “tone at the top” and makes it more difficult for upper-level managers to conduct fraud.

# Expenditures Processes and Controls—Payroll and Fixed Assets

### STUDY OBJECTIVES

This chapter will help you gain an understanding of the following concepts:

- 1.** An introduction to payroll and fixed asset processes
- 2.** Payroll processes
- 3.** Risks and controls in payroll processes
- 4.** IT systems of payroll processes
- 5.** Fixed asset processes
- 6.** Risks and controls in fixed asset processes
- 7.** IT Systems of fixed asset processes
- 8.** Ethical issues related to payroll and fixed assets processes
- 9.** Corporate governance in payroll and fixed assets processes

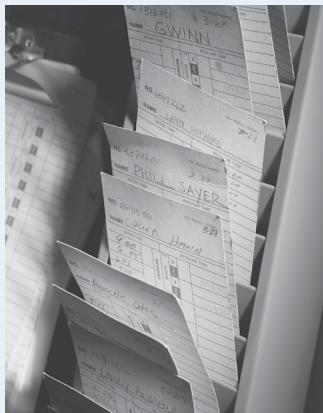
Regardless of the degree of sophistication in a company's hardware and software systems, there are still underlying processes involving people that affect whether the system succeeds. If those underlying processes are not well understood or well executed, errors and problems occur like those described in the Real World examples on the next two pages. Review the Real World examples before reading and reviewing the chapter, as those examples will help you understand the context of many concepts addressed in this chapter.

### Introduction to Payroll and Fixed Asset Processes (Study Objective 1)

This chapter is an extension of Chapter 9, as it continues to present the vital processes of acquiring the resources needed to run a business, recording the resulting liabilities, and making the related payments. The distinction here is the types of resources involved and the frequency of record keeping and payments.

The most frequent types of revenues and expenditure transactions were discussed in Chapters 8 and 9. The processes related to buying goods from vendors and selling goods to customers presented in those chapters are so common that they are typically encountered every day. These processes are sometimes called routine business processes because they involve the transactions that a business encounters on a regular, recurring basis. The volume of those transactions tends to be so large that the transactions and the related accounting activities become routine, almost like second nature, to the employees responsible for handling them. Therefore, specific authorization for each individual routine transaction is not necessary. For example, it would be an overwhelming task to specifically authorize every sale or purchase before it could be processed. On the other hand, there are many different types of transactions that do not

## The Real World



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Soon after implementing a new ERP system in 2003, the Prince George's County, Maryland, school district processed the regular payroll for its 19,000 teachers, administrators, school bus drivers, and other employees. Of those 19,000 paychecks, 1,400 were incorrect. In some cases, teachers were paid only 50 percent of what they were owed. In other cases, teachers were paid too much, and had to return the overage. This is an extremely high number of errors for payroll, and employees get very upset with such errors. The school district had just implemented a new

\$9.5 million integrated accounting software system. However, after an investigation, it was determined that the payroll errors were not the result of hardware or software problems, but problems with people and processes.<sup>1</sup>

The problems were related to the steps that employees used to submit time cards for payroll—in other words, payroll processes. The faulty processes in this case included a time-consuming policy of assigning timekeepers at each school, who had to personally review each time card before submission. Prince George's County also had payroll employees who were inadequately trained in the use of the new payroll module.

A similar payroll debacle occurred at the Los Angeles Unified School District when it implemented the payroll function of its ERP system in 2007. It took years for the district to try to recover the \$60 million in overpayments that were made because of glitches in the system and errors made by employees. An extensive investigation found several problems that led to these payroll problems (both overpayments and underpayments), one of which was inadequate training for employees who operated the payroll system.

occur regularly. They are sometimes called nonroutine transactions due to their limited occurrence and their requirement for specific authorization.

This chapter presents two categories of expenditures that do not occur nearly as often as the inventory purchases discussed in Chapter 9—namely, expenditures for human resources and capital resources. The processes for acquiring and maintaining these valuable business resources specifically involve (1) paying wages and salaries to employees (payroll) and (2) accounting for property, plant, and equipment (fixed assets). Both manual and computerized processes are addressed.

Although the processes surrounding payroll and fixed assets transactions are by no means unusual, they do not typically occur every day. Rather, they are triggered by events that tend to occur irregularly, such as the hiring or firing of an employee and the purchase or disposal of a machine. Also, these processes typically involve a relatively small number of transactions. Therefore, they have characteristics of nonroutine transactions. However, during the life of these resources, these transactions (namely, the related paychecks or depreciation) need to be accounted for on a regular, recurring basis—typically, weekly, biweekly, monthly, or quarterly. This means that they have features of both routine and nonroutine processes. Some components have similarities to those discussed in Chapters 8 and 9, such as the cash disbursements

<sup>1</sup> "Don't Let 'Peopleware' Tank a New Automated Payroll System," *Human Resources Department Management Report*, vol. 4 issue 1, Jan 2004, pp. 6–7.

## The Real World



MyLoupe / Contributor / Getty Images

Shortly after implementing new software to help manage its fixed assets, the National Railroad Passenger Corporation (Amtrak) encountered problems. Although the new software helped Amtrak streamline its fixed assets processes and retire many depreciation spreadsheets and

related systems, in 2014 its auditors noted instances where Amtrak's assets could not be accurately identified. In some cases, recorded assets could not be located; in another instance, an inspected asset was found to have an incomplete record. According to federal regulations, such findings are required to be reported.

Amtrak has been using ERP systems since 1999, yet the addition of its Fixed Asset General Ledger module came several

years later. The problems that the auditors noted were related to the lack of full system integration between the Fixed Asset General Ledger module and the various systems used to track equipment, and Amtrak's inability to fully reconcile these varied systems.<sup>2</sup>

activities common to all of these processes; but the differences are significant enough to warrant their presentation in a separate chapter. Additional topics with unique characteristics, including the conversion process and various treasury and administrative processes, will be addressed in Chapters 11 and 12, respectively.

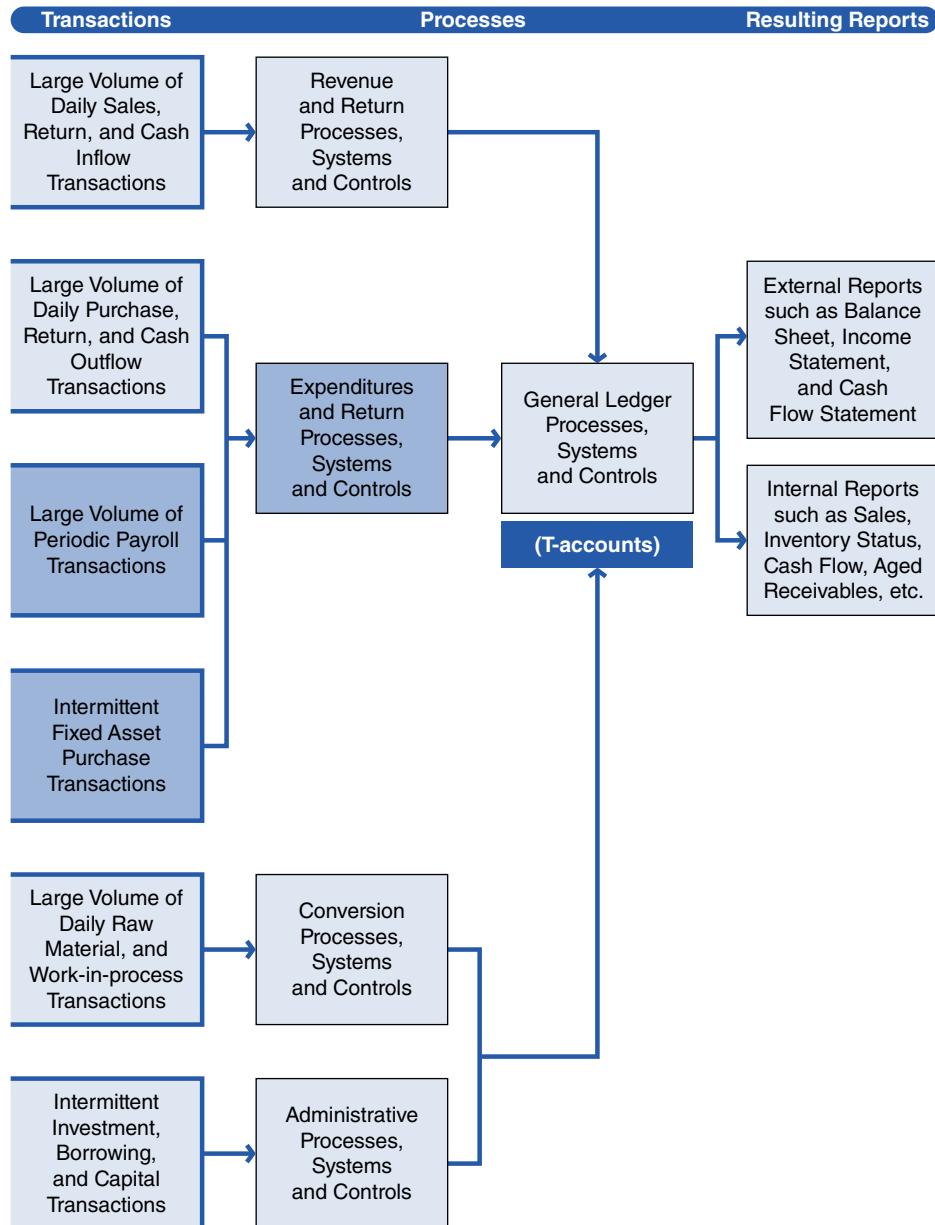
Exhibit 10-1 highlights the portions of the expenditure processes addressed in this chapter, as they relate to the overall accounting system. A company must have systems in place to capture, record, summarize, and report activities for both routine and nonroutine processes. **Payroll processes** include the policies and procedures that employees follow for:

- acquiring and maintaining human resources,
- capturing and maintaining employee data,
- paying employees for time worked, and
- recording cash, payroll liabilities, and expenses that result from these transactions.

**Fixed asset processes** include the policies and procedures for:

- purchasing property, plant, and equipment,
- capturing and maintaining relevant data about the assets,
- paying for and recording the related assets,
- recording depreciation and other expenses, and
- accounting for gains and losses.

<sup>2</sup> [www.amtrak.com/ccurl/704/393/Amtrak-Single-Audit-Report-2014.pdf](http://www.amtrak.com/ccurl/704/393/Amtrak-Single-Audit-Report-2014.pdf)



**EXHIBIT 10-1** Expenditure Processes within the Overall System

Various risks that may affect these types of expenditure transactions are also addressed in this chapter, including the following:

- Recorded expenditures may not be valid; that is, they may involve a fictitious employee or vendor, or they may have been prepared in duplicate.
- Expenditure transactions may be recorded in the wrong amount.
- Valid expenditure transactions may be omitted from the accounting records.
- Expenditure transactions may be recorded in the wrong employee or vendor account.
- Transactions may not be recorded in a timely manner.
- Transactions may not be accumulated or transferred to the accounting records correctly.

The first part of this chapter presents payroll processes, beginning with features of a typical traditional system and the related controls, followed by trends in computer-based systems. The latter part of the chapter uses a similar approach to presenting fixed asset systems. The internal controls procedures that help reduce risks are presented following each process discussion. Finally, ethics and governance issues related to these expenditure processes are covered.

Keep in mind that individual companies may have differences in their payroll and fixed assets practices. This chapter provides common, simple methods of conducting these business processes. The sections on these methods should help you understand most accounting systems involving these expenditure processes, even if they are not exactly like the ones you may have seen in your personal experience.

## Payroll Processes (Study Objective 2)

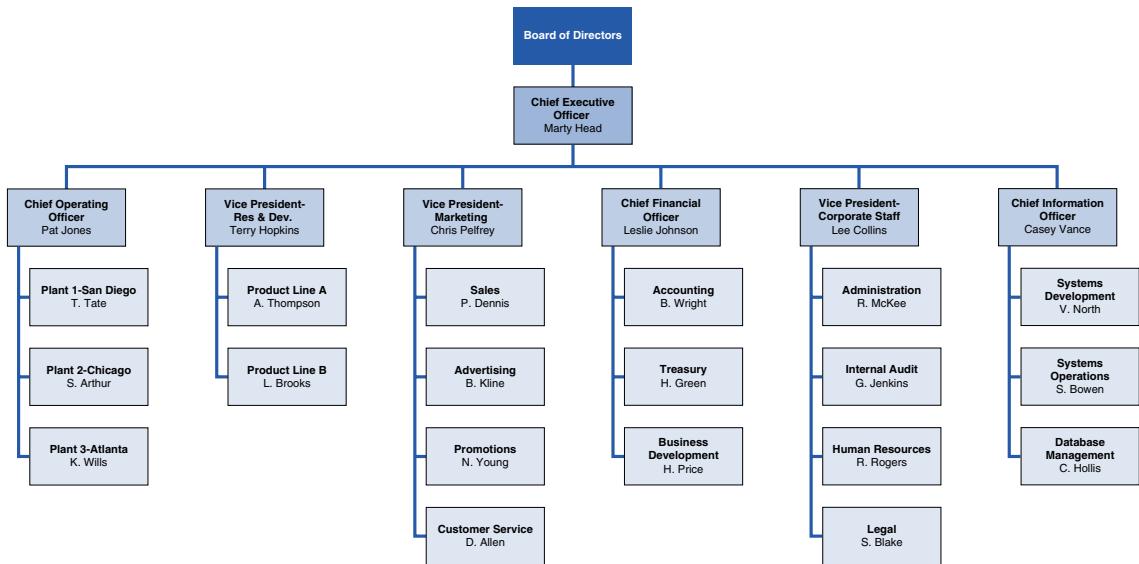
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The payroll process is initiated when employees are hired by the company. Different companies may have very diverse hiring processes. For example, some companies may have an employment office or placement department to handle their recruiting and hiring, while in others (especially smaller companies) personnel in the various departments that have job vacancies may conduct these activities. Regardless of the manner in which it is handled, the hiring of employees is typically considered a nonroutine process. Accordingly, members of management are required to specifically approve all employees hired by the company, even if they are initially screened by an employment office. A hiring decision usually happens as a result of an interview or interviews and is documented on a signed letter and/or signed employment contract.

Since companies need human resources to conduct business operations, the hiring process must occur before other business transactions can take place. Although this may be true initially, the payroll process is also an ongoing organizational process. A company may need to hire new employees at various times throughout its life cycle in order to accommodate growth and replace employees who have left the company, have retired, or have been relocated, reassigned, or terminated.

Information for all employees must be retained and updated regularly. The **human resources department** is responsible for maintaining records for each job and each employee within the organization, as well as tracking job vacancies and supporting the company's recruitment efforts. Most companies maintain an **organization chart** to map out the jobs and reporting relationships. Exhibit 10-2 presents an example of an organization chart for a generic business.

This organization chart presents only the top branches of the organization's structure. A complete organization chart would include a box or cell for each position within the company. The organization charts of different companies may look different, as the number of layers and boxes depend on the complexity of the organizational structure and the number of middle management positions. For example, the sales department may include several sales territories, and each territory may have a manager and several employees making up its sales force. The human resources department typically maintains job profiles or job descriptions that explain the qualifications and responsibilities of each position shown on the chart. These job profiles are further supported by policies and procedures manuals that outline specific activities performed by each position.



**EXHIBIT 10-2** Generic Organization Chart

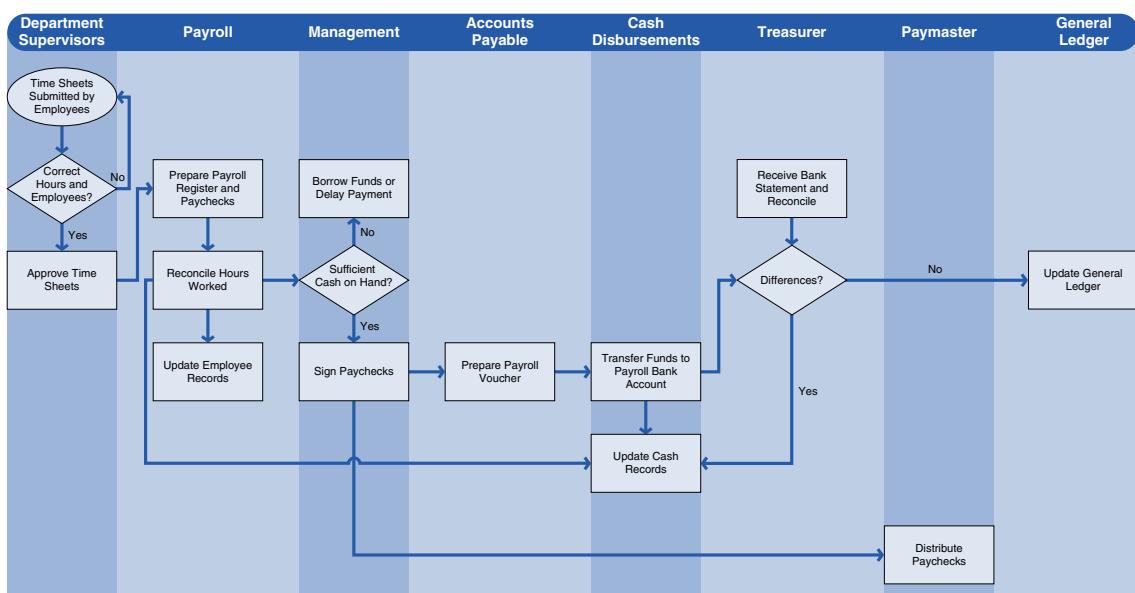
In addition to maintaining job records, the human resources department also keeps personnel files; thus, it is often referred to as the personnel department. Personnel files include information that the company needs, relevant to the people who work there. Personnel records typically include documentation related to the initial hiring, such as an employment application and contract, resume, recommendation letters, interview reports, wage or salary authorization, and results from a background investigation. Personal information must also be maintained, such as the employee's address, Social Security number, employment history, and so forth. Important information related to payroll processing is also contained in each employee's personnel file, such as overtime and commission rates, applicable tax withholdings, and authorization for payroll deductions.

In addition to the necessary tax withholdings, most companies have employee payroll deductions for such things as contributions to employee benefits programs, unions, savings plans, retirement plans, and charities. Employees must authorize which of these options they choose to be deducted from their pay. In addition, employees may have wage attachments for items such as child support, loans, or bankruptcies. Written records authorizing each of these amounts must be included in the personnel file. Also included in a personnel file is documentation regarding vacation and sick time, as well as records of attendance, performance evaluations, work schedule, promotion, and termination. Although a detailed examination of these types of employee processes and records is beyond the scope of this chapter, they are mentioned here as examples of the diverse and specialized nature of these records. Each employee's personnel file is as individual as the person it represents, so there are significant differences in the processes required to keep the records up to date. The record-keeping responsibilities of employees in the human resources department must be thorough in order to take into consideration all the different possibilities for an employee's pay status.

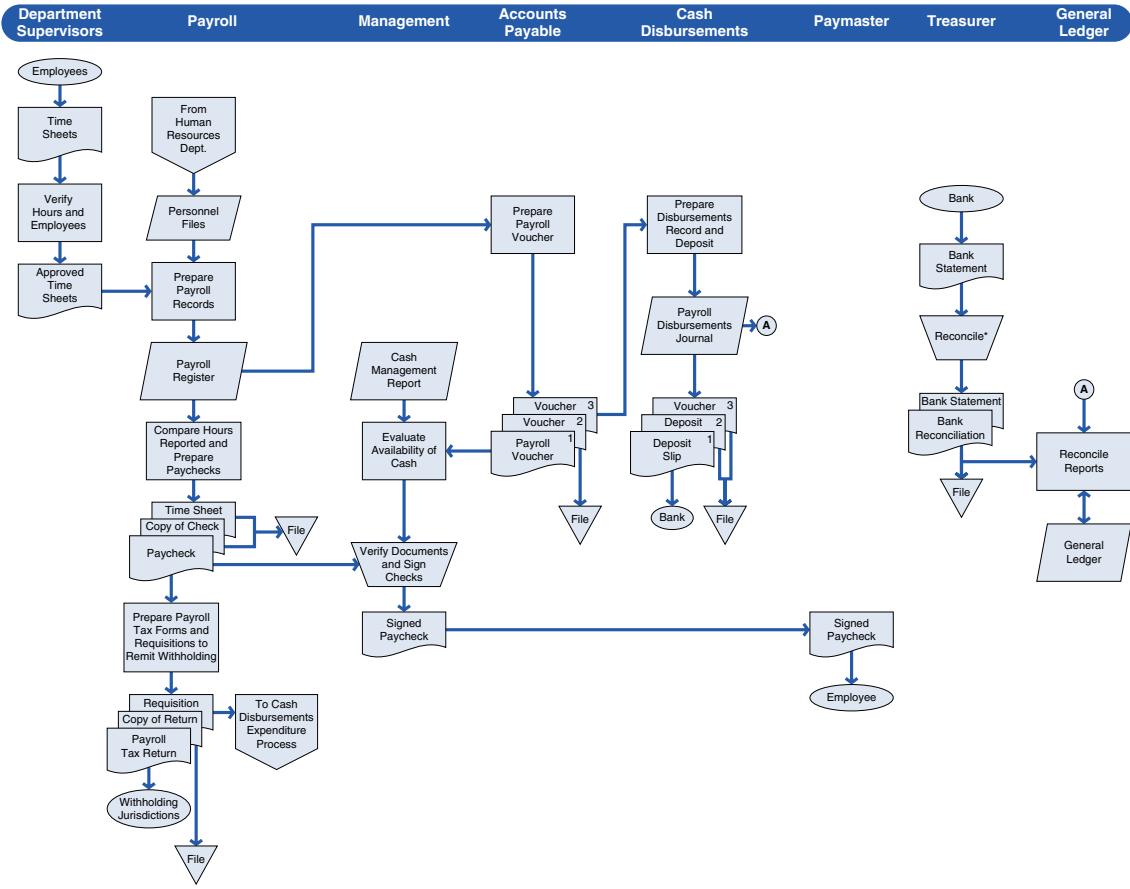
One unique feature of the information contained in an individual personnel file is that it is accessed frequently, but changed relatively infrequently. After all the information is established in an employee's file, it needs to be accessed each time payroll is processed in order for net pay to be accurately computed. It is important that the supporting information be kept up to date. Although payroll information may change periodically due to such things as tax rate changes and pay raises, the frequency of these kinds of changes is slight in comparison with the number of times the information is accessed for payroll purposes.

Depending upon the company's level of computerization, personnel records may be retained in hard copy or they may be entered into the system and retained electronically. Given the varying extent of information collected from employees, most modern companies have implemented some level of automation of their personnel records and payroll applications. After we examine the basic features of a manual payroll system, the related IT processes will be discussed.

Once an employee's personnel file is complete and the term of employment has begun, routine activities take place regarding payroll processing. Exhibit 10-3 is a business process map depicting these activities. Exhibit 10-4 shows a document flowchart for payroll processing and Exhibit 10-5 presents a data flow diagram of these processes. This is undoubtedly the most important process from the perspective of the company's employees, because it is the source of employees' paychecks. The payroll process is also unique because of its widespread nature; it affects everyone within the company. It requires the involvement of each individual within each department or location. Accordingly, personnel-related expenses are usually among the largest expenses reported on the company's income statement. For these



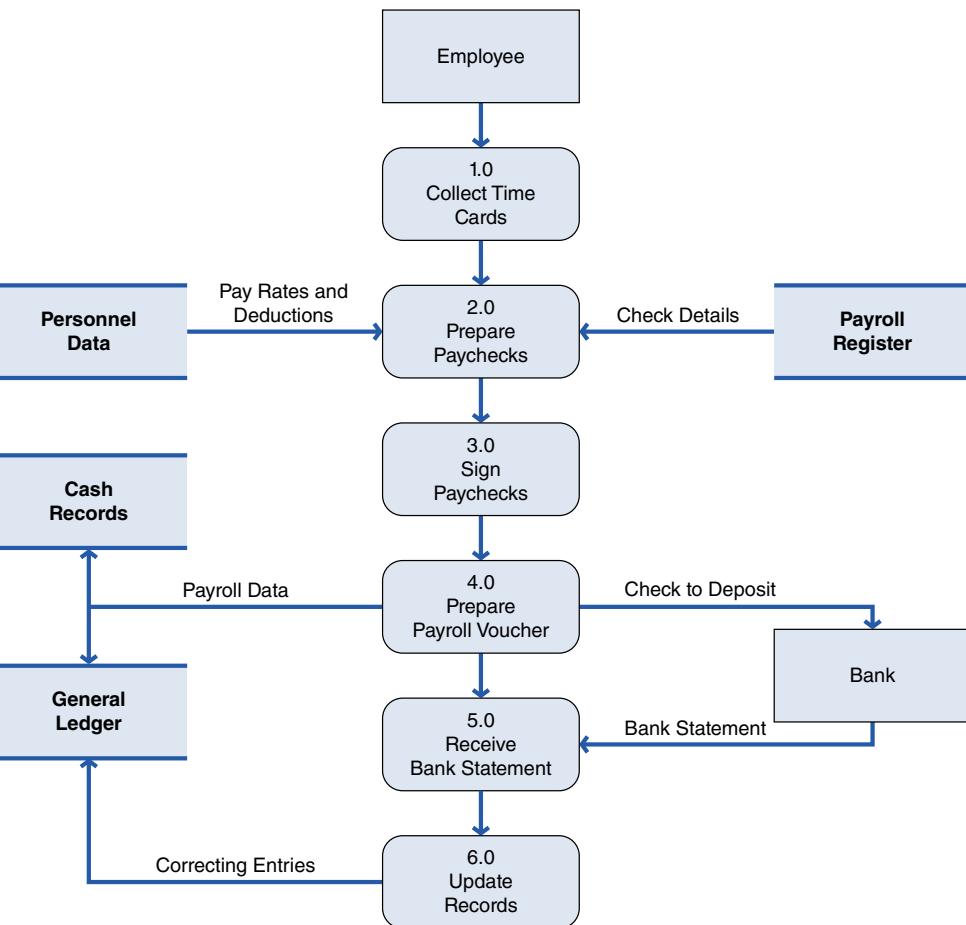
**EXHIBIT 10-3** Payroll Process Map



\* Involves comparisons of payroll register, voucher, and deposits.  
**EXHIBIT 10-4** Document Flowchart of the Payroll Processes

reasons, it is important that the company has a reliable system in place to handle its payroll activities.

Without paychecks, few employees would remain with the company. And without human



**EXHIBIT 10-5** Payroll Processes Data Flow Diagram

resources, few companies would be able to survive.

As employees perform their jobs, they earn their pay and the company accrues a corresponding liability for the wages and salaries. Determining the correct amount of pay depends on employees keeping adequate records of their hours and projects. A **time sheet** is the record of hours worked by an employee for a specific payroll period. A time sheet covers a specified time (ranging from one week to one month, depending on the frequency with which paychecks are prepared). In order to ensure that the time sheets include the most accurate and up-to-date information, they need to be updated by each employee on a daily basis. Salaried employees sometimes are not required to report their hours worked on a daily basis, but are often required to report the activities performed within the period. Employees in the production area are often required to prepare very detailed (to-the-minute) time reports, identifying the types of projects they worked on and the exact lengths of time spent, so that the company can determine the precise cost of its products. Additional information on the conversion processes is discussed in Chapter 11.

At the end of each pay period, employees submit completed time sheets to their departmental supervisors for approval. Supervisors should carefully review to make

certain that each time sheet accurately reflects the employees and hours worked in their departments. Care should be exercised in determining the appropriateness of these reports, including any overtime hours because time sheets represent the hours for which employees expect to be paid. Likewise, any vacation and sick time should be properly reported by employees and verified by the supervisors.

Once time sheets have been approved, they are forwarded to the payroll department. The payroll department is responsible for figuring the amount of net pay to be included on each paycheck. Paycheck amounts are based on the hours reported on time sheets and pay rates and deductions authorized in the respective personnel files. The computations required to support the paychecks are as follows:

$$\text{Gross Pay} = \text{Hours Reported} \times \text{Authorized Pay Rate}$$

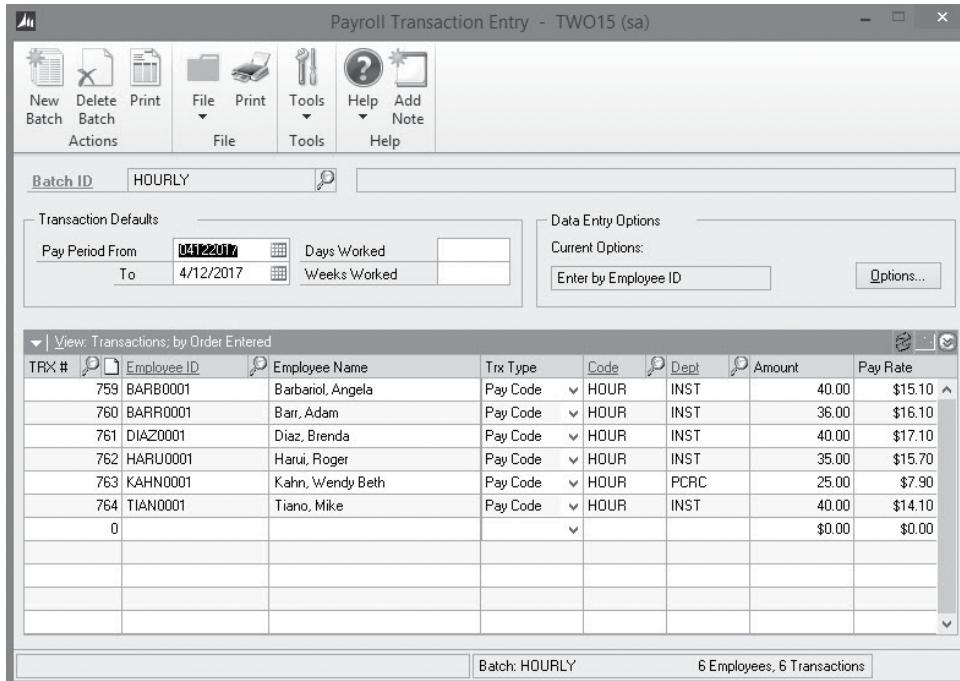
$$\text{Net Pay, i.e., Paycheck Amount} = \text{Gross Pay} - \text{Authorized Deductions}$$

Although these are relatively simple formulas that may be considered part of a routine process, it may actually be challenging to figure the amount of deductions applicable to an employee's pay. This is because each employee's deductions are likely to be different. In addition, the payroll formulas must be applied to every employee in the company, one at a time. The process is further complicated by the fact that the inputs tend to change constantly. Each payroll period will include some changes in the number of hours worked, pay rates, or withholdings. An accounting software program is a very efficient tool to assist the payroll department in managing this abundance of information. On the other hand, when done manually, the process of extracting all these inputs from the records and performing the mathematical computations is extremely time-consuming.

The payroll department prepares a payroll register to accumulate all paycheck data. A **payroll register** is a complete listing of salary or wage detail for all employees for a given time. Exhibit 10-6 shows a payroll register entry as it would be established in Microsoft Dynamics GP accounting/ERP software. In this transaction, the hourly payroll employees for the company were automatically pulled into a transaction batch. Each entry includes the employee ID, name, and the pay code applicable to this transaction. The payroll specialist would then enter the actual hours worked for each hourly worker included in the pay run. The pay rate may be listed as zero so that the individual processing the pay does not see the actual pay rate for each employee. This is an option that some companies select. In this example, the company has allowed the pay rate to be visible. When the transaction is processed, the rate for the employee's pay code is multiplied by the hours worked to calculate the gross pay. The deductions for taxes and benefits are also calculated with the payroll processed. The deductions and tax amounts are based on the employee's master file set up in the payroll system. All other information needed for the preparation of the payroll register and paycheck is retained in the system so that the payroll department personnel do not have to look it up each pay period.

The payroll department should compare the hours reported on time sheets with the hours accumulated in the payroll register before the paychecks are sent to management for authorization. Authorization is typically indicated by a manager's signature on the paychecks.

Before signed paychecks can be given to employees, the company must be sure that it has sufficient cash on hand to cover the total amount of the payroll. In addition, the cash must be deposited in the payroll cash account. Since employees usually do not hesitate to cash their paychecks, the timing of these activities is important. The accounts payable department determines the total amount of the net payroll from the payroll register and prepares a payroll voucher. A payroll voucher author-



**EXHIBIT 10-6** Preparing a Payroll Register in Microsoft Dynamics GP

izes the transfer of cash from the company's main operating account into the payroll cash account. Most companies maintain a separate bank account to handle payroll transactions. This makes it easier to account for payroll transactions and to distinguish them from cash disbursements for other business purposes.

The cash disbursements department receives the payroll voucher, carries out the transfer of funds between bank accounts, and updates the related accounting records. A **payroll disbursements journal** is prepared to provide a listing of all paychecks written, in check-number sequence, with the total supporting the amount of payroll funds transferred to the payroll bank account.

On the designated pay day, signed paychecks are distributed to employees by an independent paymaster. Any unclaimed paychecks should be returned to the treasurer or other independent party for follow-up.

Another responsibility of the payroll department is the preparation of payroll deposits and the related tax forms. All withholdings from employees' pay must be paid as designated. For example, when employees elect deductions from their pay for union dues, the company must pay the withheld amounts to the union. Similarly, federal income taxes withheld from paychecks must be paid to the federal government in a timely manner and reported periodically. This may be a challenging task, depending on the number of employees and considering the fact that multiple jurisdictions may be represented by the company's work force, each with different withholding rates and payment requirements. In addition, the company often supplements employee withholdings by paying its share of contributions for such things as insurance premiums and other employee benefit programs, savings plans, and charitable donations.

The payroll processes and procedures outlined are standard practices in many companies. Outsourcing of payroll, requiring employees to have their paychecks direct deposited and electronic transmission of payroll tax deposits are additional practices that many companies have adopted to simplify payroll processing.

Some companies elect to use an outside payroll processing service to process payroll. In some cases, this is to maintain confidentiality of payroll data. In other

cases, it is because the laws regarding payroll processing and tax related issues can be complex. Instead of retaining employees in-house to handle these details, some companies elect to outsource their payroll. With a large number of companies choosing to outsource payroll, many ERP systems provide automatic interfaces to bring payroll transactions into the system electronically. For example, Microsoft Dynamics GP has an interface to ADP® payroll. Companies can also elect to have an interface written or use tools such as the Integration Manager or Smart Connect to bring payroll transactions into their ERP system.

Another common payroll practice for companies that process their own payroll, as well as those that outsource their payroll, is to require employees to have their pay deposited directly into the employees' bank account. This saves time and is more secure since employee checks do not have to be kept in a safe or locked filing cabinet.

In addition to direct deposit of paychecks, many companies also elect to have tax deposits and other withholdings from pay electronically transmitted to the tax or other agencies.

Similar to the cash disbursements system described in Chapter 9, the payroll process should involve reconciliation of the payroll bank account with the payroll disbursements journal and payroll deposit slips. This practice is performed by someone independent of the accounting function.

## Risks and Controls in the Payroll Processes (Study Objective 3)

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Payroll transactions usually involve large sums of cash, so it is especially important that sufficient internal controls are included in the related business processes. In terms of the five internal control activities introduced in Chapter 3, the following are some procedures to be considered for implementation in this process.

### Authorization of Transactions

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Management plays an especially important role in carrying out payroll transactions correctly. If management takes its responsibilities seriously by carefully reviewing the payroll documents, then most employee errors and fraud should be prevented. Departmental supervisors must be certain that all time sheets represent actual time worked by currently active employees. The supervisors are expected to be familiar enough with their respective departments that they will recognize unusual data. In particular, they should be on the lookout for fraud schemes such as overstated hours (including unapproved overtime) and time sheets or paychecks of former employees who are no longer entitled to receive compensation.

In addition to the authorization procedures covering time reports, employee personnel files should contain evidence of proper authorization for various payroll amounts. Included in the files should be approval for pay rate adjustments, hiring, promotion, and termination (authorized by management), as well as approval for all deductions (authorized by individual employees).

Like the cash disbursements discussed in Chapter 9, payroll disbursements should be authorized by the accounts payable department on the basis of the company's need to satisfy its obligation to its employees. In addition, designated members of management should be given authority for the approval of the paychecks, noted by their signatures on the faces of the checks. The bank will keep records of those mem-

bers of management with authority to sign checks drawn on the payroll account, and it should not pay a check that does not include such a designated signature.

## **Segregation of Duties**

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The goal of segregation of duties within the payroll process is to prevent the preparation and payment of a fraudulent or erroneous paycheck. To accomplish this, certain payroll accounting functions such as authorizing, timekeeping, record keeping, and custody of the paychecks should all be separated. Namely, the human resources department, which is responsible for authorizing new employee hiring and maintaining personnel files, should be separate from the payroll time-reporting and record-keeping functions, performed primarily by the payroll, cash disbursements, and general ledger departments. In addition, employees in each of these departments should not have check-signing authority and should not have access to the signed checks or cash account. The person who distributes paychecks to employees, often referred to as a **paymaster**, should not have responsibility for any of the related payroll accounting functions and should not have custody of cash. The paymaster should also be independent of the departmental supervision responsibilities, so that a determination can be made that paychecks are being distributed to active employees. Finally, information systems operations and programming related to payroll processing should be separate from custody of payroll cash and record keeping for these processes.

## **Adequate Records and Documents**

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Personnel files and the payroll register are the fundamental records in the payroll process. In addition, there are numerous forms and reports that are required to be filed at designated times throughout the year. These documents must be filed with various taxing authorities and other organizations to summarize and remit amounts withheld from employees' paychecks. Due to the number of inputs required for accurate payroll processing and reporting, the care with which these records are prepared and maintained is crucial to the internal control environment.

The practice of issuing paychecks on prenumbered checks from a separate bank account is another control that helps to create clear records of the payroll transactions. When checks are issued numerically, a sequence can be verified to determine whether all payroll transactions have been recorded. A separate bank account clarifies the accounting process by isolating the payroll transactions in their own account. This makes it easier and quicker to reconcile the account and to identify any unusual transactions that may require investigation.

## **Security of Assets and Documents**

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Payroll information is very sensitive. It includes personal information about employees, their pay, and their performance that must be kept confidential. Accordingly, access to personnel files and payroll records should be limited to designated persons within the human resource and payroll departments. Electronic controls and physical controls should be in place to ensure the confidentiality of payroll information.

Similarly, access to payroll cash should be limited to the authorized paycheck signers. Blank payroll checks should be protected by the use of physical controls so that no one has an opportunity to create a fake paycheck. Similarly, any unclaimed

paychecks should not be maintained by employees working in human resources or payroll functions, so that they do not have an opportunity to alter the records and cash the checks for their personal use.

## Independent Checks and Reconciliation

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There are several payroll-related reconciliation procedures that should be performed regularly. For example, the number of hours reported on time sheets should be reconciled to the payroll register, and time sheets may be reconciled with production reports. Each of these reconciliations should be performed before paychecks are distributed in order to ensure the accuracy of the underlying payroll information. In addition, the payroll register should be reconciled to the general ledger on a regular basis. Moreover, someone separate from the payroll processing functions should reconcile the bank statement for the payroll cash account on a monthly basis. This bank reconciliation should follow the same procedures as required for the company's general checking account, as discussed in the cash disbursements section of Chapter 9.

## Cost-Benefit Considerations

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The more employees a company has and the more frequently it pays its employees, the more important it becomes to implement strong internal controls surrounding these processes. Other conditions that may warrant the need for strong controls include:

1. Irregular pay schedules
2. Complex withholding arrangements
3. Frequent changes in pay rates
4. Decentralized payroll functions

Many companies implement thorough controls covering the payroll processes because of the confidential nature of the underlying data. To protect the privacy of its employees and promote high morale, a company may choose to incur significant costs related to its efforts to protect the accuracy and security of payroll records.

Exhibit 10-7 identifies several internal controls in the payroll process and the related business risks that are minimized as a result of implementing these controls. This exhibit does not include all possible controls and risks that may be encountered in a payroll process, but it provides some common examples.

## IT Systems of Payroll Processes (Study Objective 4)

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The preceding presentation establishes the importance of information technology in the payroll processes. Without computerized records, the human resources and payroll departments would be forced to search all personnel files to obtain the data used to generate a payroll register. Numerous mathematical computations would also need to be performed in order to figure the amount of net pay for each employee. This manual process would be nearly impossible for medium- and large-size companies that disburse hundreds, or thousands of employee paychecks each period. It is clear that computer technology can be a necessary ally of the payroll process.

**EXHIBIT 10-7****Payroll Controls and Risks**

<b>Control:</b>	<b>Minimizes the Related Risk of:</b>
<b>Authorization:</b> Supervisor approves time sheets prior to preparation of payroll documents. Manager approves payroll prior to signing paycheck.	Invalid or inaccurate paychecks, fictitious employees Invalid paychecks or fictitious employees
<b>Segregation of Duties:</b> Separation of the custody of payroll cash from the responsibility for reconciling the bank account Separation of duties related to payroll register preparation, authorization of new hiring and pay rates, information systems, and general accounting Independent paymaster	Invalid payroll transactions, incorrect amounts, omitted transactions Invalid payroll transactions, incorrect amounts or accounts, omitted transactions Fictitious employees
<b>Records and Documents:</b> Paychecks are prepared on prenumbered checks. The payroll register is checked for mathematical accuracy and agreement with authorized pay rates and deductions.	Omitted paychecks Incorrect amounts
<b>Security:</b> Physical controls in areas where cash and paychecks are held  IT controls over computer records and physical controls in records storage areas	Lost or stolen cash or paychecks, invalid paychecks, omitted paychecks Invalid payroll transactions, incorrect amounts or accounts, timing issues, duplicate transactions
<b>Independent Checks and Reconciliations:</b> Time sheets are reconciled with the payroll register. The payroll register is reconciled with the general ledger.  Time sheets are reconciled with production reports.  Preparation of a bank reconciliation	Omitted or inaccurate paychecks Omitted or duplicate payroll transactions, incorrect amounts or accounts, timing issues, incorrect accumulations Omitted or duplicate payroll transactions, incorrect amounts or accounts, timing issues Invalid or omitted paychecks, incorrect amounts or accounts, timing issues, lost or stolen cash

Modern pressures to cut costs and the competitive nature of the business world often result in many companies requiring their human resources and payroll departments to process massive amounts of employee data in extremely short periods. Therefore, even the smallest companies may find it worthwhile to enhance their payroll processing with computerized systems.

Routine payroll processing occurs at specified time intervals—namely, the weekly, biweekly, or monthly pay dates. This frequency and the sequential nature of the payroll process cause many companies to realize that batch processing is well-suited for payroll activities. With batch processing, the human resources department is responsible for keying employee information into a personnel master file, and the timekeeper can accumulate all time sheets and enter them in the computer system in batches. The timekeeper should prepare control totals and hash totals to check the system before paychecks are generated. An alternative to manual batch accumulations is the use of electronic timekeeping devices, such as time clocks or badge readers. Electronic time clocks collect time and attendance data when employees insert their time sheets into the clock. The time clocks read bar codes on the employees' time sheets. Similarly, badge readers collect data when employee identification badges are swiped through an electronic reader. These systems accumulate data

## The Real World

Scott Paper Company, a manufacturer and marketer of paper tissue products, implemented an automated payroll system a few years ago. Traditional time clocks and manual time sheets were replaced with bar code readers that collect time and attendance data. Before its new system was implemented, Scott management collected time sheets by hand from thousands of employees,

and personnel manually keyed the numbers into a payroll system. Now the payroll figures are electronically calculated and automatically fed into the payroll system. Many different work schedules and complex pay and deduction arrangements are accommodated. In terms of increased efficiency, Scott's new approach paid for itself within its first year of implementation.

throughout the period and automatically calculate batch totals. The data batches are then used to prepare paychecks and the payroll register.

To smooth out the process and avoid the heavy workload that falls at the end of the payroll period, many companies use online software systems that integrate their human resources and payroll functions. With integrated systems, real-time personnel data is available, and the general ledger and production system can be automatically updated at the end of the payroll period. As with any online system, though, care must be exercised in restricting access to the payroll programs. Passwords and access logs should be used and reviewed for the possibility of unauthorized access.

The Internet and company intranets are also increasingly important tools for circulating payroll information. As more employees have offsite work arrangements, the Internet allows them to submit relevant information for timely updating of time and attendance records. In some cases, employees may even make changes to their payroll deductions via the Internet or intranets, and their pay stubs can be sent to them via e-mail. This makes it possible for payroll operations to remain centralized. The Web also provides many resources for employees in the human resources and payroll departments, such as access to current legislative changes that may affect payroll deductions.

Another popular use of the Internet involves the outsourcing of payroll services. Many companies use independent, Internet-based service providers to handle their payroll processing. These payroll providers specialize in offering solutions and constant access to payroll information. With outsourced payroll processing, enrolled companies are given secure access information so that a designated individual can log on and transfer payroll information via the Internet. This information can be viewed, edited, and approved before processing occurs. The company's payroll administrator will receive an e-mail message as notification that the paychecks and payroll reports have been prepared. Payroll outsourcing has become prevalent because it offers increased convenience, confidentiality, and protection from the risk of liability for failure to submit tax withholdings and the related reports.

Automation is also commonly used to enhance controls via the electronic transfer of payroll funds. Most employees elect to have their paychecks directly deposited into their personal bank accounts. This ensures the timely deposit of the funds and eliminates the need for an independent paymaster. It also simplifies the process of reconciling the bank statement, as there are fewer outstanding checks. Employees who take advantage of direct deposit realize savings of time and check-cashing fees, as well as increased confidentiality. When the automatic deposit feature is used, the

company should have procedures in place to be sure that multiple paychecks are not being deposited in a single bank account. Since each employee should receive only one paycheck at a time, the transfer of multiple paychecks into a single account could mean that a paycheck was created for a fictitious employee.

In addition to the electronic transfer of paychecks, companies can use electronic transfers to make payments of tax deposits and other payroll withholdings. Many companies have become part of governmental electronic funds transfer programs, wherein the federal and state income taxes withheld from employee paychecks are transferred online to the appropriate taxing authorities. Another efficient use of electronic transfers is for the disbursement of wage attachments. Although it may be time consuming to implement these programs due to the many different rules which apply to the various jurisdictions and agencies that receive payroll withholdings, the up-front investment tends to pay off in the long run. These programs promote savings in terms of time, expense, and increased accuracy.

## Fixed Assets Processes (Study Objective 5)

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There may be many kinds of fixed assets owned by a company. The fixed assets pool may include the following categories: vehicles, office equipment and computers, machinery and production equipment, furniture, and real estate (such as land and buildings). These assets are all necessary for the company to conduct business. They are considered long-term assets because they were purchased with the intention of benefiting the company for a long time. For many companies, the investment in fixed assets is often the largest asset reported on the balance sheet.

Even though fixed assets are classified as long-term assets, they are constantly changing. Companies continually add to or replace items in their fixed assets pool as the old items become used, worn, or outdated. Due to this frequency of change, it is important that clear accounting records exist so that the status of fixed assets accounts can be determined at any point during their useful life.

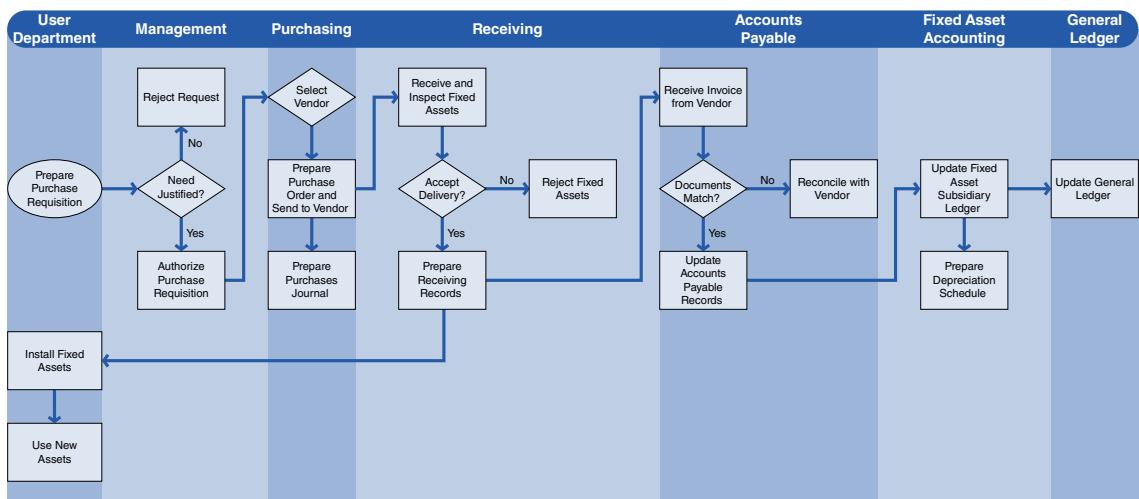
This section presents three phases of fixed assets processes: acquisition, continuation, and disposal. These three phases span the entire useful life of the fixed assets.

### Fixed Asset Acquisitions

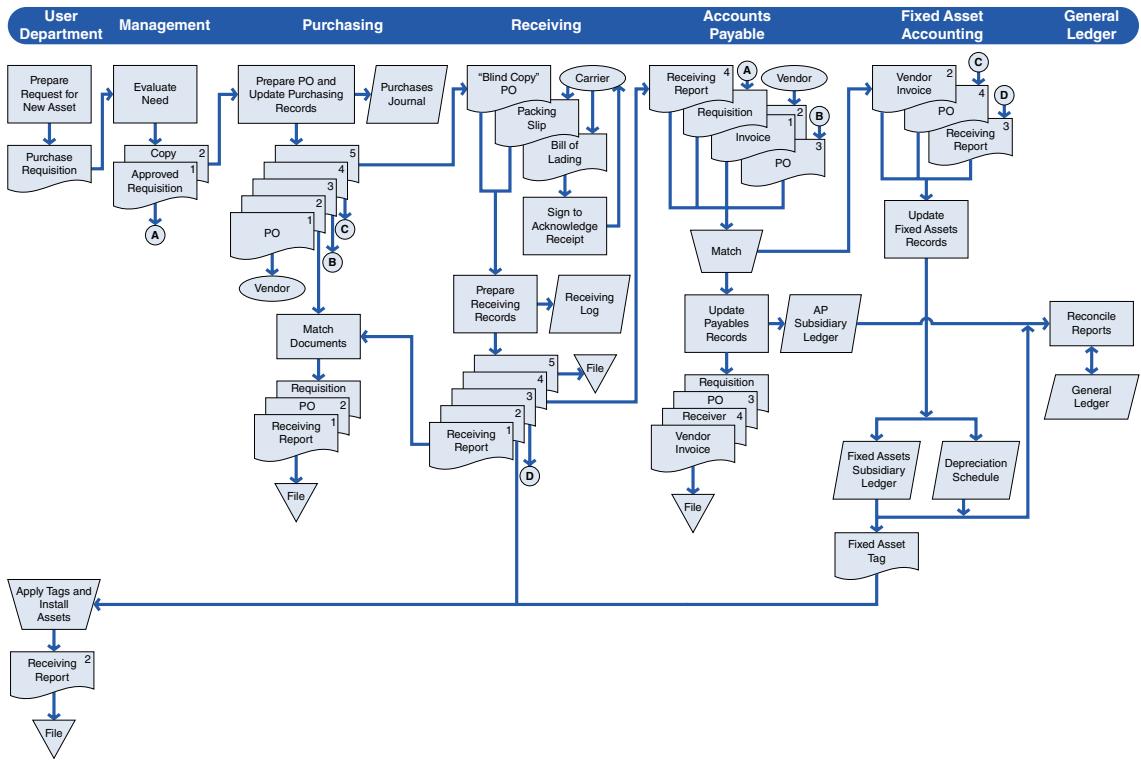
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Acquisitions of fixed assets are carried out in much the same way as inventory purchases described in Chapter 9. Exhibit 10-8 presents a business process map of the fixed assets acquisition process. You can see the similarities in these processes by comparing this exhibit with Exhibit 9-3 in Chapter 9. Two notable differences here are the placement of the acquired assets in the user department (rather than a warehouse) and the inclusion of a fixed assets department (instead of the inventory control department). Exhibit 10-9 presents a document flowchart of the records used in a fixed asset acquisition process, and Exhibit 10-10 is a data flow diagram of that process.

Fixed assets acquisitions are generally initiated when a user department identifies a need for a new asset, either to replace an existing asset or to enhance its current pool. If the need is for an asset whose cost is below a preestablished dollar amount, the process will be carried out in a routine manner, as illustrated in Exhibit 10-8. That is, a member of management will authorize the purchase of the asset, and the purchasing department will select a vendor and prepare the purchase order.



**EXHIBIT 10-8** Fixed Assets Acquisitions Process Map



**EXHIBIT 10-9** Document Flowchart for Fixed Asset Acquisition Processes

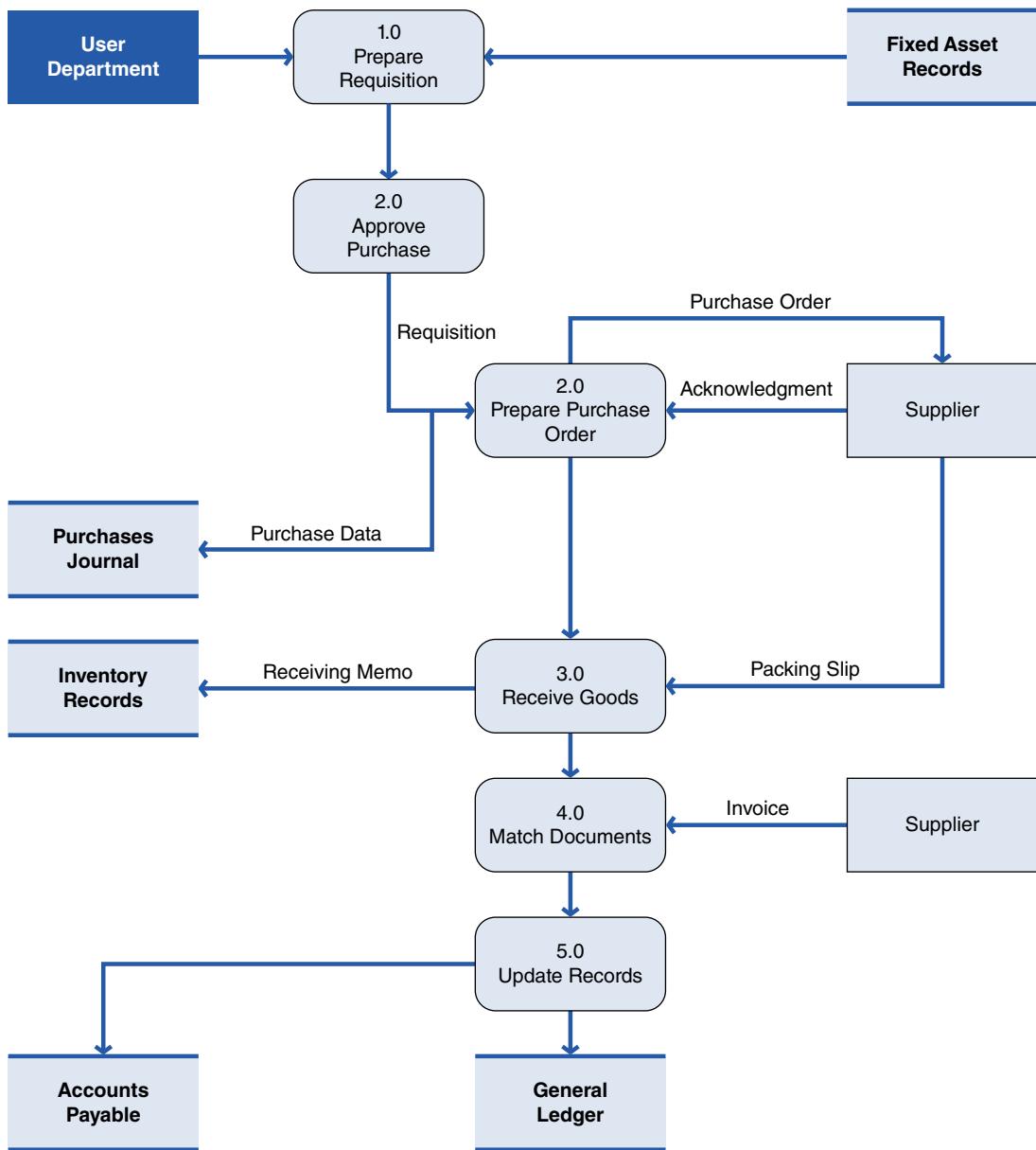


EXHIBIT 10-10 Fixed Asset Acquisitions Processes Data Flow Diagram

Sometimes, large cash outlays are required for fixed asset purchases. The company should have a policy in place requiring special processing for purchases of fixed assets that exceed a preestablished dollar limit. Accordingly, large fixed asset acquisitions would be regarded as nonroutine transactions that require specific authorization. This may delay the process significantly, as it may take weeks or months for management or the board of directors to approve large fixed asset purchase requests. Some companies require that large cash outlays for fixed assets be included in the capital budget. A **capital budget** is a financial plan detailing all of the company's investments in fixed assets and other investments. In addition, the company may require that an investment analysis or feasibility study be conducted in order to assess

the merit of the purchase request in terms of the relative costs and benefits. Accordingly, these purchases need to be planned well in advance of their desired implementation time.

Upon receipt, new fixed assets are inspected by the receiving department. A receiving report is prepared, and the items are sent to the user department for installation and use. Many companies apply a fixed asset tag, number, or label to the item so that it can be tracked in the future and distinguished from other, similar assets. Accounts payable and cash disbursement activities are also initiated at this time, in the same manner as for the expenditure processes described in Chapter 9. In addition, a fixed asset subsidiary ledger is updated. A **fixed asset subsidiary ledger** is a detailed listing of the company's fixed assets, divided into categories consistent with the general ledger accounts. Historically, companies have maintained all the subsidiary ledger details within spreadsheets. Separate spreadsheets may be prepared for each category of fixed assets.

Extreme care must be taken in recording all the necessary information in the fixed asset subsidiary ledger. All relevant information should be documented, such as acquisition dates, costs, tag numbers, and estimates of useful lives and salvage values.

In some cases, a company may construct its own fixed assets instead of purchasing them. When this occurs, the conversion processes as described in Chapter 11 are relevant.

## Fixed Assets Continuance

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The **fixed assets continuance** phase refers to the processes required to maintain accurate and up-to-date records regarding all fixed assets throughout their useful lives. This phase involves the following activities:

- Updating cost data for improvements to the assets
- Adjusting for changes in estimated figures (such as useful lives and salvage values) as needed
- Recording periodic depreciation
- Keeping track of the physical location of assets

Cost information may need to be updated when new costs are incurred related to an asset. Companies should have written procedures in place describing the circumstances under which these costs are capitalized to the fixed asset account or recorded as a repair and maintenance expense. New costs should be capitalized whenever the expenditure causes the fixed asset to become enhanced, either in terms of increased efficiency or an extended useful life. On the other hand, costs incurred to repair the assets or to maintain them in their current working state should be recorded as expenses, and not capitalized in the fixed assets account. The fixed asset accountant must make sure the appropriate adjustments are made in the fixed asset subsidiary ledger. This facilitates the accuracy of depreciation calculations.

Fixed asset accounting depends on the use of estimates. Each asset must be assigned an estimated useful life and an estimated salvage value. The judgmental nature of fixed asset accounting makes it different than the other expenditure processes discussed in Chapter 9 and earlier in this chapter. The use of estimates also means that recorded amounts may need to be changed as time passes and new information is discovered that renders the original estimates misleading. The fixed

assets subsidiary ledger may need to be adjusted from time to time as the company makes changes in the estimates that feed its depreciation calculations. For instance, it may be discovered that the asset's useful life will be shortened because of heavy usage of the asset, or lengthened due to a capital improvement. Similarly, an asset's estimated salvage value may be reduced because a new product will make the asset obsolete, or increased when the outlook for an after-market sale becomes more favorable. Regardless of the type of change, the fixed asset accountant must again exercise care in recording these changes in order to ensure the accuracy of depreciation calculations.

The periodic depreciation schedule is the most important part of the asset continuation phase. A **depreciation schedule** is the record detailing the amounts and timing of depreciation for all fixed asset categories except land and any construction-in-progress accounts. The information recorded in the fixed asset subsidiary ledger is used as the basis for computing periodic depreciation. In turn, accumulated depreciation is used to determine the book value of an asset at any point in its life. These activities recognize the fact that fixed assets diminish in value throughout their lives. Therefore, the accounting records must periodically reduce a portion of the asset's cost in order to reflect the asset's proper book value. The related computations may be relatively straightforward when performed for one individual asset at a time, but the process tends to be complicated by the large number of fixed assets the company maintains. There may be many different categories of fixed assets, and the useful lives of the company's fixed assets may range from two years to several decades. Different methods of depreciation may also be used. In addition, because of the staggered timing of fixed assets purchases, depreciation may not even be computed consistently within a particular category. Moreover, there may be multiple sets of records required by the company for financial statement and tax purposes. With many varying inputs, the accounting for fixed assets may become quite complex. This is certainly an area where strong internal controls are warranted.

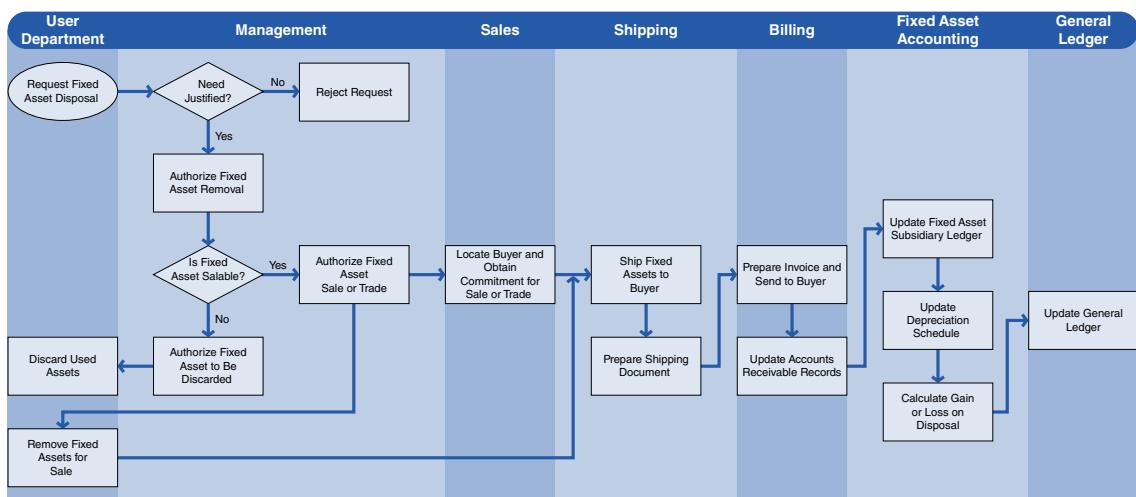
## Fixed Assets Disposals

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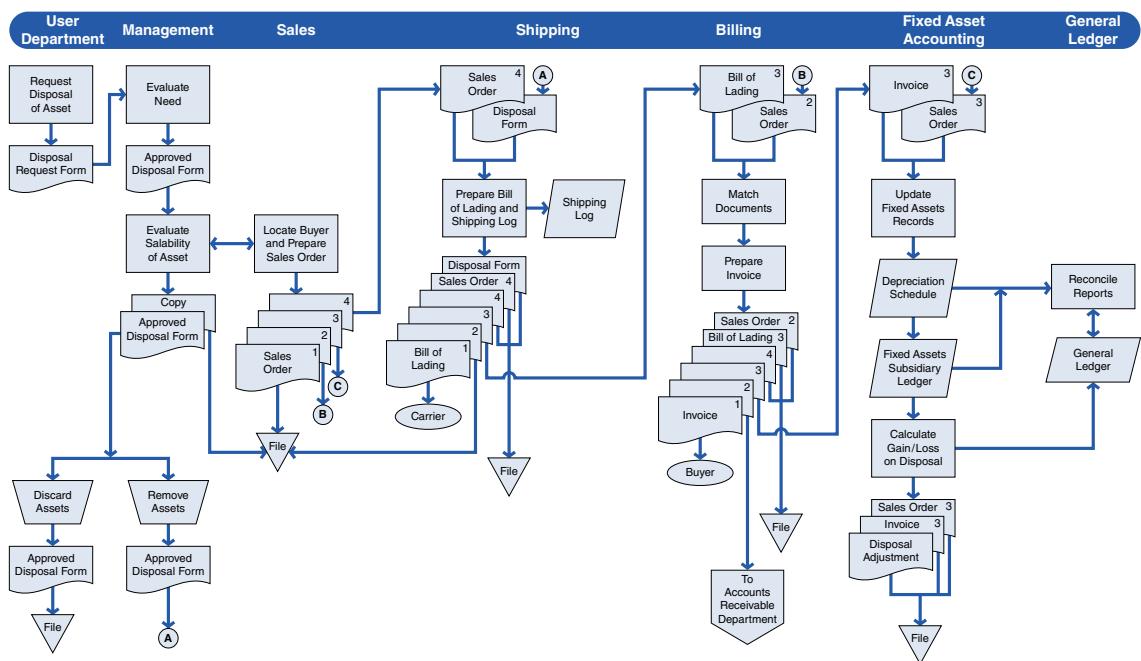
When an asset becomes old, outdated, inefficient, or damaged, the company should dispose of it and adjust its records accordingly. Disposing of an asset may include selling or exchanging it, discarding it (throwing it away), or donating it to another party who may be able to use it. The activities and documents that make up the fixed assets disposal process are depicted in Exhibit 10-11 and Exhibit 10-12, respectively.

Fixed asset disposals involve the flow of assets out of the company. As a result, there are many similarities between these processes and those related to the revenue processes discussed in Chapter 8. The most significant difference between these activities is the role of the company's fixed asset accountant. This employee or department must carry out four basic steps in accounting for the disposal of fixed assets:

1. The date of disposal is noted, and depreciation computations are updated through this date.
2. The disposed assets are removed from the fixed asset subsidiary ledger.
3. The depreciation accounts related to disposed assets are removed from the depreciation schedule and the fixed asset subsidiary ledger.
4. Gains or losses resulting from the disposal are computed.



**EXHIBIT 10-11** Fixed Assets Disposal Process Map



# Risks and Controls in Fixed Assets Processes (Study Objective 6)

## **Authorization of Transactions**

Designated members of management should be assigned responsibility for authorizing the purchase of new fixed assets, as well as the disposal or transfer of existing fixed assets. In the case of high-dollar items, there should be a strict approval process requiring the authorization of top management or the initiation of the capital budgeting procedures. This strict process for purchasing fixed assets should include at least three formal steps:

1. Investment analysis
2. Comparison with the capital budget
3. Review and approval by the appropriate level of management

When a request is made to purchase fixed assets, there should be a formal investment analysis to justify that the expenditure will generate benefits that exceed the cost. This analysis could require two parts. The first part is financial justification with a model such as net present value, payback period, or internal rate of return. These models require that dollar estimates be determined for costs and benefits of the fixed asset. The second part would be a written narrative of the benefits, especially any benefits that are difficult to quantify in dollars. In many cases fixed asset purchases are important to consider even when financial costs exceed financial benefits. For example, if a direct competitor purchases a document imaging system to speed the processing of customer paperwork, a company may need to purchase similar technology just to stay competitive. A written narrative of the need for investment can help justify the expenditure when financial benefits do not immediately surpass costs.

Secondly, management should establish a capital budget and compare all expenditures with the capital budget prior to approving any purchase of fixed assets. Finally, based on the investment analysis and the capital budget comparison, a manager at the appropriate level should approve or disapprove the proposed purchase. Generally, upper-level management approval is required for higher dollar amounts of fixed asset purchases, as shown in Exhibit 10-13.

This authorization process is much more formal and specific than the authorization of purchases of raw materials, inventory, and supplies. There should also be formal and specific approval for the disposal of fixed assets. Requests for these purchase and disposal transactions, and the related authorizations, should be documented and retained.

### **EXHIBIT 10-13**

#### **An Example of Fixed Asset Approval Levels**

<b>Fixed Asset Cost</b>	<b>Management Approval Level</b>
Below \$5,000	Operating Department Manager
\$5,000–100,000	Plant Manager
\$100,000–500,000	Division Manager
\$500,000–1 Million	Chief Executive Officer
Above \$1 Million	Board of Directors

Companies should also require management approval for the selection of a depreciation method and assignment of useful lives and estimated salvage values. Likewise, a designated manager should handle asset quality specifications, vendor selection, and negotiation of payment terms for fixed asset purchases.

## Segregation of Duties

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Custody of fixed assets needs to be separate from the related record keeping. Adequate segregation of duties reduces the risk of undetected errors or fraud by requiring separate employees to handle the different transactions that occur in each phase of the asset's life. Ideally, those with custody of fixed assets should not perform any duties in the purchasing, receiving, or fixed asset accounting departments. In addition, key IT functions such as programming, operations, data input, and security should be segregated from each other and from the related accounting duties.

## Adequate Records and Documents

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Fixed asset subsidiary ledgers are used to control the physical custody, cost, and depreciation of the fixed assets. Just like the expenditures process for inventory purchases, fixed asset purchases should be supported by a purchase requisition, purchase order, receiving report, and vendor invoice. These documents need to be matched in order to establish the validity of the acquisition and to determine whether any items have been omitted from the records. Fixed asset tags may also be used to account for the numerical sequence of items acquired. In addition, management should prepare and follow a capital budget.

## Security of Assets and Documents

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Adequate supervision is an important control concerning the security of fixed assets, because fixed assets tend to be located throughout the company where many employees could have access to them. Supervisors need to make certain that the assets are being used for their intended purposes. Physical controls should also be in place to protect fixed assets from unauthorized use, and electronic controls are needed to control access to automated records. The appropriate security features depend on the nature and value of the property.

A company should also protect its investment in fixed assets by maintaining adequate insurance coverage and conducting regular preventative maintenance procedures such as tune-ups for machinery and vehicles.

## Independent Checks and Reconciliation

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Actual fixed asset expenditures should be compared with the capital budget, and additional approval should be required if budgets are exceeded. In addition, periodic counts and inspections of fixed assets should be made by someone not otherwise responsible for fixed-asset-related activities. Those physical counts and inspections should be reconciled with the accounting records. Also, performing independent verifications to match key purchasing documents and the related accounts payable reports may uncover errors or fraud within these records.

The value of fixed assets should be appraised periodically for insurance purposes. This procedure may also uncover the possibility of impairment issues on these assets. Exhibit 10-14 summarizes the fixed asset controls and risks.

**EXHIBIT 10-14****Fixed Assets Controls and Risks**

<b>Control:</b>	<b>Minimizes the Related Risk of:</b>
<b>Authorization:</b> Requirement for specific approval for acquisitions of large-dollar items for inclusion in the capital budget Management approval of fixed asset changes prior to recording the transaction	Invalid or fraudulent acquisitions, invalid vendors, unapproved pricing, timing issues, inaccurate records Invalid or fraudulent transfers, disposals or estimate adjustments, timing issues, duplicate transactions
<b>Segregation of Duties:</b> Separation of duties related to fixed asset ordering, receiving, subsidiary ledger preparation, authorization of new acquisitions and fixed asset changes, cash disbursements, information systems, and general accounting	Invalid fixed asset transactions, incorrect amounts or accounts, omitted transactions
<b>Records and Documents:</b> Updating the fixed assets subsidiary ledger for all acquisition, disposal, and change transactions Updating depreciation schedules for periodic depreciation on all depreciable assets, using the appropriate bases, dates, useful lives, and methods Computing and recording gains and losses for all disposals of fixed assets (if applicable) Review the fixed asset subsidiary ledger and depreciation schedule for mathematical accuracy and agreement with authorized documentation	Fictitious transactions, omitted transactions, timing issues Omitted transactions, incorrect amounts, timing issues Omitted transactions, incorrect amounts or accounts Incorrect amounts
<b>Security:</b> Physical controls in areas where fixed assets are held IT controls over computer records and physical controls in records storage areas	Lost or stolen fixed assets Invalid fixed asset transactions, incorrect amounts or accounts, timing issues, duplicate transactions
<b>Independent Checks and Reconciliations:</b> Performing physical counts of fixed assets and reconciling with the fixed asset subsidiary ledger Reconciling the fixed asset subsidiary ledger with the general ledger Review the fixed asset subsidiary ledger to ensure that repair and maintenance expenses are not capitalized Reconciling fixed asset acquisitions and related expenses budgeted amounts	Stolen or fraudulent fixed assets, omitted transactions, duplicate purchases, timing issues Omitted or duplicate fixed asset transactions, incorrect amounts or accounts, timing issues, incorrect accumulations or postings Incorrect amounts or accounts Invalid or omitted transactions, duplicate transactions, incorrect amounts or accounts, timing issues

**Cost-Benefit Considerations**

The general nature of fixed assets makes them susceptible to theft, since they are distributed throughout the business and are therefore in the hands of so many different employees. Some additional factors that indicate the need for internal controls over fixed asset processes include:

1. Large quantities of fixed assets
2. Frequent fixed asset changes (such as additions, transfers, and disposals)

3. High likelihood of obsolescence due to technology changes
4. Assets under capital leasing arrangements
5. Widely dispersed fixed asset locations.

Companies tend to implement internal controls when they can justify the expense in terms of increased benefits. Accordingly, companies should assess their risk from factors such as those mentioned previously, and decide on the appropriate mix of internal controls. The examples presented in Exhibit 10-14 identify internal controls used in the fixed assets processes and the related risks that are minimized through their implementation. Although this exhibit does not represent a comprehensive list, it includes many reasonable combinations of items that affect fixed asset processes. In addition, the purchasing process maps in Chapter 9 show some purchases and cash disbursements processes that are also relevant to fixed asset systems.

## IT Systems of Fixed Assets Processes (Study Objective 7)

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The complexities of the fixed asset processes described earlier indicate the obvious fact that information technology is a friend of the fixed asset processes. More and more companies are using specialized asset management software programs instead of spreadsheets or traditional manual systems. Due to the abundance of fixed asset data, the time-consuming and tedious requirements for tracking changes, and the intricacy of the tax laws, most companies can justify the investment in computerized systems dedicated to fixed asset accounting. IT systems have evolved into simple, customized applications that may be integrated with other accounting software. These fixed assets applications automate the processes of creating and maintaining the financial records and tax documents required for adequate fixed assets management.

The benefits of automated fixed asset systems are numerous. Most companies would find it much more expensive and time consuming to manage their fixed assets by manual procedures or spreadsheets than by purchasing and implementing fixed asset software. The shortcomings of a spreadsheet-based system are as follows:

- The design of spreadsheets is very time-consuming. In addition, most companies have complex structures that are nearly impossible to replicate in spreadsheets. For example, the multiple categories and locations of fixed assets require detailed design and linkages that are very difficult to maintain in a spreadsheet system.
- Spreadsheets are not flexible enough to accommodate changes efficiently. When assets are relocated or disposed of, or changes are made to the underlying cost basis or estimates, updating the spreadsheet is time consuming and prone to error. Add to this the complexity when such changes are implemented to entire categories or departments of fixed assets, and the benefits of automated systems become even more obvious.
- It is difficult to apply varying depreciation policies within spreadsheets. Since many companies use varying rates of depreciation, especially for financial and tax purposes, they need a flexible record-keeping system.
- Spreadsheets are not well suited for handling the nonfinancial data (locations and descriptions) that are necessary for maintaining physical control of the company's assets.

- It is difficult to establish an audit trail through spreadsheets, so tracking fixed assets changes is difficult.
- Manual processes are typically required to link the spreadsheets with the general ledger and other accounting programs.
- There are limited opportunities to customize reporting. In particular, spreadsheets do not meet the needs of companies to project depreciation information and prepare specialized management reports.

Computer-based fixed asset systems can handle all of the listed items that spreadsheets cannot. It is therefore clear why most companies have replaced their spreadsheet systems with automated ones.

With automated fixed asset management systems, information related to fixed asset acquisitions and changes to existing assets are input into the software by an employee in the fixed asset accounting department. This can be done in real time or in batches, depending upon the company's reporting needs and the volume of transactions. For most companies, fixed asset acquisitions are considered nonroutine processes because they require specific authorization and are carried out infrequently. Thus, the real time approach is most reasonable. On the other hand, for large companies that have numerous acquisitions, a batch process may be a better match.

All of the relevant information regarding depreciation policies must also be input in the computer so that the system can automatically prepare the depreciation schedule and update the fixed asset control accounts. Similarly, when asset disposal information is input, the system can instantly remove the related asset records and compute any resulting gain or loss. Regardless of the type of information entered in the fixed asset system, the company should implement controls to ensure that unauthorized access does not occur. The control environment may be enhanced through the implementation of various access controls, including passwords, limits on the number of employees who have access to the system, and limits on the number of computer workstations where information may be entered.

Fixed asset management systems are easiest to implement at the beginning of the company's fiscal year. By timing the conversion for after the prior-year numbers are finalized and before any current-year depreciation is recorded, the need for mid-year adjustments is eliminated.

## The Real World

Sophisticated fixed asset software offers many advantages. Tempel Steel, a Chicago-based company with approximately 1,900 employees, uses Sage FAS software to account for fixed assets. Prior to using this software, Tempel used an older system and spreadsheets. The company estimated that the new fixed assets software cuts paperwork in half and reduces time spent on capital project management, at only one-third of the cost of its previous systems.

Pepsi-Cola, Jamaica, a Pepsi bottler with approximately 300 employees, uses the same fixed asset software as Tempel. Under its older system, the monthly update of fixed assets took about three days; while it now takes only a few minutes. This company also uses bar code technology to conduct inventory of fixed assets. This improves the efficiency and effectiveness of the fixed asset inventory process.<sup>3</sup>

<sup>3</sup> [www.sage.com/us/sage-fixed-assets/resources](http://www.sage.com/us/sage-fixed-assets/resources)

## Ethical Issues Related to Payroll and Fixed Assets Processes (Study Objective 8)



Chapter 9 presented ethical issues related to expenditure processes, such as those involving the traditional systems of purchasing and cash disbursements. This chapter examines additional issues specific to the payroll and fixed assets processes.

The payroll system is the target of several types of fraud schemes. The most common means of defrauding a company involves dishonest employees' falsification of time sheets in an effort to receive excess compensation. There are many different ways that these frauds may be carried out. The following list presents some of the typical sources of time sheet falsifications:

- Exaggeration of hours worked
- Falsification of overtime or holiday time worked, payable at higher rates
- Falsification of sales in order to increase commission payouts
- Overstatement of job-related expenses, which may be reported with the time sheets and reimbursed via the paycheck.

Other types of time sheet falsification may be carried out in the employee's effort to unfairly take time off work. Many companies have certain conditions under which they pay their employees for absences due to illness, disability, personal hardships, or vacations. Dishonest employees may take advantage of these policies in order to receive excess paid leave. For example, an employee may falsely call in sick or lie about a family emergency in order to receive pay for the time off. Or someone may fake an injury in order to collect disability payments. Another scheme involves the employee abusing the company's vacation policy by failing to record vacation hours taken. As a result, these employees might take more time off work than they have earned. These types of frauds are actually a form of theft from the company; since the employees receive unearned compensation, they are actually stealing the company's cash and receiving it in their paychecks.

The fraud schemes described involve falsified time sheets. Supervisory review of time sheets is very important in preventing these types of fraud and the significant costs that companies may bear in paying for excess compensation. In some extreme cases, employees may collude with their supervisors in order to perpetrate these kinds of fraud. For example, a supervisor may be willing to approve an employee's falsified time sheet in exchange for a share of the extra money. Therefore, it is important that the company's management be aware of the possibility of such misconduct and carry out a review of time sheets that is thorough enough to detect these kinds of schemes. Supporting documentation should be required for certain absences from work and for commission and expense payments.

Another type of payroll-related fraud is the creation of a ghost employee. A **ghost employee** is an entity who receives a paycheck, but who does not actually work for the company. It may be a previous employee who has been terminated or is deceased, a friend or relative of a fraudster within the company, or simply an imaginary employee created by a fraudster. Regardless of the manner in which the ghost has been contrived, this unethical conduct is often initiated by someone within the company's payroll function. Bogus documentation is typically created in order to circumvent the company's internal controls and carry out the fraud. However, a ghost employee usually cannot survive unless a deficiency in segregation of duties exists. In order to pull off this plot, fraudsters need access to both the

payroll preparation function and the paycheck disbursement activities. Following are some clues that a ghost employee may be lurking in the company's midst:

- The payroll register identifies paychecks without adequate tax withholdings.
- The personnel files contain duplicate addresses, Social Security numbers, or bank account numbers.
- Payroll expenses are over budget.
- Paychecks were not claimed when the paymaster distributed them.
- Paychecks returned with the bank statement contain dual endorsements, meaning that the ghost employee's paycheck was signed (forged) over to another person.

Notice that the last two items pertain to manual payroll processes. For companies with automated systems of paycheck deposits, these methods of detecting a ghost employee would not be available. Payroll frauds, such as ghost employees, can still occur in direct deposit payroll systems. A fraudster could set up a bank account and have fraudulent checks directly deposited.

The payroll-related frauds described earlier are generally employee frauds resulting in the embezzlement of company funds. Fixed assets-related fraud, described next, tends to be very different in that it involves management's misstatement of financial information.

Since fixed asset accounting involves the estimation of key information, including useful lives and salvage values, it relies on the conscientious efforts of employees to determine the inputs to the accounting reports. Unfortunately, with the many pressures on managers to present favorable financial results, managers may resort to unethical conduct in order to massage accounting numbers. This unethical practice is commonly referred to as earnings management. Fixed assets are one area where earnings management may be prevalent, due to the judgmental nature of the underlying data. For example, one way of reducing expenses (and thus, increasing net income) reported on the income statement is to extend the lives of fixed assets beyond their reasonable usefulness so that the cost of the assets is spread over a greater length of time. Similarly, the amount of the estimated salvage value could be increased above the expected amount in order to reduce the depreciable cost of the asset. Both of these schemes would reduce the amount of depreciation expense reported on the income statement in any given period. If these schemes are undertaken solely to distort earnings, they are unethical.

Another earnings management tactic is to misclassify repair and maintenance expenses as capitalized costs. This allows the costs to be spread over the life of the asset rather than reported as an expense in the year incurred.

Although there is no direct benefit (in terms of immediate cash received) to a fraudster who engages in earnings management, it is nonetheless unethical because it results in the falsification of the company's financial statements. Many investment and credit decisions are made on the basis of assumptions that the financial statements are a fair representation of the company's financial situation, so many parties stand to benefit or lose from the information contained therein. Fraudsters would realize indirect benefits if the company continued to report favorable financial results. For instance, they may have increased job security, or they may receive a year-end bonus. However, the people who make business decisions on the basis of misstated information may suffer financial losses if they rely on falsified information when making their decisions.

## The Real World

A fixed asset misclassification practice was performed at WorldCom, Inc., as the company transferred billions of dollars worth of facility-related expenses into asset accounts in 2001 and 2002. These misclassifications led to the restatement of WorldCom's financial statements and the ultimate downfall of the corporation.

Another misclassification case involved Krispy Kreme Doughnuts, Inc. This company was criticized for its aggressive practices related to fixed assets reporting. When Krispy Kreme bought back its doughnut franchises, it allegedly recorded the amounts paid as intangible assets, even though much of the outlay was for fixed assets. It did not depreciate or amortize intangible assets, so the related costs were not reported as expenses on the income statement. Krispy Kreme defended its practices, claiming

that the assets were not impaired and should not be expensed until used. This is an earnings management tactic that allowed the company to show favorable financial results, despite its dwindling profits. Following an SEC investigation, Krispy Kreme's top executives agreed to settle the matter and pay monetary fines, but they admitted no wrongdoing.

Sunbeam is another company that inflated earnings through fixed asset manipulation. During a year in which it reported dramatically increased profits, it treated certain period costs (for product development, packaging, and marketing) as fixed assets. Capitalizing these expenditures allowed for only a small part to be expensed each year via depreciation, rather than their entire amount being expensed in the year incurred.

## Corporate Governance in Payroll and Fixed Assets Processes (Study Objective 9)

Recall that the four primary functions of the corporate governance process include management oversight, internal controls and compliance, financial stewardship, and ethical conduct. While corporate governance is essential for all business processes, it is especially important in the areas of payroll and fixed assets, where historically there have been many cases of fraud, theft, manipulation, and misuse of funds.

Without good corporate governance, time sheets could be more easily altered, payroll funds can be readily stolen, and fixed assets are more likely to be misused or stolen.

Payroll funds and fixed assets do not belong to the managers of the organization; rather, the managers are stewards, or temporary agents of those assets. Corporate governance policies and procedures must be in place to ensure that expenditures occur only to benefit the organization and its owners, not to benefit the managers or employees personally. In addition, corporate governance policies should prevent a manager or employee from taking fixed assets for personal use.

The systems, processes, and internal controls described in this chapter are part of the corporate governance structure. When management designs and implements processes for payroll and fixed assets, it assigns responsibility for executing those functions to various managers and employees. As management assigns and oversees these expenditure processes, it carries out the corporate governance function of proper management oversight.

Management should also establish appropriate internal controls for payroll and fixed assets, such as those described previously in this chapter. These controls

## The Real World

Adelphia Business Solutions, Inc., provides an example of poor corporate governance leading to misuse of corporate funds earmarked for fixed asset purchases. In the late 1990s, Adelphia was the sixth largest cable television company in the United States. The corporation was majority-owned and managed by members of the Rigas family. John Rigas was the founder and chairman, and three of his sons occupied top management positions and served as directors. When the Rigas family's fraud schemes were discovered in 2001, it was apparent that many millions of dollars in corporate funds had directly benefited Rigas family members.

The Rigas family commingled corporate funds with family funds and caused the corporation to buy fixed assets that benefited only the family. These purchases included land and several luxury Manhattan condominiums, as well as the construction of a private golf course. The board of directors, which included Rigas family members, was not an independent board that exercised good corporate governance. Good corporate governance should begin with a strong and independent board of directors, and effective policies, procedures, and systems must be in place throughout the entire organization.

accomplish the objectives of safeguarding assets within expenditure processes and ensuring the accuracy and completeness of the related data. These controls are also part of the corporate governance structure.

When management has designed, implemented, and continually manages processes and internal controls, it is helping to ensure proper stewardship of the company's assets. Corporate governance requires proper financial stewardship. The processes, internal controls, and feedback data from its systems help management report to owners and other stakeholders about proper stewardship of assets within the expenditure processes. These assets include funds for payroll and fixed assets.

Finally, good corporate governance requires ethical conduct. This chapter described some of the ethical issues that management must consider and address within the payroll and fixed assets processes. When top management acts ethically and encourages ethical behavior throughout the organization, stronger corporate governance is the result. There are usually fewer cases of fraud, error, or ethical problems in organizations where top management behaves ethically and encourages ethical behavior.

Perhaps it would be easier to understand the way this chapter's topics fit into a corporate governance perspective if you think of it from a negative point of view. For example, if management of a particular organization did not establish sound business processes, good internal controls, and ethical policies, it would lack good corporate governance. In such an organization, expenditure processes would be poorly executed and poorly controlled. Management would not be exercising proper financial stewardship. Therefore, stakeholders such as investors, creditors, and owners would have little or no trust in management's ability to use funds in a manner that would benefit the organization and its owners. The organization would not represent the type of enterprise in which we would wish to invest our own money. On the other hand, when an organization has good corporate governance, the stakeholders can properly have confidence that proper stewardship is occurring. Establishing and executing proper processes, internal controls, and ethical guidelines leads to better corporate governance and, therefore, good financial stewardship.

## Summary of Study Objectives

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**An introduction to payroll and fixed asset processes.** Payroll and fixed asset processes are different from other expenditures in two ways. First, they tend to have fewer transactions than the process of purchasing raw materials. Second, they have both routine and nonroutine aspects. Payroll has routine processes for weekly, biweekly, or monthly payroll activities, but there are also nonroutine processes for hiring, terminating, or changing the status of employees. Fixed asset processes are routine for depreciating fixed assets, but nonroutine for approving the purchase and disposal of fixed assets.

**Payroll processes.** Employees must first be hired through the human resources department. The routine accounting processes for maintaining valid employees is the collection, review, and approval of time cards; the calculation of payroll based on pay rates, hours, and deductions; the preparation, approval, and signing of paychecks; a transfer of sufficient funds to the payroll account; distribution of paychecks; and updating payroll and general ledger records.

**Risks and controls in payroll processes.** Payroll processes involve large sums of cash and the potential for erroneous or inflated timekeeping. Proper controls are necessary to protect the company's cash and to ensure accurate and complete payroll records. These internal controls can be categorized into authorization, segregation, adequate records and documents, security of assets and documents, and independent checks.

**IT systems of payroll processes.** Payroll requires routine mathematical calculations and the storage of large volumes of data regarding employees, deductions, vacation days, sick days, and other data. These characteristics of payroll make it a good fit for IT systems. IT systems can include payroll and human resources software, automated timekeeping through bar codes or ID badges, Internet-based timekeeping, and electronic transfer of funds. Some organizations outsource payroll to a payroll processing firm that uses IT systems to provide efficient and cost-effective payroll services.

**Fixed asset processes.** Many of the processes to purchase fixed assets are similar to those processes to purchase raw materials. The differences in processes occur in the authorization of the purchase, the continuance of the fixed asset after purchase, and the disposal of fixed assets. Authorization is usually specific and based on investment analysis and comparison with the capital budget. Fixed asset continuance requires maintenance of a fixed asset subsidiary ledger for changes in location of fixed assets, ongoing costs to enhance or maintain the assets, and updating of depreciation records. Disposal of fixed assets requires specific approval and record keeping to remove fixed assets from the records and to recognize any gain or loss.

**Risks and controls in fixed asset processes.** Some of the risks and controls of fixed assets are similar to those for raw materials purchases. The major differences are that the authorization is more formal and specific for fixed asset acquisitions and the physical security of fixed assets requires more widespread supervision. Segregation of duties, adequate records and documents, and independent checks are very similar to those for raw materials purchases.

**IT systems of fixed asset processes.** The efficiency and effectiveness of accounting for fixed assets can be greatly improved through the use of specialized asset management software. Such software simplifies the record keeping regarding location and description of fixed assets, depreciation and maintenance records, audit trail, and linkages to the general ledger.

**Ethical issues related to payroll and fixed assets processes.** Payroll is subject to much unethical employee manipulation such as inflation of hours worked, falsification of overtime or commission records, overstatement of job-related expenses, and creation of ghost employees. Fixed asset information is more likely to be manipulated by management to unethically enhance the financial statements. Often, this occurs when management misclassifies expenses as fixed asset purchases.

**Corporate governance in payroll and fixed assets processes.** Payroll funds and fixed assets are particularly susceptible to theft, and business organizations must be careful to maintain effective corporate governance systems with respect to these processes. In addition to the need for strong management oversight, internal controls, and ethical practices, corporate managers must recognize their responsibility to be good stewards of the assets underlying the payroll and fixed assets processes.

## Key Terms

Capital budget	Fixed asset subsidiary ledger	Organization chart	Payroll processes
Depreciation schedule	Ghost employee	Paymaster	Payroll register
Fixed asset continuance	Human resources department	Payroll	Time sheet
Fixed asset processes		disbursements journal	

## End of Chapter Material

### Concept Check



- 1 Which of the following statements about payroll and fixed asset processes is true?
    - a. Both have only routine processes.
    - b. Both have only nonroutine processes.
    - c. Both have routine and nonroutine processes.
    - d. Payroll has only routine processes, while fixed asset has only nonroutine processes.
  - 2 For a given pay period, the complete listing of paychecks for the pay period is a
    - a. payroll register
    - b. payroll ledger
    - c. payroll journal
    - d. paymaster
  - 3 A payroll voucher
    - a. authorizes an employee paycheck to be written
- b. authorizes the transfer of cash from a main operating account to a payroll account
  - c. authorizes the transfer of cash from a payroll account to a main operating account
  - d. authorizes the paymaster to distribute paychecks
  - 4 For proper segregation of duties, the department that should authorize new employees for payroll would be
    - a. payroll
    - b. human resources
    - c. cash disbursement
    - d. general ledger
  - 5 Which of the following is not an independent check within payroll processes?
    - a. Time sheets are reconciled with production records.
    - b. Time sheets are reconciled with the payroll register.

- c. Paychecks are prepared on prenumbered checks.
  - d. The payroll register is reconciled with the general ledger.
- 6 An integrated IT system of payroll and human resources may have extra risks above those of a manual system. Passwords and access logs are controls that should be used in these integrated systems to lessen the risk of
- a. hardware failures
  - b. erroneous data input
  - c. payroll data that does not reconcile to time cards
  - d. unauthorized access to payroll data
- 7 Internal control problems would be likely to result if a company's payroll department supervisor was also responsible for
- a. reviewing authorization forms for new employees
  - b. comparing the payroll register with the batch transmittal data
  - c. authorizing changes in employee pay rates
  - d. hiring subordinates to work in the payroll department
- 8 Which of the following procedures would be most useful in determining the effectiveness of a company's internal controls regarding the existence or occurrence of payroll transactions?
- a. Observe the segregation of duties concerning personnel responsibilities and payroll disbursement.
  - b. Inspect evidence of accounting for prenumbered payroll checks.
  - c. Recompute the payroll deductions for employee fringe benefits.
  - d. Verify the preparation of the monthly payroll account bank reconciliation.
- 9 In meeting the control objective of the safeguarding of assets, which departments should be responsible for distribution of paychecks and custody of unclaimed paychecks, respectively?
- | Distribution<br>of paychecks | Custody of<br>unclaimed paychecks |
|------------------------------|-----------------------------------|
| a. Treasurer                 | Treasurer                         |
| b. Payroll                   | Treasurer                         |
| c. Treasurer                 | Payroll                           |
| d. Payroll                   | Payroll                           |
- 10 A company's internal controls policies may mandate the distribution of paychecks by an independent paymaster in order to determine that
- a. payroll deductions are properly authorized and computed
  - b. pay rates are properly authorized and separate from the operating function
  - c. each employee's paycheck is supported by an approved time sheet
  - d. employees included in the period's payroll register actually exist and are currently employed
- 11 The purpose of segregating the duties of hiring personnel and distributing payroll checks is to separate the
- a. authorization of transactions from the custody of related assets
  - b. operational responsibility from the record-keeping responsibility
  - c. human resources function from the controllership function
  - d. administrative controls from the internal accounting controls
- 12 Which of the following departments or positions most likely would approve changes in pay rates and deductions from employee salaries?
- a. Human resources
  - b. Treasurer
  - c. Controller
  - d. Payroll
- 13 The purchase of fixed assets is likely to require different authorization processes than the purchase of inventory. Which of the following is not likely to be part of the authorization of fixed assets?
- a. Specific authorization
  - b. Inclusion in the capital budget
  - c. An investment analysis or feasibility analysis of the purchase
  - d. Approval of the depreciation schedule
- 14 Which of the following is not a part of "adequate documents and records" for fixed assets?
- a. Fixed asset journal
  - b. Fixed asset subsidiary ledger
  - c. Purchase order
  - d. Fixed asset tags
- 15 Which of the following questions would be least likely to appear on an internal control questionnaire regarding the initiation and execution of new property, plant, and equipment purchases?
- a. Are requests for repairs approved by someone higher than the department initiating the request?
  - b. Are prenumbered purchase orders used and accounted for?
  - c. Are purchase requisitions reviewed for consideration of soliciting competitive bids?
  - d. Is access to the assets restricted and monitored?

- 16 Which of the following reviews would be most likely to indicate that a company's property, plant, and equipment accounts are not understated?
- Review of the company's repairs and maintenance expense accounts
  - Review of supporting documentation for recent equipment purchases
  - Review and recomputation of the company's depreciation expense accounts
  - Review of the company's miscellaneous revenue account.
- 17 Which of the following is not an advantage of fixed asset software systems when compared with spreadsheets?
- Better ability to handle nonfinancial data such as asset location
  - Easier to apply different depreciation policies to different assets
  - Manual processes to link to the general ledger
  - Expanded opportunities for customized reporting
- 18 The term "ghost employee" means that
- hours worked has been exaggerated by an employee
  - false sales have been claimed to boost commission earned
  - overtime hours have been inflated
  - someone who does not work for the company receives a paycheck

### Discussion Questions

- 19 (SO 1) Sales and inventory purchases are routine processes that occur nearly every day in a business. How are these routine processes different from payroll or fixed asset processes?
- 20 (SO 1) Even though payroll and fixed asset processes may not be as routine as revenue processes, why are they just as important?
- 21 (SO 2) Why do you think management should specifically approve all employees hired?
- 22 (SO 2) Why is it important that the human resources department maintain records authorizing the various deductions from an employee's paycheck?
- 23 (SO 2) Explain why an employee's individual record is accessed frequently, but changed relatively infrequently.
- 24 (SO 2) Explain two things that should occur to ensure that hours worked on a time card are accurate and complete.
- 25 (SO 2) Explain the reasons for an organization having a separate bank account established for payroll.
- 26 (SO 3) What is the purpose of supervisory review of employee time cards?

- 27 (SO 3) Why is it important to use an independent paymaster to distribute paychecks?
- 28 (SO 3) Why do payroll processes result in sensitive information, and what is the sensitive information?
- 29 (SO 4) Why is batch processing well suited to payroll processes?
- 30 (SO 4) What are the advantages of automated time keeping such as bar code readers, or ID badges that are swiped through a reader?
- 31 (SO 4) What are the advantages of outsourcing payroll?
- 32 (SO 5) Fixed assets are purchased and retired frequently. Given this frequent change, why are clear accounting records of fixed assets necessary?
- 33 (SO 5) Why is it important to conduct an investment analysis prior to the purchase of fixed assets?
- 34 (SO 5) Explain why categorizing fixed asset expenditures as expenses or capital assets is important.
- 35 (SO 5) What are some of the practical characteristics of fixed assets that complicate the calculation of depreciation?
- 36 (SO 6) What is different about the nature of fixed asset purchasing that makes authorization controls important?
- 37 (SO 6) Explain the necessity of supervision over fixed assets.
- 38 (SO 6) Why are some fixed assets susceptible to theft?
- 39 (SO 7) Explain why a real-time update of fixed asset records might be preferable to batch processing of fixed asset changes.
- 40 (SO 7) Why is the beginning of a fiscal year the best time to implement a fixed asset software system?
- 41 (SO 7) What negative things might occur if fixed asset software systems lacked appropriate access controls?
- 42 (SO 8) Why might a supervisor collude with an employee to falsify time cards?
- 43 (SO 8) How does the misclassification of fixed asset expenditures result in misstatement of financial statements?

### Brief Exercises

- 44 (SO 2) Describe the type of information that a human resources department should maintain for each employee.
- 45 (SO 2) The calculation of gross and net pay can be a complicated process. Explain the items that complicate payroll calculations.
- 46 (SO 3) Explain how duties are segregated in payroll. Specifically, who or which departments conduct the authorization, timekeeping, recording, and custody functions?

- 47** (SO 3) Explain the various reconciliation procedures that should occur in payroll.
- 48** (SO 4) Explain the ways in which electronic transfer of funds can improve payroll processes.
- 49** (SO 5) Explain the kinds of information that must be maintained in fixed asset records during the asset continuance phase.
- 50** (SO 6) The authorization to purchase fixed assets should include investment analysis. Explain the two parts of investment analysis.
- 51** (SO 8) Explain the types of unethical behavior that may occur in the fixed assets area.

## Problems

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- 52** (SO 2) Following is a time sheet completed by an hourly wage earner at Harold, Inc.:



<b>Name:</b> Jane Kaller			
<b>Pay Period Ending:</b> 05/02/07			
<b>SS#</b> 222-55-6666			<b>Approval:</b> KTB
Mon.	IN	08:02	M
	OUT	11:40	M
	IN	12:34	M
	OUT	17:02	M
Tue.	IN	08:00	T
	OUT	11:45	T
	IN	12:44	T
	OUT	17:01	T
Wed.	IN	08:11	W
	OUT	11:30	W
	IN	12:15	W
	OUT	17:00	W
Thur.	IN	07:57	Th
	OUT	11:44	Th
	IN	12:52	Th
	OUT	17:16	Th
Fri.	IN	12:01	F
	OUT	16:15	F
	IN	17:10	F
	OUT	21:05	F
Sat.	IN	09:00	Sa
	OUT	12:04	Sa
	IN		
	OUT		
Sun.	IN		
	OUT		
	IN		
	OUT		

<b>Employee Date</b>	<b>Name/SS#</b>	<b>Hours: Regular/ Overtime</b>	<b>Pay Rate: Regular/ Overtime</b>	<b>Gross Pay</b>	<b>FICA Withheld</b>	<b>Medicare Withheld</b>	<b>Federal Inc. Tax Withheld</b>	<b>Net Pay</b>
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Use Microsoft Excel to perform the following tasks:

- a. Design an appropriate format for a data entry screen that could be used in the payroll department to enter information from this time sheet in the company's payroll software program.
- b. Prepare a payroll journal with the column headings shown in the table above. Enter the relevant information from the preceding time sheet onto this journal and calculate gross pay, federal withholdings, and net pay. Use two lines for this employee, and assume that the pay rate is \$19.75 per hour, with time-and-a-half for overtime. (Overtime applies to any time worked over 40 hours within one week.) Use the following withholding rates: FICA (Social Security)—6.2 percent of gross pay; Medicare—1.45 percent of gross pay; federal income taxes—20 percent. Assume no additional withholdings.



- 53 (SO 2) The textbook website has a Microsoft Excel spreadsheet titled payroll\_problem.xls. This spreadsheet is used by Naltner Company to calculate its biweekly payroll. Using the information in that spreadsheet, calculate all details for the February 22, 2013, payroll. Hours worked by each employee are contained in the first worksheet. The following four worksheets contain details for each of the three employees and a total for the three employees. The sixth and last worksheet contains federal tax withholding tables to calculate federal tax to withhold. Calculate the gross pay and deductions for all three employees.



- 54 (SO 5) The textbook website has a Microsoft Excel spreadsheet titled fixed\_asset.xls. The spreadsheet represents a fixed asset subsidiary ledger for Brozzos Corporation. On July 3, 2013, Brozzos purchased for

the office a multifunction printer/fax/copier from Brereton Office Supplies for \$200. The machine has no salvage value and a four-year life. Add a new ledger record for this machine and calculate and record the 2013 depreciation expense for all fixed assets. Brozzos uses straight-line depreciation with a half-year convention.

- 55 (SO 6) Explain the process of approval of purchases for fixed assets. How does this process differ from that of purchasing raw materials?
- 56 (SO 3) Using an Internet search engine, search for the phrase "biometric time clock." (Be sure to include the quotation marks.) From your search results, describe a biometric time recording system and its advantages.
- 57 (SO 7) Using an Internet search engine, search for the phrase "fixed asset software." (Be sure to include the quotation marks.) Examine the results to find companies that sell fixed asset software. List and explain some of the features of fixed asset software that these companies offer as selling points for their software.
- 58 (SO 8) Read the article at this link: [www.offthegridnews.com/privacy/how-car-insurance-companies-are-tracking-your-every-move/](http://www.offthegridnews.com/privacy/how-car-insurance-companies-are-tracking-your-every-move/). Describe any ethical considerations in using such technology. Consider both the company and employee perspectives. Also discuss whether you believe the use of this device could be an internal control for the company.
- 59 (SO 8) Using an Internet search engine, search for the terms "Patti Dale" and "theft." (Be sure to include the quotation marks around the name.) Explain the unethical behavior that occurred. Also, explain any internal controls that you believe were missing or not followed in this case.



## Cases

- 60 Glazer Company is a small manufacturing firm with 60 employees in seven departments. When the need arises for new workers in the plant, the departmental manager interviews applicants and hires on the basis of those interviews. The manager has each new employee complete a withholding form. The manager then writes the rate of pay on the W-4 and forwards it to payroll.

When workers arrive for their shift, they pull their time cards from a holder near the door and keep the

time card with them during the day to complete the start and end times of their work day. On Friday, the time cards are removed from the holder and taken to payroll by any employee who is not busy that morning. If there were any pay rate changes for the payroll period due to raises or promotions, the manager calls the payroll department to inform payroll of these rate changes.

Using the rate changes and the time cards, the payroll department prepares the checks from the

regular bank account of the Glazer Company. The manager of the payroll department signs the checks, and the checks are then forwarded to each department manager for distribution to employees.

**Required:**

Describe any improvements you would suggest to strengthen the payroll internal controls at Glazer.

- 61 Rossi Industries has payroll processes as described in the following paragraphs:

When a new employee is hired, the human resources department completes a personnel action form and forwards it to the payroll department. The form contains information such as pay rate, number of exemptions for tax purposes, and the type and amount of payroll deductions. When an employee is terminated or voluntarily separates from Rossi, the human resources department completes a personnel action form to indicate separation and forwards it to the payroll department.

Each employee in the production department maintains his own time card weekly. Employees fill out their time cards in ink each day, and at the end of the week, the time cards are forwarded to the payroll department. Employees in the payroll department use the time cards and employee records to prepare a weekly paycheck for each employee who has turned in a time card. A copy of the payroll checks is forwarded to the accounts payable department, and the original payroll checks are forwarded to the cash disbursements department to be signed. The payroll department updates the payroll subsidiary ledger. After the paychecks are signed, they are given to department supervisors to distribute. Any unclaimed checks are returned to the payroll department.

**Required:**

- a. Prepare a process map of the payroll processes at Rossi.
- b. Identify both internal control strengths and internal control weaknesses of the payroll processes.
- c. For any internal control weaknesses, describe suggested improvements.

- 62 Wilson Enterprises is a midsize manufacturing company with 120 employees and approximately \$45 million in sales. Management has established a set of processes to purchase fixed assets, described in the following paragraphs:

When a user department determines that it may be necessary to purchase a new fixed asset, the departmental manager prepares an asset request form. When completing the form, the manager must describe the fixed asset, the advantages or efficiencies

offered by the asset, and estimates of costs and benefits. The asset request form is forwarded to the director of finance. Personnel in the finance department review estimates of costs and benefits and revise these if necessary. A discounted cash flow analysis is prepared and forwarded to the vice president of operations, who reviews the asset request forms and the discounted cash flow analysis, and then interviews user department managers if she feels it is warranted. After this review, she selects assets to purchase until she has exhausted the funds in the capital budget.

When an asset purchase has been approved by the VP of operations, a buyer looks up prices and completes a purchase order. The purchase order is mailed to the vendor, and a copy is forwarded to accounts payable. The fixed asset is delivered directly to the user department so that it can be installed and used as quickly as possible. The user department completes a receiving report and forwards a copy to accounts payable. If the invoice, purchase order, and receiving report match, payment is approved and cash disbursements prepares and mails a check.

The accounts payable department updates the accounts payable subsidiary ledger and the fixed asset spreadsheet file.

**Required:**

- a. Identify any internal control strengths and weaknesses in the fixed asset processes at Wilson. Explain why each is a strength or weakness.
- b. For each internal control weakness, describe improvement(s) in the processes that you would recommend to address the weakness.

- 63 The Crishner Company has the following processes related to fixed assets: When a department manager determines a need for a new fixed asset, he prepares a purchase requisition, which is forwarded to the chief financial officer. If the requested fixed asset purchase will not exceed remaining funds in the capital budget, the CFO approves the purchase and forwards the requisition to the purchasing department.

The purchasing agent assigned to purchase the fixed assets begins phoning vendors until she finds a vendor selling the requested asset. The purchase order is prepared and mailed to the vendor. Vendors are instructed to deliver the fixed asset to the requesting department.

A copy of the invoice is forwarded to the fixed asset department to record the asset details. Personnel determine the estimated life and salvage value by looking up the last similar asset purchase and using the previous estimated life and salvage value.

**Required:**

Describe any improvements you would suggest to strengthen the fixed asset internal controls at Crishner.

- 64 (CMA Adapted) Rider Co. makes automobile parts for sale to major automobile manufacturers in the United States. The following information is available regarding internal controls over machinery and equipment:

When a departmental supervisor needs a new item of machinery or equipment, he or she must initiate a purchase request. The acquisition proposal must be presented to the plant manager. If the plant manager agrees with the need, he must review the corporate budget allocation for his plant to determine the availability of funds to cover the acquisition. If the allocation is sufficient, the departmental supervisor is notified of the approval and a purchase requisition is prepared and forwarded to the purchasing department.

Upon receipt of a purchase requisition for machinery and equipment, the purchasing department researches the company records in order to locate an appropriate vendor. A purchase order is then completed and mailed to the vendor.

As soon as new machinery or equipment is received from the vendor, it is immediately sent to

the department for installation. Bellott's policy is to place new assets into service as soon as possible so that the company may immediately begin to realize the economic benefits from the acquisition.

The property accounting department is responsible for maintaining property, plant, and equipment ledger control accounts. The ledger is supported by lapsing schedules that are used to compute depreciation. These lapsing schedules are organized by year of acquisition so that depreciation computations can be prepared in units that combine all assets of the same type that were acquired the same year. Standard depreciation methods, rates, and salvage values were determined ten years ago and have been used consistently since that time.

When machinery or equipment is retired or replaced, the plant manager notifies the property accounting department so that the proper adjustments can be made to the ledger and lapsing schedules. No regular reconciliation between the physical assets on hand and the accounting records has been performed.

**Required:**

Identify any internal control weaknesses and suggest improvements to strengthen the internal controls over machinery and equipment at Rider.

## Solutions to Concept Check

- 1 (SO 1) Which of the statements about payroll and fixed asset processes is true? **c. Both have routine and nonroutine processes.** Examples of routine processes are regular payroll runs and recording depreciation. Nonroutine processes are hiring employees and purchasing fixed assets.
- 2 (SO 2) For a given pay period, the complete listing of paychecks for the pay period is a **a. payroll register.**
- 3 (SO 2) A payroll voucher **b. authorizes the transfer of cash from a main operating account to a payroll account.** After reviewing the payroll register, accounts payable prepares a payroll voucher to transfer an amount of cash necessary to cover the payroll checks written.
- 4 (SO 3) For proper segregation of duties, the department that should authorize new employees for payroll would be **b. human resources.** This segregates the authorization from the timekeeping and payroll record keeping.
- 5 (SO 3) Which of the statements is not an independent check within payroll processes? **c. Paychecks are prepared on prenumbered checks.** This is an important control concerning completeness, but it is not part of the independent check control procedures.
- 6 (SO 4) An integrated IT system of payroll and human resources may have extra risks above those of a manual system. Passwords and access logs are controls that should be used in these integrated systems to lessen the risk of **d. unauthorized access to payroll data.** Passwords and logs are both examples of access controls, whereas the other options are related to equipment controls and data controls.
- 7 (CPA Adapted) (SO 3) Internal control problems would be likely to result if a company's payroll department supervisor was also responsible for **c. authorizing changes in employee pay rates.** This would be a violation of the principle of segregation of duties, as the same employee would have both record keeping and authority functions.
- 8 (CPA Adapted) (SO 3) The procedure most useful in determining the effectiveness of a company's internal controls regarding the existence or occurrence of payroll transactions would be **a. to observe the segregation of duties concerning personnel**

- responsibilities and payroll disbursement.** Option b. is concerned with the completeness assertion, option c. is related to accuracy, and option d. is an independent check.
- 9 (CPA Adapted) (SO 3) In meeting the control objective of safeguarding assets, the **a. treasurer** should be responsible for distribution of paychecks and the **treasurer** should have custody of unclaimed paychecks. The payroll department should not have responsibility for either of these payroll custody functions, because it is responsible for payroll record keeping.
- 10 (CPA Adapted) (SO 3) A company's internal control policies may mandate the distribution of paychecks by an independent paymaster in order to determine that **d. employees included in the period's payroll register actually exist and are currently employed.** Each of the other options is related to authorization for payroll transactions.
- 11 (CPA Adapted) (SO 3) The purpose of segregating the duties of hiring personnel and distributing payroll checks is to separate the **a. authorization of transactions from the custody of related assets.** The human resources department has authorization responsibility with regard to payroll transactions, whereas the distribution of paychecks involves custody of payroll cash.
- 12 (CPA Adapted) (SO 3) The **a. personnel** department most likely would approve changes in pay rates and deductions from employee salaries. This is another name for human resources. None of the other responses is appropriate, because they each include record keeping or custody functions.
- 13 (SO 5) The purchase of fixed assets is likely to require different authorization processes than the purchase of inventory. **d. Approval of the depreciation schedule** is not likely to be part of the authorization of fixed assets. This is generally categorized as an independent check rather than an authorization function.
- 14 (SO 6) **a. A fixed asset journal** is not a part of "adequate documents and records" for fixed assets. While there should be either a manual or computerized fixed asset subsidiary ledger, a fixed asset journal is nonexistent.
- 15 (CPA Adapted) (SO 6) The question least likely to appear on an internal control questionnaire regarding the initiation and execution of new property, plant, and equipment purchases would be **d. Is access to the assets restricted and monitored?** This question is concerned with safeguarding of the asset after it is placed in service. Each of the other responses relates to acquisitions.
- 16 (CPA Adapted) (SO 6) **a. Review of the company's repairs and maintenance expense accounts** is most likely to be an indication that a company's property, plant, and equipment accounts are not understated. Fixed asset additions are sometime misclassified as repairs or maintenance expenses, so it is wise to monitor this account for the nature of the underlying expenditures.
- 17 (SO 7) **c. Manual processes to link to the general ledger** are not an advantage of fixed asset software systems compared with spreadsheets. Fixed asset system software usually has linkages to the general ledger. Spreadsheets do not have linkages to the general ledger and require manual processes to enter data into the general ledger.
- 18 (SO 8) The term "ghost employee" means that **d. someone who does not work for the company receives a paycheck.**

# Conversion Processes and Controls

### STUDY OBJECTIVES

This chapter will help you gain an understanding of the following concepts:

- 1.** Basic features of conversion processes
- 2.** Components of the logistics function
- 3.** Cost accounting reports generated by conversion processes
- 4.** Risks and controls in conversion processes
- 5.** IT systems of conversion processes
- 6.** Ethical issues related to conversion processes
- 7.** Corporate governance in conversion processes

The Real World example on the next page will help you understand the context of many concepts in this chapter. Please read the Real World example to begin effective reading and studying of this chapter. The Real World example explains how Nissan Motor Company uses advanced technology to enhance its conversion processes.

This chapter examines the activities and information flows in a manufacturing firm's conversion processes. The first part of the chapter covers the basic features of the conversion processes, beginning with a typical traditional system and the related controls, followed by trends in computer-based systems. The latter part of the chapter examines ethical issues and corporate governance related to the conversion processes.

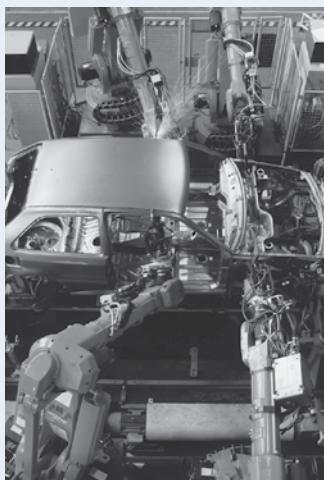
Individual companies may have differences in their conversion processes. This chapter explains common, simple methods of conducting these business activities, and these explanations should help you understand different accounting systems involving conversion processes, even if they are not exactly like the ones you may have seen or will see in your personal experience.

## Basic Features of Conversion Processes (Study Objective 1)

A company's conversion processes involve the activities related to the transformation of resources into goods or services. These resources include the following:

- Materials, including raw materials inventory
- Labor, namely, the human resources required for operations
- Overhead, including fixed assets, indirect materials, indirect labor, and various other expenses necessary to run the operating facility

## The Real World



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Nissan Motor Company's automobile plant near Jackson, Mississippi, has cutting-edge technology and robotic assemblers. "Assembly lines are powered by enormous robots; at one stop in the line, a bay of over 25 robots each make 12 welds per second. Suppliers are tied into the line by computers; parts actually arrive in the order they'll be used."<sup>1</sup> This complex technology allows Nissan to handle four different models in random order and to finish a vehicle in 13 hours. The plant can produce 400,000 vehicles in a five-day period with two shifts operating.

Manufacturing has changed dramatically over the past few decades due to robotics, computers, and global competition. To keep pace with these changes, manufacturers must have flexible processes, such as those at Nissan. Manufacturers must also have activities and accounting systems that help them predict, order, and track the various raw materials and parts used in their conversion processes.

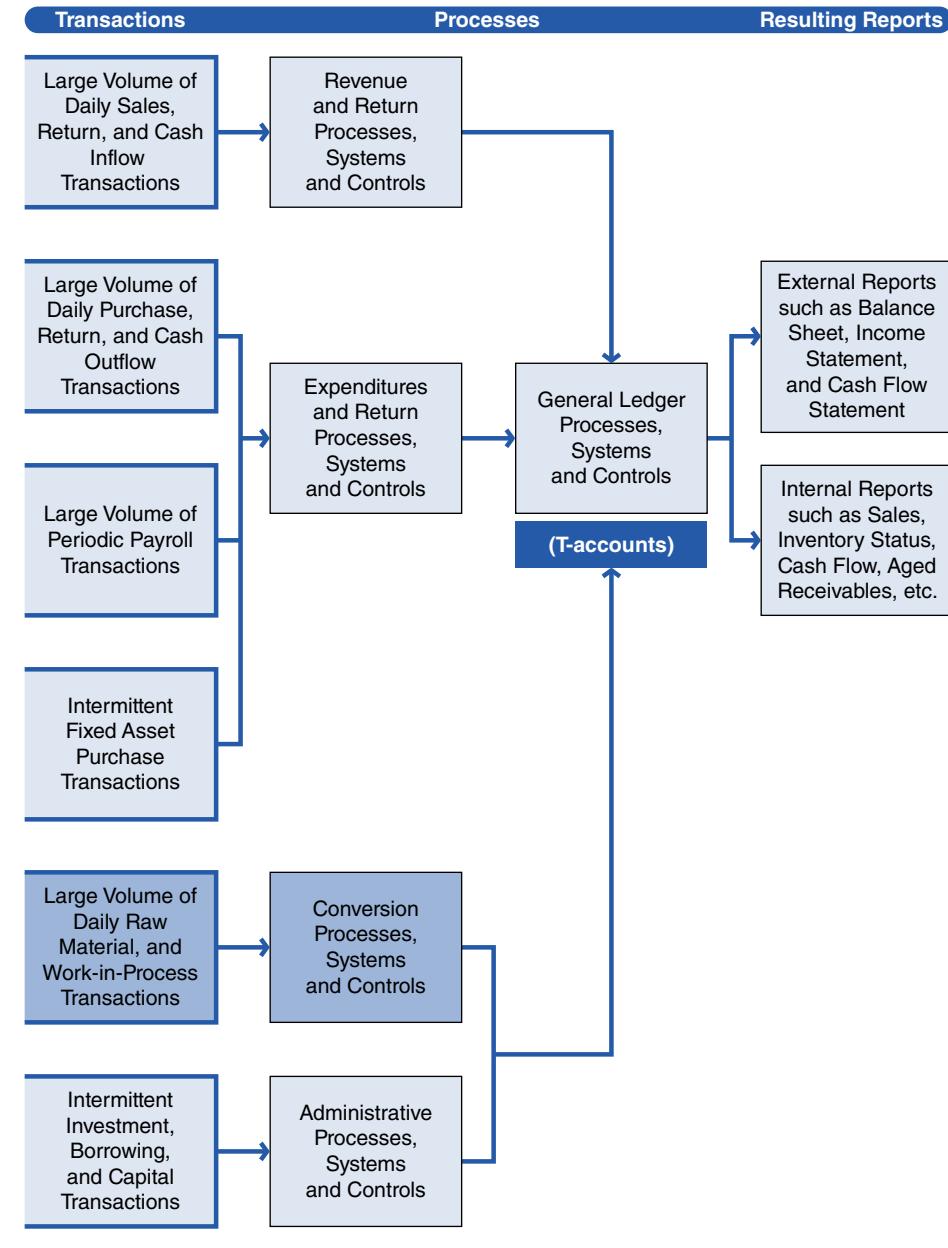
Exhibit 11-1 highlights the portions of the conversion processes addressed in this chapter, as they relate to the overall accounting system.

A company must have systems in place to capture, record, summarize, and report all of its conversion activities. The major activities within this process include operational planning that supports the company's strategies, optimizing the use of the employees, property, and inventories that are needed in operations, controlling production flows, ensuring product quality, and preparing the related cost accounting and financial accounting records. These are considered routine processes in most companies because of the large number of transactions encountered on a daily basis.

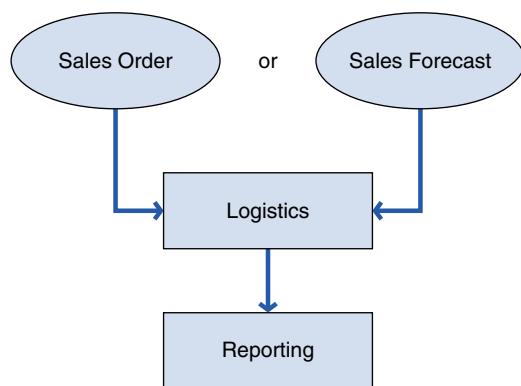
Although many companies are not considered manufacturing firms—that is, their principal functions are not manufacturing operations—most companies do conduct some sort of productive activity. For example, even in service organizations such as professional firms and health care organizations, the processes of converting resources into outputs (services) are considered conversion activities. Therefore, whether the company is in business to manufacture automobiles, build houses, treat patients in a medical facility, or provide consulting services, there is some sort of productive activity that drives its business. Thus, the contents of this chapter are relevant to most companies, even nonmanufacturing companies. However, the discussion in the remainder of this chapter is set in the context of a manufacturing environment where the principal business activity is the production of finished goods. Exhibit 11-2 provides an overview of the functions within the conversion process.

The conversion process is initiated when a company recognizes the need to conduct operations. This need may arise in one of two ways. First, a sales order may have been received and conversion activities must take place in order to produce the goods needed to fill the order. Alternatively, the company may desire to produce goods to increase its inventory stock, even if a sales order has not yet been received for the related items. As a result of sales forecasting, management may launch production in order to be sure that certain levels of inventory are on hand to support sales expected in the future.

<sup>1</sup> G. Pascal Zachary, "Dream Factory," *Business 2.0*, vol. 6, no. 5, June 2005, p. 99.



**EXHIBIT 11-1** Conversion Processes within the Overall System



**EXHIBIT 11-2** Overview of the Conversion Process

Regardless of the reason for initiating production, companies should have in place an organized approach to their conversion activities. The next section describes the typical components of such an approach.

## Components of the Logistics Function (Study Objective 2)

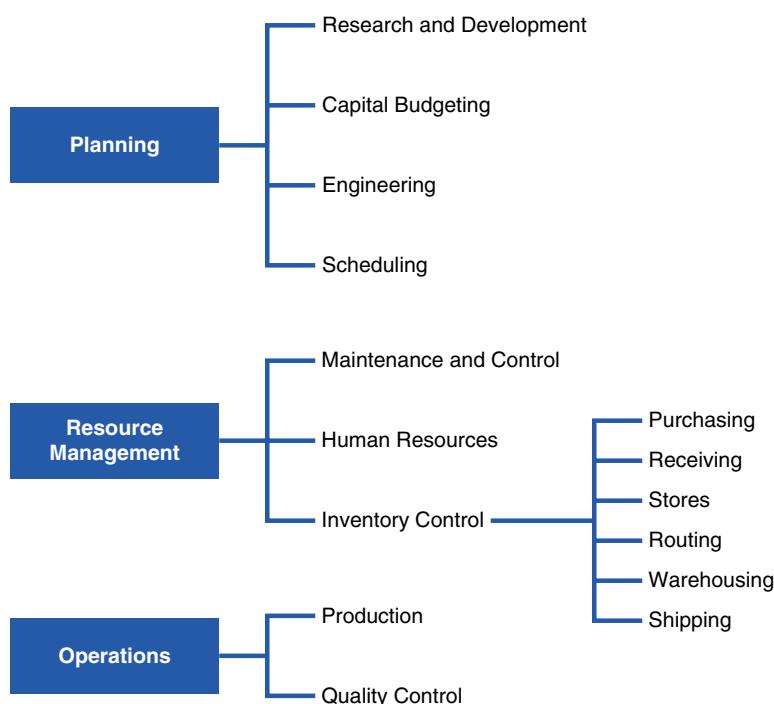
The major function within the conversion process is the logistics function. **Logistics** is the logical, systematic flow of resources throughout the organization. It involves the well-planned and coordinated efforts of many departments. Its goal is to make the most efficient use of the resources available in order to support the organization.

The logistics function has three primary components: planning, resource management, and operations. Exhibit 11-3 presents these components and their subcomponents.

### Planning

The **planning** component of the logistics function directs the focus of operations. It is concerned with determining what products should be produced, how many products should be produced, what resources should be available, and what timing is needed. It is supported by the efforts of research and development, capital budgeting, engineering, and scheduling.

**Research and development** focuses on product improvement. Its efforts involve investigating and developing new, innovative products and methods of producing those products. The research and development department may also conduct studies to determine which parts should be manufactured and which will be purchased,



**EXHIBIT 11-3** Components of the Logistics Function

considering the most efficient manner of conducting operations. This department is also responsible for researching and testing new or improved products and processes before they are put into practice.

**Capital budgeting** plans the capital resources needed to support production. It is concerned primarily with fixed assets, including the facilities and equipment needed to conduct operations as planned. Since capital resources typically require an outlay of large sums of cash, it is essential that they be planned in advance so that securing the necessary approvals and financing arrangements does not delay their implementation. The fixed assets acquisition processes were discussed in Chapter 10.

**Engineering** is responsible for planning the specifications for products that will be manufactured. This department prepares the detailed design of each product, identifying the component parts and methods of production. Engineers also prepare the following two important documents used in the conversion process:

1. A **bill of materials** is the form that specifies the components of a product, including descriptions and quantities of materials and parts needed.
2. An **operations list** describes the chain of events that constitute a product's production. It includes all the necessary operations to be performed, identifying the locations, resources used, and standard timing for each phase.

Engineering's role in the planning process is essentially similar to writing a recipe for a product. In the manufacturing process, a bill of materials or a subassembly provides details regarding all the required ingredients and amounts, and the operations list provides the instructions for preparation. Exhibit 11-4 is a Microsoft Dynamics GP ERP screenshot of a subassembly form created when manufacturing a product.

The screenshot shows the 'Assembly Entry - TWO15 (sa)' window in Microsoft Dynamics GP. The window has a toolbar with Save, Delete, Post, View, File, Tools, and Help buttons. Below the toolbar are sections for Document Number (ASM00000000000013), Doc. Date (2/28/2017), Site ID (WAREHOUSE), Batch ID (ASSEMBLY 1), Bill Number (PHON-FGS-0002), Description (Phone-Hands Free Single Ear), Assemble Quantity (1), Status (Released), U of M (Each), and Subassembly (PHON-FGS-0002). At the bottom, there is a table for Component Item with rows for PHON-RCV-0002 and PHON-BAS-0001, showing Stock Quantity, Assemble Quantity, and Ext. Standard Qty. The table also includes columns for S/L, U of M, and Distribution, Serial/Lot, Substitute buttons. The bottom navigation bar includes back, forward, and search buttons, along with a Bill Number dropdown.

Component Item	S/L	U of M	Stock Quantity	Assemble Quantity	Ext. Standard Qty
PHON-RCV-0002		Each		0	1
PHON-BAS-0001		Each		1	0

**EXHIBIT 11-4** Preparing a Manufacturing Assembly Entry in Microsoft Dynamics GP

**Scheduling** plans the timing for production activities, taking into consideration all the open sales orders, inventory needs, and the resources available. It uses the operations lists to determine how the timing for particular products will fit in with other demands on production resources. Its dual goal is to meet the customer's needs while making the most efficient use of the company's resources. Accordingly, the scheduling department must plan the production process so that idle time is minimized, since idle time is unproductive time. Although idle time may be the result of factors (such as machine breakdowns or power failures) that are beyond the control of those in a planning role, its impact may be minimized by the use of proper planning and control.

Scheduling personnel prepare important documentation used in the conversion process. **Production orders** authorize production activities for a particular sales order or forecasted need. A **production schedule** outlines the specific timing required for a sales order, including the dates and times designated for the production run. These documents combine information from the sales order (or forecast), bill of materials, and operations list. The goal is to plan the production schedule so that there is no idle time between production activities.

## Resource Management

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There are many resources that feed the conversion process. Although the specific resources vary greatly from company to company, they tend to fall into three broad categories: maintenance and control, human resources, and inventory control.

In a manufacturing environment, it is important to designate responsibility for maintenance and control to a person or department that can devote sufficient attention to these matters. **Maintenance and control** is concerned with maintaining the capital resources used to support production, including production facilities and other fixed assets such as machinery, equipment, computers, and vehicles. The maintenance of these fixed assets includes all of the activities necessary to keep them in good working condition, such as scheduling tune-ups and other preventative maintenance procedures. It also requires timely repair in the case of breakdowns or other interruptions. Control of fixed assets includes the ongoing monitoring necessary to support production in the most effective and efficient manner. In this role, employees in the maintenance and control department often work closely with those in the various planning functions. For example, they may interact with personnel responsible for capital budgeting to determine asset replacement schedules or additions to production facilities. Or they may work with engineers and schedulers to consider product design specifications, the layout of production stations, and other potential enhancements to production processes.

The **human resources** department is responsible for managing the placement and development of sufficient qualified personnel. This includes hiring and training workers, as well as maintaining records of their performance. Chapter 10 discussed this function in more detail, but the focus here is the optimal use of human resources to support production. Plant managers and supervisors must oversee production in the various work stations, plants, or locations. Line workers must be placed effectively to handle production in these various areas. Human resources personnel must often work with those responsible for scheduling to ensure that adequate human resources are available to sustain the company's planned course of action. Care must also be taken to prepare and accumulate job time tickets or time sheets for all production employees so that actual labor costs are included in the cost of products.

The **inventory control** department is responsible for managing and recording the movement of inventory in the many different directions that it may go throughout the conversion process. Exhibit 11-3 lists the many departments or groups within the company that are involved with these functions. Some of these functions have been introduced in previous chapters. For instance, the purchasing and receiving functions are discussed in Chapter 9, and the shipping function is discussed in Chapter 8. This chapter will focus on the activities comprising the stores, routing, and warehousing functions, as they are not discussed elsewhere in this text.

One inventory control function that is important to the conversion process is the determination of **economic order quantities (EOQ)**, or the most efficient quantity of products to purchase. This determination is based on the relative costs of maintaining inventory and ordering materials. Many companies rely on their inventory managers to notify the purchasing function about the number of units needed to replenish inventories to their desired levels. This activity is closely related to the purchasing function. Although details of the purchasing function are presented in Chapter 9, there is no previous coverage of EOQ. The EOQ can be calculated using the following formula:

$$\text{EOQ} = \sqrt{\frac{2RS}{A}}$$

where

- R = the number of units of this item required for the year
- S = the cost of placing an order to purchase this item
- A = the cost of holding a unit of this item in inventory for the year

The inventory **stores** function concerns the control of raw materials inventory held in storage or in holding areas, waiting for processing. **Raw materials** include the basic components of the company's products, including anything from wood, metal, and nails to finished parts purchased as subassemblies. Storing these materials is necessary when they are purchased in large quantities or in order to maintain designated levels of stock in anticipation of future sales. After the items are received, they are usually moved to a storeroom. The storeroom should be organized in a manner that makes it easy to locate the items when they are needed in production or to satisfy a sales order.

**Routing** is the issuance and movement of materials into the various production phases. When items are removed from the storeroom and taken into production, a routing slip is prepared to indicate the movement of inventory. A **routing slip** documents the descriptions and quantities of materials taken into production for a specified sale or other authorized production activity. It should also be prepared whenever purchased materials are taken directly into production from the receiving area. The routing slip is also sometimes called a materials issuance form, or move ticket. It is important in tracking the physical movement of inventory items. Accordingly, it should be updated when the items are subsequently moved from one production station to another. Some companies use routing slips with multiple removable stubs so that a record of the materials movement can be retained in each production station.

When inventory is routed out of the receiving or storage area, it is no longer considered raw materials inventory; rather, it becomes **work-in-process inventory**. Likewise, when production is completed and inventory is prepared for disposition

to the warehouse or to the customer, it becomes **finished goods inventory**. These three classifications of inventory—raw materials, work-in-process, and finished goods—are important in the accounting processes.

**Inventory status reports** are prepared at various stages of production to document the extent of work completed and the resulting level of inventory. Inventory status reports provide detail on the resources used in production to-date, as well as the resources available to complete production of the goods. These reports should be monitored regularly so that the scheduling department can be notified if changes need to be made.

Inventory **warehousing** involves managing the holding area for finished goods awaiting sale. Companies maintain inventories of finished goods when they produce fairly homogeneous products or when it is important for them to be able to fill sales orders quickly. Accordingly, an inventory warehouse should be well organized so that the items can be located and moved into the shipping department as quickly as possible. Likewise, it should be controlled in order to prevent theft, loss, or damage.

The goal of inventory control is to minimize the cost of maintaining inventories. Whether inventory is maintained in the form of raw materials, work-in-process, or finished goods, most companies weigh the costs and benefits of carrying inventories. The costs are generally incurred in the areas of stores and warehousing, whereas the benefits tend to be more difficult to measure because they relate to keeping customers satisfied. Ideally, the elimination of inventories is desirable, except in cases where inventory is needed immediately due to sales that may result from unexpected changes in production scheduling or increased demand for the company's products.

## Operations

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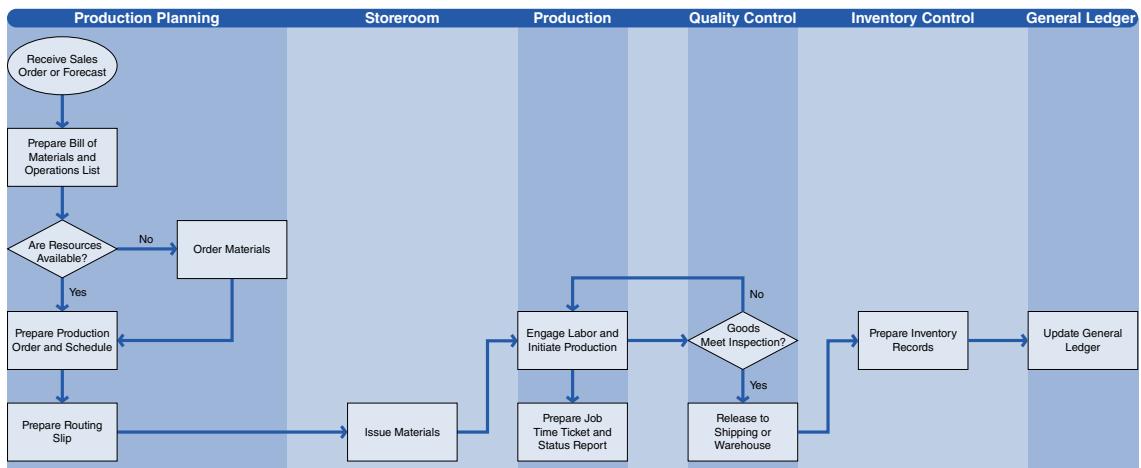
**Operations** is the term commonly used to refer to the major business activity in which a company engages. It is often synonymous with the terms “production” and “manufacturing.” This function involves the day-to-day performance of production activities, including monitoring the related costs, time, and quality.

Depending on the size of the company and the diversity of its product offerings, operations may be performed by a variety of methods, including the following:

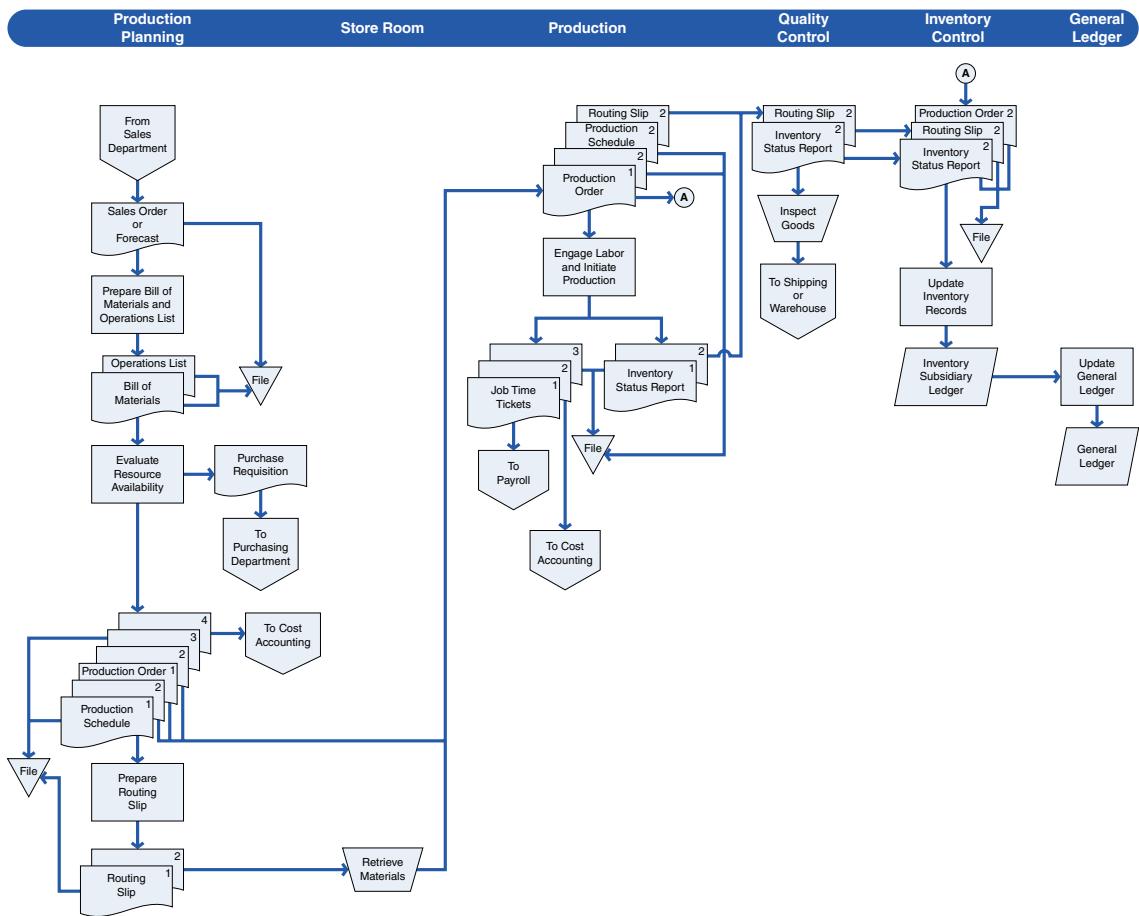
- Continuous processing of homogeneous products
- Batch processing, where each batch contains homogeneous products, but each batch is not necessarily the same type of product
- Custom, made-to-order processing, where each order may be unique.

A company's production process may be conducted in a single operating facility or multiple locations and stations. Regardless of its production complexity as determined by the method of production and the number of locations, each scheduled production order follows a designated physical flow through the production process. The production process generally involves a systematic flow similar to that described in Exhibit 11-5. The documents used in this process are presented in a document flow chart in Exhibit 11-6. Exhibit 11-7 shows a data flow diagram of the conversion process.

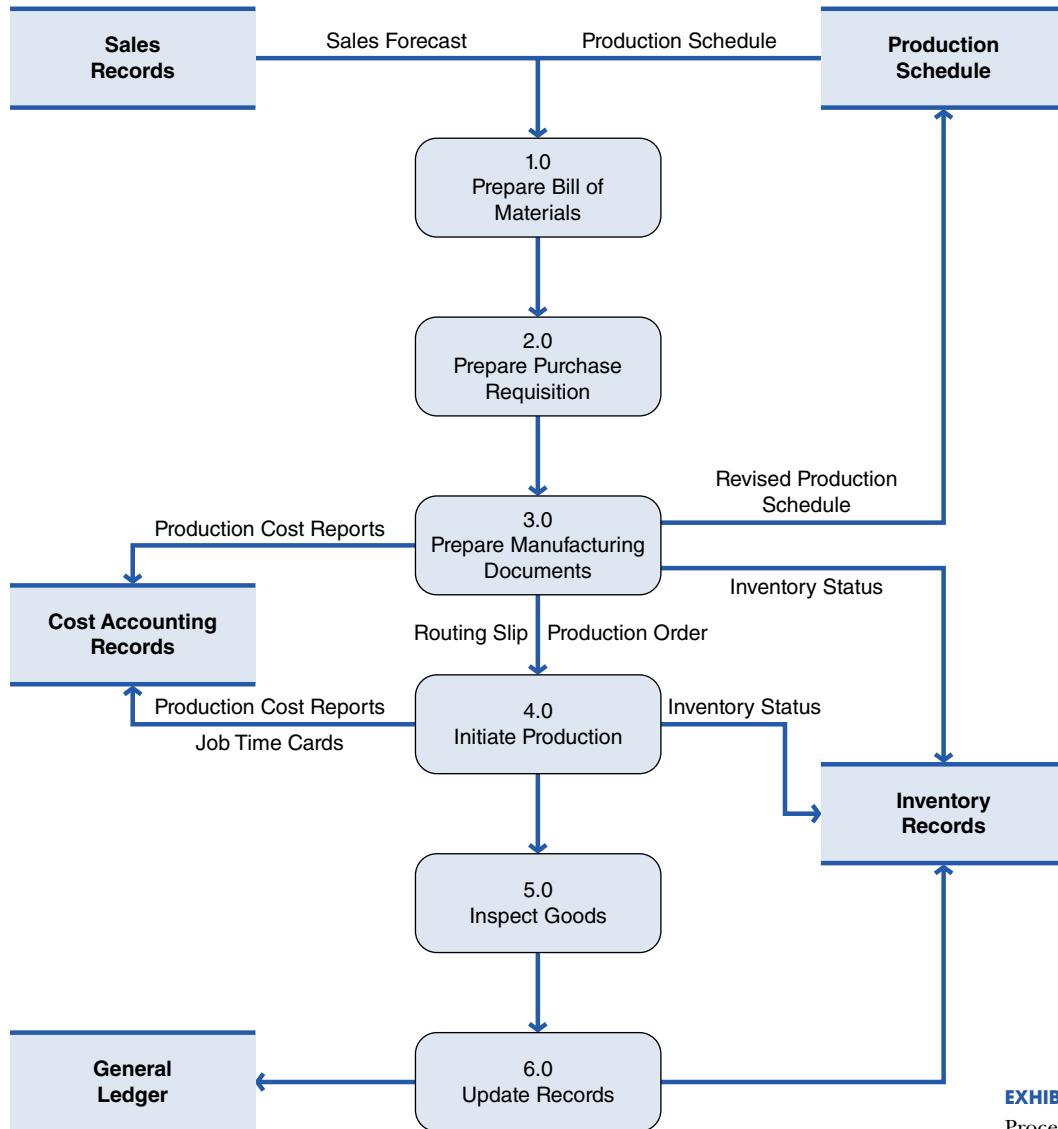
Except for the preparation of the documents that initiate the production planning process and the general ledger accounting that finalizes this process, all of the other processes depicted in Exhibit 11-5 are components of the logistics function. These activities and the related documentation were described earlier in this chapter.



**EXHIBIT 11-5** Production Process Map



**EXHIBIT 11-6** Document Flowchart of the Production Process


**EXHIBIT 11-7** Conversion Process Data Flow Diagram

The final hub in the logistics function is **quality control**. This is a follow-up to production, where the products are inspected for quality before they are moved to the warehouse or shipping area. The company may have a policy of inspecting every item produced (especially if the items are made to order), or they may be inspected arbitrarily or in specific intervals (more likely for batch production runs or with homogeneous products). The nature of a company's products may also require that they be tested in order to determine that they are top quality. The frequency of inspections or product testing should be based on the likelihood of finding defects. The more problems a company has with defective products, the more extensive its quality control processes should become. It is often the case that quality control problems are the result of unfavorable materials usage or labor efficiency variances. For this reason, quality control personnel often work closely with cost accountants and resource managers to solve production problems.

Defective products may be returned to the production floor for rework. **Rework** refers to the additional procedures necessary to bring a product up to its required specifications. In some cases, the extent of a product's defect may be so great that it is not cost-effective for it to be reworked. When this occurs, the product may be scrapped or discarded. The costs of rework and scrap must be taken into account when accounting for the production process.

## Cost Accounting Reports Generated by Conversion Processes (Study Objective 3)

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Production accounting and the related financial reporting are performed by the various accounting departments. Many of these accounting applications were discussed in previous chapters. Cost accounting, however, relates specifically to the conversion process and is therefore discussed further in this section. Cost accountants prepare production cost analyses, inventory records, and standard costing information. This information is critical in helping managers make business decisions concerning the conversion processes.

Once the bill of materials and operations list have been established for a particular product, cost accountants can begin the process of determining standard costs. **Standard costs** are expected costs based on projections of a product's required resources. Standard costs include direct materials, direct labor, and overhead. Overhead consists of indirect materials (such as nails, glue, and other supplies), indirect labor (attributed to production management and maintenance personnel), and costs of maintaining the production facility (such as rent, utilities, insurance, and depreciation of production equipment). The development of standard costs help companies control their production costs and monitor the quality of their production process. Developing standard overhead rates is also important in the process of applying overhead to products.

During production periods, cost accountants accumulate the costs of actual materials and labor for the company's products. Materials costs are based on review of the routing slips and inventory status reports, and journal entries are recorded for the transfer of items from the raw materials inventory account to work-in-process. Labor costs are derived from time sheets and are added to work-in-process. Overhead costs must be applied to work-in-process, with the standard overhead rate applied to actual activity (hours or units), as documented in the inventory status report.

After work-in-process costs have been determined, cost accountants review completed production transactions for items transferred to the warehouse or shipping area. Care must be taken to ensure that production orders are canceled when the items are completed. The work-in-process and finished goods inventory accounts should be updated to reflect the completion of products and their movement out of production.

Most manufacturing companies prepare perpetual inventory records to record the flow of inventories. **Perpetual inventory systems** involve recording purchases as raw materials inventory, recording all the components of work-in-process for inventories in various stages of production, and recording the total cost of sales for products completed and sold. While perpetual inventory records are the generally preferred way of controlling inventory quantities, they are not always used in practice. Some small companies with relatively simple inventories may be able to control their inventories with periodic systems. **Periodic inventory systems**

involve updating the inventory and cost of sales accounts only at the end of the period. When periodic systems are in place, close management supervision and ongoing monitoring of key operating statistics are necessary to achieve adequate control.

After costs have been recorded for materials, labor, and overhead in the respective inventory accounts, cost accountants compute variances for these three cost components. **Variances** represent the differences between actual costs and the standard costs applied. Other types of analyses often prepared by cost accountants include comparisons of actual costs with budgets and/or prior periods, and computations of ratios for financial analysis. Comparisons of actual costs with amounts reported by other production stations may also be helpful in pinpointing problem areas. The differences noted from these analyses should be discussed among various employees within the logistics function. Unfavorable differences should be investigated to determine whether logistics changes are needed to improve the conversion processes.

## Risks and Controls in Conversion Processes (Study Objective 4)

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Because conversion processes involve the physical movement of inventory throughout the operating facility (causing inventory to spread among multiple locations, departments, and employees), it is important that sufficient internal controls be included in the related business processes. In terms of the five internal control activities introduced in Chapter 3, the following are some procedures to be considered for implementation in conversion processes.

### **Authorization of Transactions**

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Designated employees in the company should be given responsibility for purchasing raw materials, including specifying the quality of the items needed, selecting of vendor, and determining the appropriate quantities to order.

The following activities in the conversion process require express authorization:

- Initiation of production orders
- Issuance of materials into the production process
- Transfer of finished goods to the warehouse or shipping areas

These responsibilities require continuous monitoring of the production activities, and should therefore be conducted by an experienced member of management.

### **Segregation of Duties**

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Custody of inventories and the accounting for inventories and cost of sales need to be separate in order for internal control objectives to be met. Adequate segregation of duties reduces the risk of errors or fraud by requiring separate processing by different employees at the various stages of the conversion process. This feature is enhanced by the performance of independent reviews and reconciliations, discussed later.

Ideally, those responsible for handling inventories in the materials storeroom and warehouse and issuing the movement of inventories into and out of these areas

should be separate from the production stations and from the cost accounting function. Similarly, the inventory control functions should not be performed by those responsible for production or by those performing cost accounting functions. With respect to IT processing, companies should strive to separate the duties of systems development, computer operators, and users. The IT functions should also be separate from the accounting and custody functions.

## Adequate Records and Documents

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Complete, up-to-date, and accurate documentation on production orders, inventory and cost of sales records, and inventory status reporting is needed to support the conversion process. The practice of issuing documents on prenumbered forms is a control that helps to create clear records of the conversion transactions. When production orders and routing slips are issued numerically, a sequence can be accounted for to determine whether all conversion transactions have been recorded.

The creation and monitoring of variance reports is another control that is especially important in the conversion process. Its importance lies in the ongoing analysis of the information as it relates to production activities. The usefulness of variance data depends upon the integrity of the underlying system and the timeliness of its preparation. These variance reports are useful only if they contain reliable and accurate information. Likewise, they must be provided in a timely manner so that management can use them to make decisions in time to make a difference in the process.

## Security of Assets and Documents

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Physical controls should be in place in the company's storerooms, warehouses, and production facilities in order to safeguard the inventories held therein. These physical controls may include fences and alarm systems, security guards, or other, high-tech security tools such as retina scanners. In addition, water sprinkler systems, fire prevention devices, and adequate insurance coverage should be maintained in inventory storage areas. There should be policies in place to ensure that only authorized employees handle the inventories in each of these locations.

Likewise, only authorized employees should access the inventory records. In order to control this, companies should assign passwords to employees who access the files. These employees should be required to log all transactions in the logistics function. Timely backup of production files is also important in protecting the information and guaranteeing continued processing even in the event of destruction or unavailability of the original files.

## Independent Checks and Reconciliation

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There are many recommended procedures for overseeing the conversion process through the performance of various supervision and review activities. Probably the most typical control is the requirement for conducting periodic physical inventory counts and comparing the results with recorded inventory quantities. A **physical inventory count** determines the quantity of inventory on hand by actually counting

all items on the premises and in other areas of the company's responsibility. This should be performed for all three categories of inventory (raw materials, work-in-process, and finished goods), regardless of whether perpetual or periodic systems are in place. Companies using periodic inventory systems rely upon the physical inventory counts as a basis for determining the end-of-period inventory and cost of sales amounts. However, even companies that maintain perpetual records tend to conduct physical counts as a means of determining the accuracy of their records and the related general ledger control accounts. In perpetual systems, the timing of the physical inventory count is flexible, and the quantity determined via the physical inventory count must be compared with the perpetual records. This task of comparing quantities on hand with recorded quantities is referred to as the **physical inventory reconciliation**.

In addition to the physical inventory reconciliation, someone independent of the record keeping and custody functions should review the materials, labor, and overhead reports that support the inventory amounts. Specifically, production orders should be reconciled with records of work-in-process and finished goods inventory. Labor reports should also be reconciled with employee time sheets. In addition, routing slips should be reconciled with records of inventories transferred to the warehouse or shipping areas.

The records and documentation section just presented describes the importance of cost variance reports as control features. These reports need to be monitored and reconciled to determine the source of any problems within the conversion process. Such review procedures typically involve members of management who can overview the process and authorize improvements.

## Cost-Benefit Considerations

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The more products a company has and the more complex its conversion process is, the more internal controls should be in place to monitor and safeguard its assets. There are other factors that influence the level of risk inherent in a business that may warrant the implementation of strong controls. Namely, if the goods are extremely valuable, they may be especially susceptible to theft. For instance, if a company's inventory consists of fine jewelry, its inventory storage facility is likely to be controlled much differently than the warehouses of a company whose inventory consists of construction materials such as lumber and cement mix. In addition, if a company's inventory items are difficult to differentiate or inspect, strong controls may be needed to properly identify the items. Other conditions within the production facility may warrant the need for additional controls, such as inconsistent or high levels of inventory movement, which can make it difficult for supervisors to review the reasonableness of conversion transactions without additional information. Finally, there are factors about the organization of the company that affect the design of operation or its internal controls. If the inventory is held at various locations or the process of valuing inventories is particularly complex, additional controls may also be recommended.

Exhibit 11-8 summarizes examples of internal controls in the conversion process and the related business risks that are minimized as a result of the implementation of these controls. This exhibit does not include all the possible controls and risks that may be encountered in the conversion processes, but it does provide some common examples.

**EXHIBIT 11-8****Conversion Controls and Risks**

<b>Control:</b>	<b>Minimizes the Related Risk of:</b>
<b>Authorization:</b>	
Approving production orders prior to commencing production	Invalid order or fictitious transactions, inaccurate cost accounting reports
Management approval of routing slips before issuing materials into production	Invalid inventory transactions or incorrect amounts
<b>Segregation of Duties:</b>	
Separation of the custody of inventory from those responsible for maintaining inventory and cost of sales records	Invalid inventory transactions, incorrect amounts, omitted transactions
Separation of duties related to cost accounting, authorization of new production orders, issuance of resources into production, information systems, and general accounting	Invalid inventory transactions, incorrect amounts or accounts, omitted transactions
<b>Records and Documents:</b>	
Preparing production orders and routing slips on prenumbered forms	Omitted transactions
Reviewing inventory reports for mathematical accuracy and agreement with physical quantities and established product costs	Incorrect amounts
<b>Security:</b>	
Physical controls in areas where inventory is held	Lost or stolen inventory, invalid or omitted inventory records
IT controls over computer records and physical controls in records storage areas	Invalid inventory transactions, incorrect amounts or accounts, timing issues, duplicate transactions
<b>Independent Checks and Reconciliations:</b>	
Reconciling time sheets with production reports for work-in-process and finished inventories	Omitted or duplicate payroll transactions, incorrect amounts or accounts, timing issues
Reconciling inventory records with the general ledger	Omitted or duplicate payroll transactions, incorrect amounts or accounts, timing issues, incorrect accumulations
Investigating and reconciling variances	Invalid or omitted transactions, incorrect amounts or accounts, timing issues
Reconciling physical inventory quantities with the inventory records	Invalid or omitted transactions, incorrect amounts or accounts, timing issues, lost or stolen inventory

## IT Systems of Conversion Processes (Study Objective 5)

Because of the potentially large number of inventory items maintained by a company and the variety of processing flows that may affect them throughout the conversion process, it is often difficult to keep current inventory and production records with manual systems. IT systems can be a true friend of the conversion process. Recent technological developments have resulted in significant changes in the way that many companies conduct their conversion processes. Computerized systems may provide the following benefits in this process, which result in huge savings in terms of productivity, quality, flexibility, and time:

- Automatic computation of materials requirements based on sales orders and sales forecasts
- Systematic scheduling that allows for greater flexibility and increased efficiencies
- Timely transfer of inventories throughout the process, due to the automatic notification features
- Validation of data entries that detect errors before they are recorded
- Automatic updating of inventory status reports that saves time and increases accuracy
- Automatic preparation of financial accounting entries and cost accounting reports

In addition to these advantages, integration of all or part of the company's processing applications, planning, resource management, operations functions, and cost accounting system will yield even greater benefits in terms of workforce efficiency, paperwork reduction, and other cost reductions.

A computer-based conversion process needs to have a significant amount of data input into the system. All of the information supporting the bill of materials, operations lists, production orders and schedules, routing slips, time sheets, and inventory status reports must be captured by the computer applications. There are many options for inputting this data. It can be keyed in from terminals or preformatted touch screens, scanned in from bar codes or magnetic strips on the inventory items or employee identification cards, or received automatically from integrated systems in the production process. Once the supporting data is entered, the system can automatically generate the documents listed. It can also identify inventory shortages, calculate economic order quantities, dispatch inventory items to be issued into production, and accumulate information to be used for the periodic posting of conversion activities to the general ledger.

A database containing conversion process information must include files for each category of inventory (raw materials, work-in-process, and finished goods) as well as for key transactions that occur, such as the initiation of production orders, materials issuance, labor application, and the accumulation of other costs incurred in the production progress. The inventory files include both standard and actual data. In addition, both inventory and transaction files need to be maintained for each production station at each operating facility.

Computerized systems can have programmed constraints that enhance internal controls over the conversion process. For example, the system may be programmed to issue error reports whenever a work-in-process record is not generated for an existing production order, or when the same operation is performed at multiple production stations, or when a single employee performs incompatible operations. These situations indicate that an error has occurred in the production process. The timely notification can allow for corrections to be made with minimal cost and disruption.

Additional trends in computer systems that enhance the conversion process are described in the following paragraphs.

**Computer-aided design (CAD)** techniques may be used to enhance the engineering function. CAD software allows engineers to work with advanced graphics at electronic work stations to create 3D models that depict the production environment.

**Computer-aided manufacturing (CAM)** involves the complete automation of the production process, including the full replacement of human resources with computers. Industrial robots may also be used in a CAM environment. **Industrial robots** are computers that are programmed to perform repetitive procedures.

## The Real World

Jean Larrivée Guitars designs and manufactures steel string guitars and mandolins known to produce a distinctively clear sound because of their great structural integrity due to the company's symmetrical bracing system. There are dozens of models manufactured; however, before any of them can be made into an actual product, its design is worked out in CAD drawings. The digitized data from the CAD process is then brought to the factory to be replicated.

Larrivée uses CAD to design many pieces of its instruments, including the neck, bridge, fingerboard, kurfing, rosette, and inlays. For the neck alone, approximately 450 hours of programming time were required to precisely

design the piece that would appease both professional guitarists and beginners. Even this considerable investment of time is merely a fraction of what would have been required to achieve such precision without computerization. In addition, through CAD, the cost of drawing blueprints is greatly reduced.

Once the lines of an instrument are drawn in CAD, Larrivée uses a CAM system for cutting the parts. Cutting requires extreme precision, yet Larrivée's use of CAM can actually improve quality and increase efficiency by machining six fingerboards at a time. This makes it possible to free up human resources for more challenging (but less precise) tasks like buffing, fitting, binding, and painting the instruments.

**Materials resource planning (MRP)** involves the automated scheduling of production orders and movement of materials in the production process.

**Manufacturing resource planning (MRP-II)** considers all manufacturing resources, rather than focusing on materials. MRP-II systems are an expansion of MRP. MRP-II adds features that provide for the forecasting of capacity requirements and for developing schedules for future production processing.

**Enterprise-wide resource planning (ERP)** systems have evolved from MRP-II. ERP systems integrate all of the conversion processes into a single software program while still meeting the needs of each functional area. In addition to the manufacturing applications included in MRP-II systems, ERP offers additional functions such as purchasing, accounts payable, human resources, and payroll.

**Computer-integrated manufacturing systems (CIMs)** integrate all of the conversion processes to allow for minimal disruptions due to reporting requirements

## The Real World

Wild West Motor Company, a custom motorcycle manufacturer, uses Alias Studio Tools for its CAD and CAM processes. This software has played an instrumental role in helping Wild West double production in recent years and spark a corresponding increase in sales.

Wild West uses CAD software to prepare digital models of motorcycle tanks and seats. These models are imported into the CAM system to create solid models of the actual parts or as a starting point for a mold or die. The integration of

the two systems allows for easy back-and-forth transfers for making refinements. Paul Seiter, Wild West's founder, estimates that the company saves \$75,000, plus weeks—or months—for each project now being designed and tooled in-house (compared with the cost of outsourcing those projects). Furthermore, Seiter has challenged the company's engineers to use the software to create and incorporate innovative styles into the company's products to increase its competitive advantage.

or inventory movement issues. They are similar to ERP systems in that they integrate all of the functional areas of the conversion process. However, CIMs are unique because they also integrate the financial and cost accounting applications. In the modern business environment, more and more companies are turning to CIMs to gain competitive advantages. CIMs are built upon a network of production equipment that is integrated with the company's computers and record-keeping systems.

**Just-in-time (JIT) production systems** are concerned with minimizing or eliminating inventory levels and the related costs of maintaining those inventories. This is accomplished by carefully controlling each stage of the production process so that products are completed just in time to sell them. These systems are feasible only when the company has good relationships with reliable vendors (to eliminate the need to maintain stock of raw materials) and there are few quality control problems. JIT also requires extensive computer systems to monitor and record the many transactions and data in a JIT system.

The use of **radio-frequency identification (RFID)** systems within conversion processes are on the rise. RFID uses pin-head-sized tags to monitor and account for inventories through the receiving, stores, production, warehousing, and shipping functions. It can do so without the line-of-sight closeness that is required by bar coding systems. The tags have a silicon chip and tiny antenna that hold and transport identifying data about the inventory item. A tag reader serves as the input device for the computer system that accounts for the inventory. This technology makes it possible to specifically distinguish individual items comprising a company's inventory, thus eliminating the need for cost flow assumptions such as LIFO and FIFO and their related computations. In a manufacturing company, the RFID system can automatically trigger routing slips, update inventory status reports, allocate labor and overhead to inventory units, and monitor the exact location of the related products. With an RFID system, counting inventory and tracking the movement of inventory is much faster, efficient, and accurate. Retail companies are also using RFID to track inventory within their stores. Some stores are taking nightly inventory counts to compare inventory levels to the accounting records.

## The Real World

In the mid-1960s, most retailers were not yet focused on computerized operations. Although there were only 20 Walmart stores at that time, Sam Walton was already focused on the need to computerize merchandise controls to outpace competitors like Kmart, Target, and Woolworth. Sam Walton recruited the top student from IBM's New York training school to come to Bentonville, Arkansas, to lead Walmart's computerization efforts.

Sam Walton's foresight brought unprecedented success. Today, Walmart is known for its sophisticated logistics and just-in-time inventory system. Its computer

database is one of the largest in existence for a retail company.

In addition, Walmart uses RFID technology to track and record inventories, and requires that its top suppliers also use RFID. When its suppliers use RFID, it allows Walmart to track purchased items as they are received at distribution warehouses, loaded on trucks, and moved to retail stores. Within the retail stores, it allows workers to easily determine what is on the shelves and what might be missing. For example, they could quickly see which size of Wrangler jeans is out of stock on the shelves. This allows them to quickly restock, which improves sales and leads to more satisfied customers.

## Ethical Issues Related to Conversion Processes (Study Objective 6)

Previous chapters examined ethical misconduct related to the purchasing, cash disbursement, payroll, and fixed assets processes. Many of those issues are also pertinent to the conversion system, as the relevant business activities also correspond to processes in the conversion system.

In addition, the conversion system is the target of many types of fraud schemes. Most of these involve the falsification of inventory quantities, hiding of inventory costs, or manipulation of the gross profit figure. These types of fraud schemes are generally perpetrated by management in an attempt to meet or beat earnings targets. **Earnings management** is the act of misstating financial information in order to improve financial statement results.

One method used by managers to increase the gross profit is to offer price discounts to customers. Although many companies offer price discounts, there may be a problem with this scenario if the intention of management is to artificially boost earnings. Sales discounts become problematic when they are offered as a coercive tactic to lure customers into making a purchase earlier than normal. Although it may be an effective way to increase sales, there are ethical implications to this practice. Customers will expect the discounted prices to be offered in the future, and the temporary increase in cash flow for the company may affect projections that are not likely to be realized.

Another earnings management technique exists whereby managers authorize the production of excessive inventories. This is a method of gaming the system by manipulating inventory amounts through the use of absorption costing techniques. **Absorption costing** involves the inclusion of both variable and fixed costs in determining unit costs for ending inventories and cost of goods sold. Thus, absorption costing provides for the transfer of fixed manufacturing costs to the balance sheet (via the inventory accounts) in the period when the inventory is sold. Accountants can take advantage of this system by overproducing inventories. When the amount of inventory produced exceeds the company's requirements to support sales orders, the level of finished goods inventories increases. The more inventory units that are on hand, the greater is the proportion of fixed costs that will be allocated to the balance sheet. If normal inventory levels had been maintained, a greater proportion of fixed costs would have been allocated to cost of goods sold and reported on the income statement as a deduction from sales.

### The Real World

In the early 1990s, an inventory fraud scheme was discovered at F&C International, Inc. F&C is a manufacturer of flavors and fragrances, with operations in New York and Cincinnati. Its founder and majority owner, Jon Fries, engaged in a series of frauds, all of which involved the conversion process. Fries mislabeled inventory items in order to overstate their value, recorded fictitious production and shipping activities, and falsified sales figures in an attempt to meet projections. He even appointed a task force of employees who were ordered to

carry out these plans. The task force was also instructed to alter reports and destroy certain supporting documentation. His motive for committing these crimes was threefold: He desired to increase profits in order to improve the reputation of the company, improve his relationship with the company's debtors in order to expand his borrowing potential, and increase his own compensation. Fries was convicted of fraud and served a prison sentence. The frauds he orchestrated led to the company's ultimate downfall.

Another ethics issue related to the conversion process involves the ethical decisions encountered as the processes become more automated. Management should consider the moral implications of replacing human resources with electronic resources. To the extent possible, management should take an active role in the reassignment (rather than termination) of personnel when production jobs are eliminated as a result of automation.

## Corporate Governance in Conversion Processes (Study Objective 7)

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Recall that the four primary functions of the corporate governance process include management oversight, internal controls and compliance, financial stewardship, and ethical conduct. Each of these functions is applicable to the conversion processes, which must include a proper corporate governance structure in order to properly discourage fraud, theft, and misuse or manipulation of conversion-related resources.

The systems, processes, and internal controls described in this chapter are part of a corporate governance structure. When management designs and implements conversion processes, it assigns responsibility for executing the related logistics and reporting functions to various managers and employees. It must be mindful of the risks of stolen or misused inventories and fixed assets, alteration of documents or reports, and other frauds in this process. Accordingly, it must also implement and monitor internal controls to minimize these risks. As management considers these assignments and subsequently monitors the underlying processes and controls, it is carrying out its corporate governance functions of proper management oversight and internal controls and compliance.

When management has designed, implemented, and continually monitors processes and internal controls, it is helping to ensure proper stewardship of the company's assets. Corporate governance requires proper financial stewardship, and since inventories and fixed assets are frequently the largest assets reported on a company's balance sheet, financial stewardship in these areas is especially important. It is also especially challenging, due to the ever-changing nature of the company's inventory items throughout the various stages of the conversion process.

Finally, good corporate governance depends upon the ethical conduct of management. When management sets an appropriate tone at the top by consistently demonstrating and encouraging ethical conduct, it is more likely that a stronger system of corporate governance will result. Improved effectiveness and efficiency and reduced risks of fraud tend to accompany workplace environments marked by effective corporate governance.

## Summary of Study Objectives

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**Basic features of conversion processes.** A company's conversion processes involve the activities related to transforming materials, labor, and overhead into goods or services. The primary functions within the conversion process are logistics and reporting.

**Components of the logistics function.** The logistics function includes three components: planning, resource management, and operations. Planning involves research and development, capital budgeting, engineering, and scheduling. Resource

management involves maintenance and control, human resources, and inventory control (including the determination of the economic order quantity as well as the purchasing, receiving, stores, routing, warehousing, and shipping activities). Finally, operations involves production and quality control.

**Cost accounting reports generated by conversion processes.** Cost accountants prepare production cost analyses, inventory records, and standard costing information on the basis of conversion activities. Variance reports may be prepared to explain differences between actual and standard costs. The types of reports prepared may vary greatly from company to company, and may depend upon whether a perpetual or periodic inventory system is in place.

**Risks and controls in conversion processes.** Conversion activities should be well monitored and controlled. Consideration should be given to establishing proper controls related to the authorization of transactions, segregation of duties, adequate documents and records, security, independent checks and reconciliation, and the related cost–benefit factors.

**IT systems of conversion processes.** Integration of a company's conversion processing applications and cost accounting systems yields significant benefits in terms of workforce efficiency, paperwork reduction, and other cost savings. Popular computerized systems in the conversion process include computer-aided design (CAD), computer-aided manufacturing (CAM), materials resource planning (MRP), manufacturing resource planning (MRP-II), enterprise-wide resource planning (ERP), computer-integrated manufacturing (CIM), just-in-time (JIT) production systems, and radio-frequency identification (RFID) systems.

**Ethical issues related to conversion processes.** The conversion process is the target of many types of fraud schemes, most of which involve falsification of inventory, manipulation of gross profits, or other earnings management techniques.

**Corporate governance in conversion processes.** The conversion processes described in this chapter are part of the management oversight of corporate governance. The internal controls and ethical tone and procedures within the conversion process are also part of the corporate governance structure. Establishing and maintaining reliable inventory management processes, internal controls, and ethical practices help ensure proper financial stewardship.

## Key Terms

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Absorption costing	Earnings management	Inventory control	Operations
Bill of materials	Economic order quantity (EOQ)	Inventory status report	Operations list
Capital budgeting	Engineering	Just-in-time (JIT) production	Periodic inventory systems
Computer-aided design (CAD)	Enterprise-wide	Logistics	Perpetual inventory systems
Computer-aided manufacturing (CAM)	resource planning (ERP)	Maintenance and control	Physical inventory counts
Computer integrated manufacturing (CIM)	Finished goods	Manufacturing resource planning (MRP-II)	Physical inventory reconciliation
Computer integrated manufacturing (CIM)	Human resources	Materials resource planning (MRP)	Production order
	Industrial robots		Production schedule

<b>Quality control</b>	<b>Research and development</b>	<b>Scheduling</b>	<b>Warehousing</b>
<b>Radio-frequency identification (RFID)</b>	<b>Rework</b>	<b>Standard costs</b>	<b>Work-in-process</b>
<b>Raw materials</b>	<b>Routing</b>	<b>Stores</b>	
	<b>Routing slip</b>	<b>Variances</b>	

## End of Chapter Material

### Concept Check



- 1 Manufacturing has changed in recent years as a result of each of the following factors except
  - a. globalization
  - b. technological advances
  - c. increased competition
  - d. lack of economic prosperity
- 2 The term *conversion processes* is often used synonymously with
  - a. operations
  - b. production
  - c. manufacturing
  - d. all of the above
- 3 Which of the following activities is not part of the planning component of the logistics function?
  - a. Research and development
  - b. Capital budgeting
  - c. Human resource management
  - d. Scheduling
- 4 Which of the following activities is an inventory control activity?
  - a. Engineering
  - b. Maintenance
  - c. Routing
  - d. Quality control
- 5 Which of the following statements concerning an operations list is true?
  - a. It is an engineering document that describes the chain of events within a company's conversion process.
  - b. It is an engineering document that specifies the descriptions and quantities of component parts within a product.
  - c. It is a capital budgeting document that describes the chain of events within a company's conversion process.
- 6 It is a capital budgeting document that specifies the descriptions and quantities of component parts within a product.
- 7 Which of the following terms relates to the control of materials being held for future production?
  - a. Routing
  - b. Work-in-process
  - c. Stores
  - d. Warehousing
- 8 Which of the following questions is most likely to be found on an internal control questionnaire concerning a company's conversion processes?
  - a. Are vendor invoices for materials purchases approved for payment by someone who is independent of the cash disbursements function?
  - b. Are signed checks for materials purchased mailed promptly without being returned to the department responsible for processing the disbursement?
  - c. Are approved requisitions required when materials are released from the company's warehouse into production?
  - d. Are details of payments for materials balanced to the total posted to the general ledger?
- 9 When additional procedures are necessary to bring a defective product up to its required specifications, this is referred to as
  - a. rework
  - b. scrap
  - c. work-in-process
  - d. variance reporting
- 10 A firm expects to sell 1,000 units of its best-selling product in the coming year. Ordering costs for this product are \$100 per order, and carrying costs are \$2 per unit. Compute the optimum order size, using the EOQ model.
  - a. 10 units
  - b. 224 units
  - c. 317 units
  - d. 448 units

- 10** Which of the following internal controls is typically associated with the maintenance of accurate inventory records?
- Performing regular comparisons of perpetual records with recent costs of inventory items
  - Using a just-in-time system to keep inventory levels at a minimum
  - Performing a match of the purchase request, receiving report, and purchase order before payment is approved
  - Using physical inventory counts as a basis for adjusting the perpetual records
- 11** If a manufacturing company's inventory of supplies consists of a large number of small items, which of the following would be considered a weakness in internal controls?
- Supplies of relatively low value are expensed when acquired.
  - Supplies are physically counted on a cycle basis, whereby limited counts occur quarterly and each item is counted at least once annually.
  - The stores function is responsible for updating perpetual records whenever inventory items are moved.
  - Perpetual records are maintained for inventory items only if they are significant in value.
- 12** The goal of a physical inventory reconciliation is to
- determine the quantity of inventory sold
  - compare the physical count with the perpetual records
  - compare the physical count with the periodic records
  - determine the quantity of inventory in process
- 13** Which of the following is not considered a benefit of using computerized conversion systems?
- Automatic computation of materials requirements
  - Increased sales and cost of sales
  - Increased efficiency and flexibility
  - Early error detection and increased accuracy
- 14** Which of the following represents a method of managing inventory designed to minimize a company's investment in inventories by scheduling materials to arrive at the time they are needed for production?
- The economic order quantity (EOQ)
  - Material resource planning (MRP)
  - First-in, first-out (FIFO)
  - Just-in-time (JIT)
- 15** For which of the following computerized conversion systems is Walmart well known?
- CAD/CAM
  - MRP-II
  - CIMs
  - JIT

### Discussion Questions

- 16** (SO 1) What are the three resources that an organization must have to conduct a conversion (or transformation) process?
- 17** (SO 1) Do conversion processes occur in manufacturing companies only? Why, or why not?
- 18** (SO 1) Why are conversion activities typically considered routine data processes?
- 19** (SO 2) Differentiate between a bill of materials and an operations list.
- 20** (SO 2) Differentiate between the roles of the engineering and the research and development departments.
- 21** (SO 2) What are the two types of documents or reports that are likely to trigger the conversion process?
- 22** (SO 2) What are the three primary components of logistics?
- 23** (SO 2) What types of information must be taken into consideration when scheduling production?
- 24** (SO 2) Differentiate between a routing slip and an inventory status report.
- 25** (SO 2) What are the conversion responsibilities of the maintenance and control, inventory control, inventory stores, and human resources departments?
- 26** (SO 2) What is the purpose of an inventory status report?
- 27** (SO 2) What is the overall goal of the inventory control department?
- 28** (SO 2) What is the purpose of the quality control department?
- 29** (SO 3) What is the purpose of determining standard costs?
- 30** (SO 3) What should be done when unfavorable variances are discovered?
- 31** (SO 3) Why would perpetual inventory records be preferable to periodic inventory records in a manufacturing company?
- 32** (SO 4) Which three activities in the conversion process should require specific authorization before they are begun?

- 33** (SO 4) Why is it important to separate the functions of inventory control and the production stations? What could go wrong if these functions were not separated?
- 34** (SO 4) Why is it so important that variance reports be prepared in a timely manner?
- 35** (SO 4) Explain how a physical inventory count would differ in a company using a perpetual inventory system versus one using a period inventory system.
- 36** (SO 5) When IT systems are used in conversion processes, what are some of the resulting advantages to the organization?
- 37** (SO 5) How can programmed controls within the IT system for conversion processes enhance internal controls?
- 38** (SO 5) What is the difference between CAD, CAM, and CIM?
- 39** (SO 5) What is the difference between MRP, MRP-II, and ERP?
- 40** (SO 6) How can conversion processes be manipulated to show higher earnings?
- 44** (SO 2) Some companies use the same facility for both inventory stores and warehousing. Describe the difference between these two inventory control activities, and how the respective areas might be distinguished within the facility.
- 45** (SO 2) For the following activities within the conversion process, place them in sequence that indicates the order in which they would normally be performed:
- Inspection of goods
  - Materials issuance
  - Preparation of time sheets
  - Preparation of a bill of materials
  - Preparation of an inventory status report
  - Preparation of a production schedule
- 46** (SO 3) Describe the purpose of each of the following cost accounting records or reports:
- Work-in-process and finished goods inventory accounts
  - Bill of materials
  - Variance reports
  - Routing slips
- 47** (SO 3) Describe how a cost accountant would cancel a production order upon completion of the related product. Why is this important?
- 48** (SO 4) When taking a physical inventory count at a typical manufacturing facility, which category of inventory (raw materials, work-in-process, or finished goods) is likely to be the most time consuming to count and determine the relevant costs for? Why?
- 49** (SO 4) Identify several factors that indicate the need for more extensive internal controls covering conversion processes.
- 50** (SO 5) Using the table below, match the IT systems on the left with their definitions on the right:

CAD	a. A network including production equipment, computer terminals, and accounting systems
CAM	b. Electronic workstation including advanced graphics and 3D modeling of production processes
MRP	c. Automated scheduling of manufacturing resources, including scheduling, capacity, and forecasting functions
MRP-II	d. The minimization of inventory levels by the control of production so that products are produced on a tight schedule in time for their sale
ERP	e. A single software system that includes all manufacturing and related accounting applications
CIMs	f. Automated scheduling of production orders and materials movement
JIT	g. Production automation, including use of computers and robotics
RFID	h. The use of tiny tags affixed to inventory items to automatically monitor movement and account for the various stages of processing.

## Problems

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- 51** (SO 2) Suppose a company has 1,000 units of a raw material part on hand. If 750 of these units are routed into production, should the company place an order to stock up on more of these parts? In order to answer this question, determine the economic order quantity (EOQ) for this part, assuming that the following are true:
- The company plans to use 10,000 units during the coming year.
  - The company orders this part in lots of 1,000 units, and each order placed carries a processing cost of \$2.50.
  - Each unit of inventory carries an annual holding cost of \$6.40.
- 52** (SO 4) Suppose a company is experiencing problems with omitted transactions in the conversion process—i.e., inventory transactions are not always being recorded as they occur. Refer to Exhibit 7-7 to describe at least three internal controls that should be in place to help alleviate such problems.
- 53** (SO 5) Using an Internet search engine, search for the terms “CAD” + “industrial robots.” Identify a company (name and location) that provides manufacturing automation by using robotics. Describe some of the robotic operations that are featured on the company’s website.
- 54** (SO 5) Using an Internet search engine, search for the terms “just in time” + “automotive.” From the results you find, explain why just-in-time inventory systems are such an important factor in the competitive automotive industry.
- 55** (SO 6) Explain how the over-production of inventories can be seen as unethical in an absorption costing environment. 
- 56** (SO 6) Price discounts are commonly used in the business world as incentives for customers. How may this practice (or its misuse) be deemed unethical? 
- 57** (SO 3) Austin Bar Supply manufactures equipment for bars and lounges. While the company manufactures several different products, one is a blender that bartenders use to make certain kinds of drinks. From the textbook website at <http://www.wiley.com/college/turner>, download the spreadsheet template named requisition.xls. Using information in the spreadsheet template, complete the requisition form to calculate the quantity and cost of the parts needed to manufacture a batch of 500 bar blenders. To look up the cost from the price list sheet, you will use a spreadsheet function called VLOOKUP. Be sure to design your formulas in a way that will incorporate changes in the batch size or changes to costs of individual parts.
- 58** (SO 5) Using an Internet search engine, locate a publication called “RFID Journal.” Find a recent article that describes the use of RFID in manufacturing. Briefly describe the example(s) discussed in the article.

## Cases

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- 59** Bloomington Enterprises is a manufacturer of model trains that sell under the name Bloomington Toy Trains in toy stores and hobby shops throughout the United States and Europe. The company employs 160 people in its home office and sole manufacturing and storage facility, which are both located in Bloomington, Indiana.

The inventory storeroom is called the stores department, and it is managed by Louis Tyson. Both materials and finished goods are maintained in this area, as well as the supporting inventory records. Louis performs a daily review of the items on hand by monitoring the inventory subsidiary ledger and determining whether additional materials are needed. If they are, Louis prepares a materials requisition form to submit to the production planning department.

The production planning department is led by Kathy Williams. Upon receipt of a materials

requisition form from Louis, Kathy files the form. Kathy’s files contain not only the materials requisition forms received from Louis, but also sales forecasts received from the sales department. These files are monitored on a daily basis; if there is a match between the needs identified by both stores and sales, a bill of materials and a routing slip are prepared and forwarded to the production room. If inventory quantities for supporting materials are sufficient, a production schedule is prepared and forwarded to the production room. If materials are needed to support production of the items, a purchase requisition is prepared and forwarded to the purchasing and stores department.

Kathy Williams is also the supervisor of the production room. Once new documents are obtained from the production planning department, the bill of materials and routing slip are sent to stores, where Louis retrieves the necessary materials. He makes a

copy of the bill of materials and routing slips and then returns these documents to the production room, along with the requested materials. At the end of the day, Louis updates the inventory subsidiary ledger and prepares a journal voucher summarizing the day's use of materials.

In the production room, the leaders of each production line collect employee time cards at the end of each week and send them to the payroll and cost accounting departments. They also prepare weekly job cost reports for the cost accounting department, itemizing the various costs that have been incurred.

Tom Alexander heads the cost accounting department. Tom uses the job cost reports and time cards to create journal vouchers that update the work-in-process and finished goods inventory accounts. As new cost data is obtained, the cost accountants are continually accumulating actual cost data to be compared with standard costs. Variances are calculated and compared, and the information is used to evaluate the line workers in the production room, as well as the managers and supervisors of each department.

Dan Smith is responsible for updating the general ledger on a weekly basis. The information from the journal vouchers is entered in the general ledger program, which automatically updates the respective accounts. All journal vouchers are filed in Dan's office.

**Required:**

- a. Draw a process map of the conversion processes at Bloomington Enterprises.
  - b. Draw a document flowchart showing the records used in the conversion processes at Bloomington Enterprises.
  - c. List any strengths and weaknesses in the company's internal control procedures. For each weakness, suggest an improvement.
  - d. Describe any benefits that Bloomington Enterprises may receive by installing newer IT systems within its conversion processes. Be specific as to how IT systems could benefit each of the processes described, or how they could eliminate any weakness identified per item c.
- 60 Ski Slope, Inc. is a manufacturer of equipment used for snow skiing and snow boarding. The company's products are sold under two brand names, one comprising its top-of-the-line equipment and the other comprising its line of moderately priced equipment and ski attire. Ski Slope's sole location near Rochester, New York, is home to both its offices and manufacturing facility. Ski Slope's products are

sold worldwide, and current year sales are expected to reach \$180 million.

Ski Slope's conversion process begins in the storekeeping department, where inventories and the related records are maintained. Alex Barton manages the storekeeping function by reviewing the files on a daily basis to determine the inventory needs. He prepares an inventory status report and forwards it to the production planning and control department.

Production planning and control is lead by Eli Walters. Every day Eli prepares bills of materials, routing slips, production orders, and production schedules. Copies of each of these documents are forwarded to the production floor. Eli concurrently determines inventory needs by reviewing the following documents:

- Inventory status reports received from the storekeeping department
- Sales forecasts from the marketing division

If additional quantities of materials inventory are needed, Eli prepares a purchase requisition and forwards copies to the storekeeping and purchasing departments. If inventory quantities are adequate, no further action is taken.

Eli Walters also manages the production processes. Production supervisors on each of the company's six production lines report to Eli. When these supervisors receive production orders and supporting documentation from the production planning and control department, copies of the bill of materials and routing slips are forwarded to Alex Barton. In return, Alex sends the requested materials to the production line. Alex then updates the inventory ledger and sends the bill of materials and routing slips to the cost accounting department. He then prepares a journal voucher for the change in inventories and forwards it to Alex D'Angelo, who is responsible for the general ledger.

At the production lines, the supervisors prepare job tickets to accumulate costs associated with their activities; these tickets are forwarded to cost accounting. They also collect employee time sheets and send them to cost accounting on a weekly basis. The time sheets are prepared in duplicate, and the second copy is sent to the personnel department.

In Ski Slope's cost accounting department, Josh Richardson collects all of the documents to determine the actual costs of the products. Actual costs are compared with standards, and variances are computed. Total variances are used to evaluate managers and supervisors. Next, Josh updates the work-in-process and finished goods inventory files; then he prepares a journal voucher and forwards it to Alex D'Angelo.

In the general ledger department, Alex updates the general ledger by entering the journal vouchers into the general ledger computer software program. Journal vouchers are filed by date.

**Required:**

- a. Draw a process map of the conversion processes at Ski Slope.
  - b. Draw a document flowchart showing the records used in Ski Slope's conversion processes.
  - c. List any strengths and weaknesses in Ski Slope's internal control procedures. For each weakness, suggest an improvement.
- 61 Sole Footwear, Inc., is a manufacturer of a popular line of casual shoes and sandals that has experienced significant growth within the past 18 months. The unique design of its product line has always been the key to the company's success. It is currently still using a system consisting of manual job costing sheets and inventory cards. Although this system was satisfactory in the past, the company's recent growth has resulted in various problems with operations and inventory control. The biggest problem is with meeting the production and delivery schedules. Many products are delivered late because the products are not completed on time. In addition, some products are delayed in the production process because the required materials are out of stock; it sometimes takes a week or more to restock back-ordered materials. To make matters worse, the company has been unable to control waste of its raw materials. There are significant quantities of materials left over after the production runs. These excess materials are eventually written off because no known scrap market exists.

Job costing sheets and inventory cards are updated at the end of each week. It takes nearly a week for the production clerks to update the accounting records from these documents. When customers inquire about the status of their orders, the production clerks use the job costing sheets to estimate delivery dates. Because of the back-order problems, though, these estimates are often overly optimistic. This inability to provide accurate delivery dates has been a serious source of customer dissatisfaction.

The production and inventory managers have recognized the need for the company to improve its system of tracking customer orders and maintaining raw materials inventory. They have tried to convince top management of the need to improve the timeliness of information flow between the production, inventory, and accounting departments. However, top management believes that customers will be willing to wait for their orders because the products are in high demand. Furthermore, top management is reluctant to spend money on automation.

Recently, competitors have started to imitate Sole's footwear designs, and some customers have hinted that they are tempted to place future orders with these competitor companies. Sole's production and inventory managers are making another plea to top management for a new computerized inventory information system.

**Required:**

- a. List the problems with the existing system at Sole's Footwear.
  - b. Identify the relevant information that the production and inventory managers need to accumulate in order to support the decision to automate the conversion process.
  - c. List specific items that could be provided by an automated system, and describe how this could be essential to the company's continued success.
- 62 (CMA Adapted) Bentley Dynamics, Inc., produces computer chips for personal electronic devices used to record music. The chips are sold primarily to large manufacturers; however, occasional production overruns may be discounted and sold to small manufacturers. Since Bentley's operating budget assigns all fixed production expenses to its predictable market—large manufacturers—there are no fixed expenses allocated to products sold to small manufacturers. This results in significant profits in the small manufacturer market segment, even though the products are discounted.



All of Bentley's products are tested for quality standards, and rejected chips are reworked to acceptable levels. The projected failure rate of reworked chips is determined to be 10 percent. Recently, however, customer feedback has suggested that the rework process is not always bringing the chips up to quality standards. Patty McCay, cost accountant, and Marty Cambiss, quality control engineer, have determined that a failure to maintain precise temperature levels during chip production results in a product defect that has a 50 percent failure rate. Unfortunately, current testing techniques do not detect this defect, so the company has no way to identify which chips will fail. Enhancements to the rework process would alleviate the defects problem; however, the additional cost is believed to be excessive, considering that half of the products would not benefit from the enhancement. Marty Cambiss and Patty McCay discussed this issue with Bentley's marketing manager, Ellis Wynn, who has indicated that the defect problem will have a significant negative impact on the company's reputation.

Patty McCay has documented the problem in her report, which will be presented at the meeting of the board of directors next week. She is convinced that

the problem will have a serious impact on the company's profitability.

Upon reviewing the cost accounting report to be presented to the board of directors, the plant manager became enraged and stormed into the office of the controller, demanding that the report be revised to downplay the rework issue. The controller agreed that the report's current presentation would draw too much attention to the problem and would likely be alarming to the board members. He instructed Patty McCay to revise the report and tone down the issue so as to avoid upsetting the board members.

Patty McCay is convinced that the board members would be misinformed if the serious nature of

this problem were not highlighted in her report. She went back to Marty Cambiss and Ellis Wynn to try to solicit their support in pressing this issue; however, both of them were unwilling to get further involved in a matter that appears controversial.

**Required:**

- a. What should Patty do? Explain your answer and discuss the ethical considerations that she should recognize in this situation.
- b. What corporate governance functions are missing at Bentley's? Be specific and describe the facts of the case and their relevance to corporate governance.

## Solutions to Concept Check

- 1 Manufacturing has changed in recent years as a result of each of the factors except **d. lack of economic prosperity**.
- 2 (SO 2) The term conversion processes is used synonymously with **d. all of the above**. Operations, production, and manufacturing are all synonyms for the conversion process.
- 3 (SO 2) **c. Human Resource Management** is part of the resource management component, not part of the planning component of the logistics function.
- 4 (SO 2) **c. Routing** is an inventory control activity. Answer a. is part of the planning component; b. is part of the resource management component; and d. is part of the operations component.
- 5 (SO 2) The following statement concerning an operations list is true: **a. It is an engineering document that describes the chain of events within a company's conversion process**. Answer b. is incorrect because an operations list does not describe a product's components. Answers c. and d. are incorrect because an operations list is not a capital budgeting document.
- 6 (SO 2) **c. Stores** relate to the control of materials being held for future production. Answers a. and b. relate to current production and answer d. relates to finished goods (past production).
- 7 (CPA Adapted) (SO 2) The following question is most likely to be found on an internal control questionnaire concerning a company's conversion processes: **c. Are approved requisitions required when materials are released from the company's warehouse into production?** This is the only response that pertains specifically to the conversion process. Responses a. and b. concern the expenditures and cash disbursements functions, and response d. pertains to general accounting.
- 8 (SO 2) When additional procedures are necessary to bring a defective product up to its required specifications, this is referred to as **a. rework**. Answer b. relates to defective products for which no additional procedures are deemed worthwhile; answer c. relates to the original production (rather than additional procedures); answer d. relates to quantification of production differences.
- 9 (CIA Adapted) (SO 2) A firm expects to sell 1,000 units of its best-selling product in the coming year. Ordering costs for this product are \$100 per order, and carrying costs are \$2 per unit. Compute the optimum order size, using the EOQ model. The answer is **c. 317 units**. This is the square root of  $(2 \times 1,000 \times \$100) / \$2$ , or the square root of 100,000. Answer a. is incorrect because total carrying costs are used rather than unit carrying costs. Answer b. is incorrect because it failed to multiply by the constant 2. Answer d. is incorrect because it failed to divide by carrying costs.
- 10 (CPA Adapted) (SO 4) The following internal control is typically associated with the maintenance of accurate inventory records: **d. using physical inventory counts as a basis for adjusting the perpetual records**. Answer a. is incorrect because the most recent costs do not necessarily reflect the carrying cost of inventories. Answer b. is incorrect because it relates to cost savings rather than to an internal control improvement. Answer c. is incorrect because it relates to the existence of inventory rather than its accurate reporting.
- 11 (CPA Adapted) (SO 4) If a manufacturing company's inventory of supplies consists of a large number of small items, the following would be considered a

weakness in internal controls: **c. The stores function is responsible for updating perpetual records whenever inventory items are moved.**

Since the stores function is responsible for movement of inventory (a custody function), a violation of the principles of segregation of duties exists if this function is also responsible for record keeping. Each of the other responses represents common practices that are not considered control weaknesses.

- 12 (SO 4) The goal of a physical inventory reconciliation is to **b. compare the physical count with the perpetual records.**
- 13 (SO 5) **b. Increased sales and cost of sales** is not considered a benefit of using computerized

conversion systems. Each of the other answers relates to improvements in terms of cost savings, efficiencies, and/or improved controls.

- 14 (CMA Adapted) (SO 5) **d. JIT** represents a method of managing inventory designed to minimize a company's investment in inventories by scheduling materials to arrive at the time they are needed for production. Answer a. relates to optimum order quantities. Answer b. relates to manufacturing systems. Answer c. is an inventory costing method.
- 15 (SO 5) Walmart is well known for the computerized conversion system **d. JIT**. Each of the other answers relates to manufacturing systems and therefore would not likely be used by a retail business.

# Administrative Processes and Controls

### STUDY OBJECTIVES

This chapter will help you gain an understanding of the following concepts:

- 1.** An introduction to administrative processes
- 2.** Source of capital processes
- 3.** Investment processes
- 4.** Risks and controls in capital and investment processes
- 5.** General ledger processes
- 6.** Risks and controls in general ledger processes
- 7.** Reporting as an output of the general ledger processes
- 8.** Ethical issues related to administrative processes and reporting
- 9.** Corporate governance in administrative processes and reporting

The Real World examples on the following two pages will help you understand the context of certain concepts addressed in this chapter. Please read those Real World examples to begin effective reading and studying of this chapter. Those Real World examples portray important aspects of the posting and closing processes of the general ledger, which is one of the administrative processes described in this chapter. Also described here are source of capital processes, investing processes, and reporting. Therefore, the administrative processes described in this chapter include

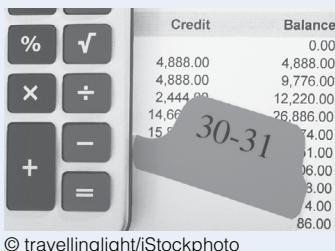
1. Source of capital processes
2. Investment processes
3. General ledger processes

### Introduction to Administrative Processes (Study Objective 1)

The previous chapters described many processes that occur within an organization, including sales of products and services, cash collections, purchases of materials and fixed assets, payroll, cash disbursements, and conversion processes. While these are all different processes, they do have several things in common. Each of these processes involves a regular transaction process that occurs daily or at another recurring interval. These processes usually generate a large number of transactions that must be recorded in the accounting system. In addition, top management has usually established procedures and controls that allow these processes to occur without intervention or specific authorization by management. For example, a salesperson does not have to wait for specific approval for each sale she negotiates.

The previous chapters described the processes that collect data within these business processes, record the transaction data, and trigger subsequent events to occur.

## The Real World



All but the smallest organizations do a monthly closing of the general ledger and provide feedback reports to management after the closing process. The closing process is necessary to ensure that all expenses are accrued and posted to the proper accounts prior to preparing reports. This entails posting all monthly transaction summaries and correcting any errors that are detected. This closing process can be very time-consuming, especially when one department must wait on another department. For example, the general ledger cannot be closed until the payroll department receives and processes all month-end time cards. A typical timing of the closing process is shown in Exhibit 12-1.<sup>1</sup>

Notice that, in the example, the total time required is 12 working days and management receives financial reports 8 days after month end. Many managers believe 8 days is too long to wait to receive financial feedback reports. The modern, integrated IT systems in use today can help to drastically reduce the length of time needed for the monthly closing. In fact, many companies monitor the time required to carry out their closing process. Furthermore, some companies are striving to achieve a "fast close" or "virtual close," whereby the timing of the monthly closing process is reduced to a few days or hours, respectively.

Despite these trends in improving the speed of the closing process, many companies still have long closing processes because of a lack of system integration and the time-consuming nature of the human steps in the process (such as error correction and re-keying of data). Even in the largest corporations with modern IT systems, there are still human processes in the general ledger closing because systems are not always integrated.

<b>Accrue payroll</b>				X	X						
<b>Close accounts payable</b>					X	X					
<b>Close manufacturing</b>						X	X				
<b>Record depreciation</b>	X	X									
<b>Monthly reporting</b>							X	X	X	X	
<b>Day of close</b>	-3	-2	-1	0	1	2	3	4	5	6	7

Month End

**EXHIBIT 12-1** Timing of a Traditional Closing Process

This chapter will focus on two different sets of remaining processes. Both are administrative processes and are depicted in Exhibit 12-2.

The first set of administrative processes presented in this chapter includes investment, borrowing, and capital transactions, as shown in the lower left-hand box of Exhibit 12-2. These processes are unlike those described in the previous chapters because they are not regular, recurring, or high-volume processes. Examples of such processes are the sale of stocks or bonds; the initiation of loans, bonds, or notes payable; and the investment of funds in marketable securities. These types of processes

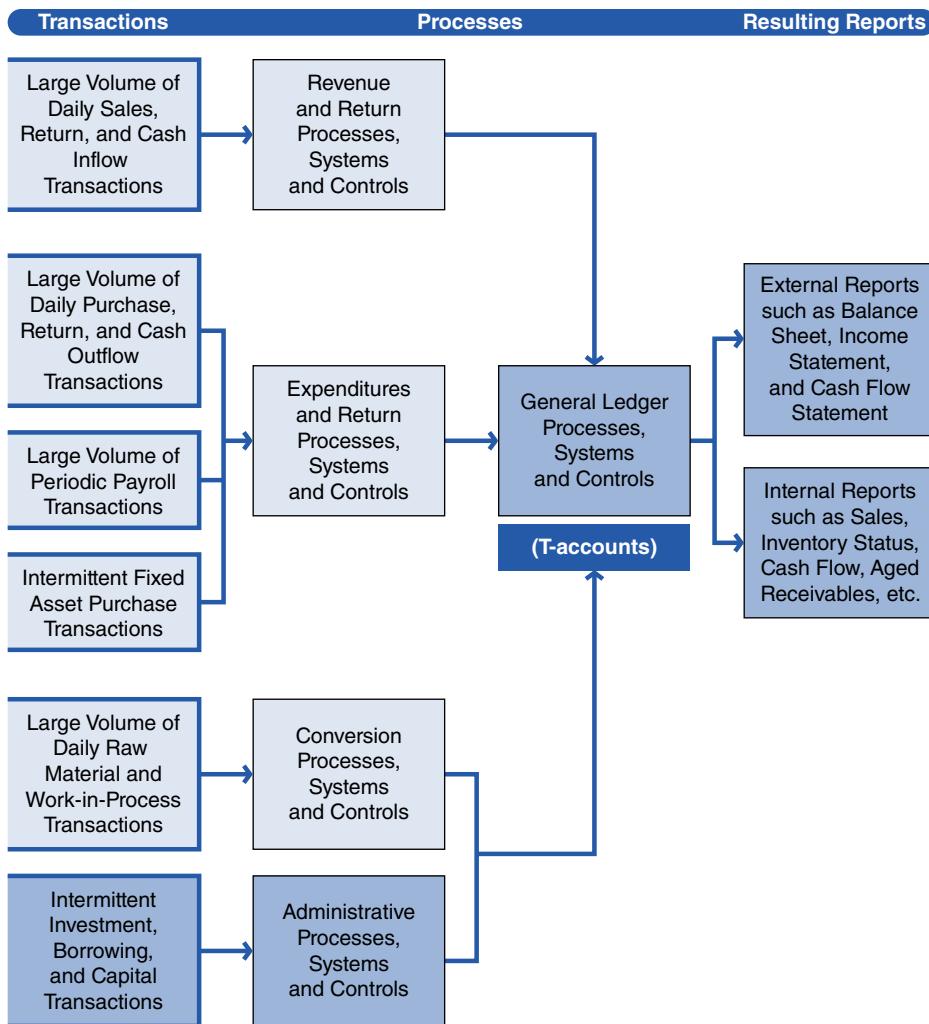
<sup>1</sup> Adapted from Buzz Adams, "Creating Value with an Instant Close," *Strategic Finance*, September 2002, p. 49.

## The Real World

Alcoa, Inc., the world's leading producer of aluminum, is well known for its accomplishments in the areas of sustainability and innovation in the transportation, aerospace, construction, and electronics industries. In 2016, Alcoa was appointed to *Fortune* magazine's list of Most Admired Companies for the 30th consecutive year.

A lesser known fact about Alcoa is that it is often the first of the Dow Jones Industrial companies to report its quarterly earnings. Alcoa has worked hard to achieve a fast close, whereby it has fine-tuned its accounting processes and

information systems to facilitate the completion of periodic transaction processing and closing of the general ledger within two days of the end of the period. Then, it can report its consolidated financial results externally within one week. In today's fast-paced business environment, companies can gain competitive advantage by closing their books quickly and delivering timely information to internal and external stakeholders. Having a fully integrated ERP system and streamlined processes are key components to a quick close at the end of a period.



**EXHIBIT 12-2** Overall View of Transactions, Processes, and Resulting Reports

can be categorized as either source of capital processes or investment processes. They are not routine, but occur only when the need arises. Moreover, the nature of these processes usually dictates that specific authorization for each transaction is necessary. For example, a company would initiate the sale of common stock only upon approval of the top management or board of directors. Even though these are not regular, recurring events, there must be established processes, procedures, and controls to conduct, record, and report the results of the transactions. Without established procedures and internal controls, the processes might not be properly authorized, recorded, or reported.

The second type of administrative processes is the general ledger processes, as shown in the middle and right-hand boxes of Exhibit 12-2. Each of the transactions and processes presented in Chapters 8–11 must result in financial information being recorded in general ledger accounts. That is, any sale, cash collection, expense, or payment must eventually affect general ledger accounts such as revenue accounts, expense accounts, and cash accounts. Therefore, there must be processes within the organization that funnel all of the transaction information from each of these processes into general ledger accounts. The general ledger account balance information is then used to prepare reports for both internal and external users.

Each of the processes just described is an administrative process. **Administrative processes** are transactions and activities that are either specifically authorized by top managers or used by managers to perform administrative functions. Investment of excess funds and raising capital funds are nonroutine processes that occur when specifically authorized. On the other hand, the general ledger and reporting processes provide feedback to owners and managers and assist these groups in the administration of the organization. These administrative processes are further described in the following sections.

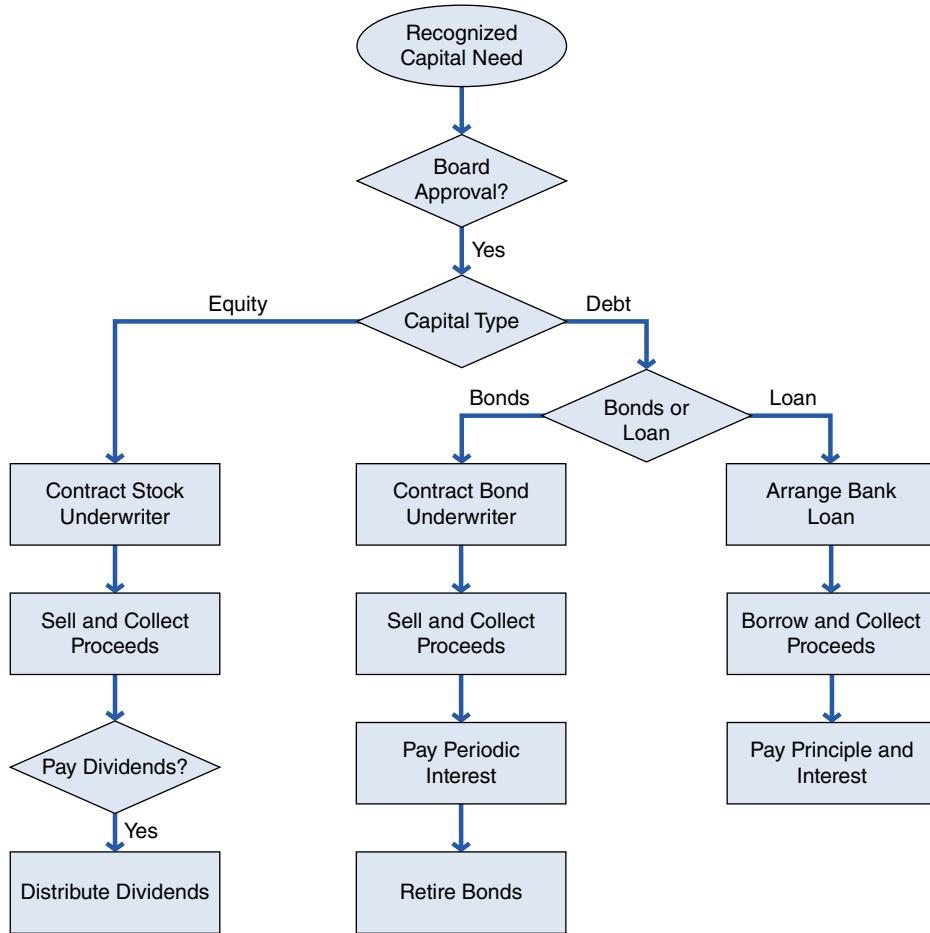
## Source of Capital Processes (Study Objective 2)

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The operation of any organization requires long-term capital assets such as land, buildings, and equipment. To purchase these capital assets, top management must have capital available. **Capital** is the funds used to acquire the long-term capital assets of an organization. Capital usually comes from long-term debt or equity. Long-term debt results from borrowing funds via loans or bonds payable, and equity results from issuing common or preferred stock. These financial instruments provide the capital necessary to acquire long-term capital assets. **Source of capital processes** authorize the raising of capital, execute the raising of capital, and properly account for that capital.

The transactions and resulting processes related to loans, bonds payable, and stock should be executed only when authorized by top management or the board of directors, and use of the resulting capital must be properly controlled. These processes are administrative processes because top managers, the administrators of the organization, are responsible for the authorization, control, and use of the capital. Exhibit 12-3 shows the processes related to raising capital. The processes related to expenditures of capital (purchases of fixed assets) were described in Chapter 10.

Occasionally, top management may recognize the need to raise capital. This need might arise from the desire to accomplish organizational goals that require substantial funds, such as expanding the organization, replacing a substantial amount of plant, property, and equipment, or acquiring other businesses. To accomplish any of these goals, management would need access to a substantially large amount of



**EXHIBIT 12-3** Source of Capital Process Map

capital. Top management would then investigate the most appropriate method of raising the needed capital.

The board of directors must decide between the two general sources of capital funds: debt or equity. If debt is chosen, the organization will either borrow funds from a financial institution or some other creditor, or it will sell bonds. If equity is chosen as the source of capital, the corporation will need to sell common or preferred stock. Corporations are usually unable to access the bond and stock markets directly and must conduct those transactions through an underwriter. An **underwriter** is a third party that contracts with a corporation to bring new securities issues to the public market.

Since top management directs these capital processes, there is inherent control. The fact that these processes cannot occur without specific authorization and oversight by top management is a strong internal control.

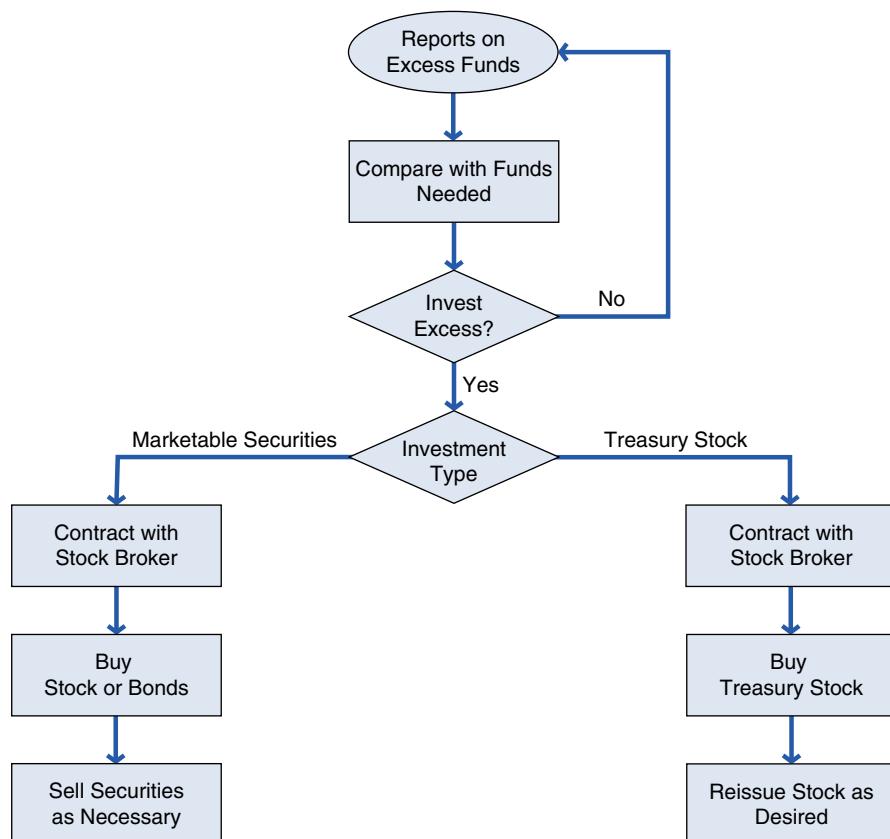
## Investment Processes (Study Objective 3)

In many instances, an organization finds that it has more funds on hand than necessary to operate the organization. The proper performance of the stewardship function would suggest that management should invest these excess cash funds in a place where they can earn a return. Management should properly manage,

or administer, the investment of excess funds. **Investment processes** authorize, execute, manage, and properly account for investments of excess funds. While there are several ways for an organization to invest its excess funds, the most frequently used methods are to invest in marketable securities or repurchase the company's outstanding common stock. Marketable securities are stocks or bonds purchased on open securities markets. A corporation's own stock that is repurchased by the company on the open market is called treasury stock. Exhibit 12-4 shows the processes of investing excess funds.

Regardless of how the excess funds are invested, there should be a set of administrative processes that authorize, execute, and properly account for the investments. It is important to recognize that investment processes should not be initiated unless top management has no immediate need for those funds. Top management should be continually monitoring the funds available and considering the future need for funds. Thus, the recognition that there are excess funds and the related decision to authorize the investment of those funds are administrative (top management) functions. Usually, the treasurer of the corporation (or those under the authority of the treasurer) has the responsibility for making investment decisions and overseeing investments.

The parties that make up top management depend upon the type of organization. For a corporation, the board of directors is the top management level that authorizes and controls source of capital processes. For partnerships or proprietorships, the owners are the top managers. For the purpose of explaining the processes in Exhibit 12-4, a corporation with a board of directors is the type of organization and management depicted.



**EXHIBIT 12-4** Investment Process Map

Securities and treasury stock often are not purchased directly on the market; rather, a brokerage firm is used to execute the purchase. After purchasing securities or treasury stock, the treasurer of the company often maintains custody of the securities and the record of those securities. In some companies, a trustee is used to maintain custody of the securities or records of the securities. At some point in the future, management will likely determine that there are more important or profitable uses for invested funds. The securities or treasury stock can then be resold through a broker.

Since most large corporations have complex IT accounting systems, those systems can automate much of the investment processes, including notifying management when excess funds exist. That is, the IT system can forecast future cash needs and future cash inflows by monitoring the expected timing of accounts payable due dates and expected collections of accounts receivable. The system can continually compare current cash balances with forecasted needs and sources, and provide feedback to top management about potential excess funds.

## Risks and Controls in Capital and Investment Processes (Study Objective 4)

For both source of capital processes and investment processes, the important control is the specific authorization and oversight provided by top management. The very close supervision of these transactions helps prevent risks of theft or misuse of the cash related to capital and investment processes. In addition, the large sums of money involved in capital and investment decisions usually dictates that the cash not be handled according to normal cash receipts procedures. For example, a stock sale to raise capital might result in millions or billions of dollars in proceeds. Company employees are not likely to handle the cash proceeds from such a stock transaction; rather, the funds would probably be transferred electronically. The broker would electronically transfer funds to the company bank account.

Since these transactions are authorized by top management and the funds are not necessarily handled by employees, the underlying risks are not the same as other

### The Real World

In the early 2000s, the Securities and Exchange Commission investigated Nathan A. Chapman, Jr., and three of his companies. One of the companies, echapman.com, was scheduled to sell stock through an initial public offering (IPO). In an IPO, the company offering stock must explain to potential investors the manner in which funds from the IPO will be used.

The SEC found that Chapman lied about the use of IPO funds. Chapman was actually using proceeds from the sale of new stock to buy more of his own company's stock. These purchases were only intended to show a larger trading

volume for the stock, thereby making it look more attractive in the stock market. Chapman was attempting to artificially pump up the price of the stock through these fraudulent stock purchases. To conceal this fraud scheme, his company falsified its financial statements.

In this case, typical internal controls such as segregation of duties and reconciliations would not likely prevent or detect these frauds. The more important controls of specific authorization by top management and close scrutiny by the internal and external auditors are especially important for controlling capital and investment processes.

processes. Generally, the risks are not related to employee fraud, but are instead related to management fraud. That is, frauds perpetrated by manipulating capital or investment processes are much more likely to be conducted by top managers. Internal controls aimed at preventing and detecting employee fraud are not as effective in capital and investment decisions. This does not mean that typical internal controls should be ignored, but that in addition to any regular controls in place, the company must carefully examine risks related to its capital and investment processes and implement relevant controls aimed at prevention and detection of management fraud.

## General Ledger Processes (Study Objective 5)

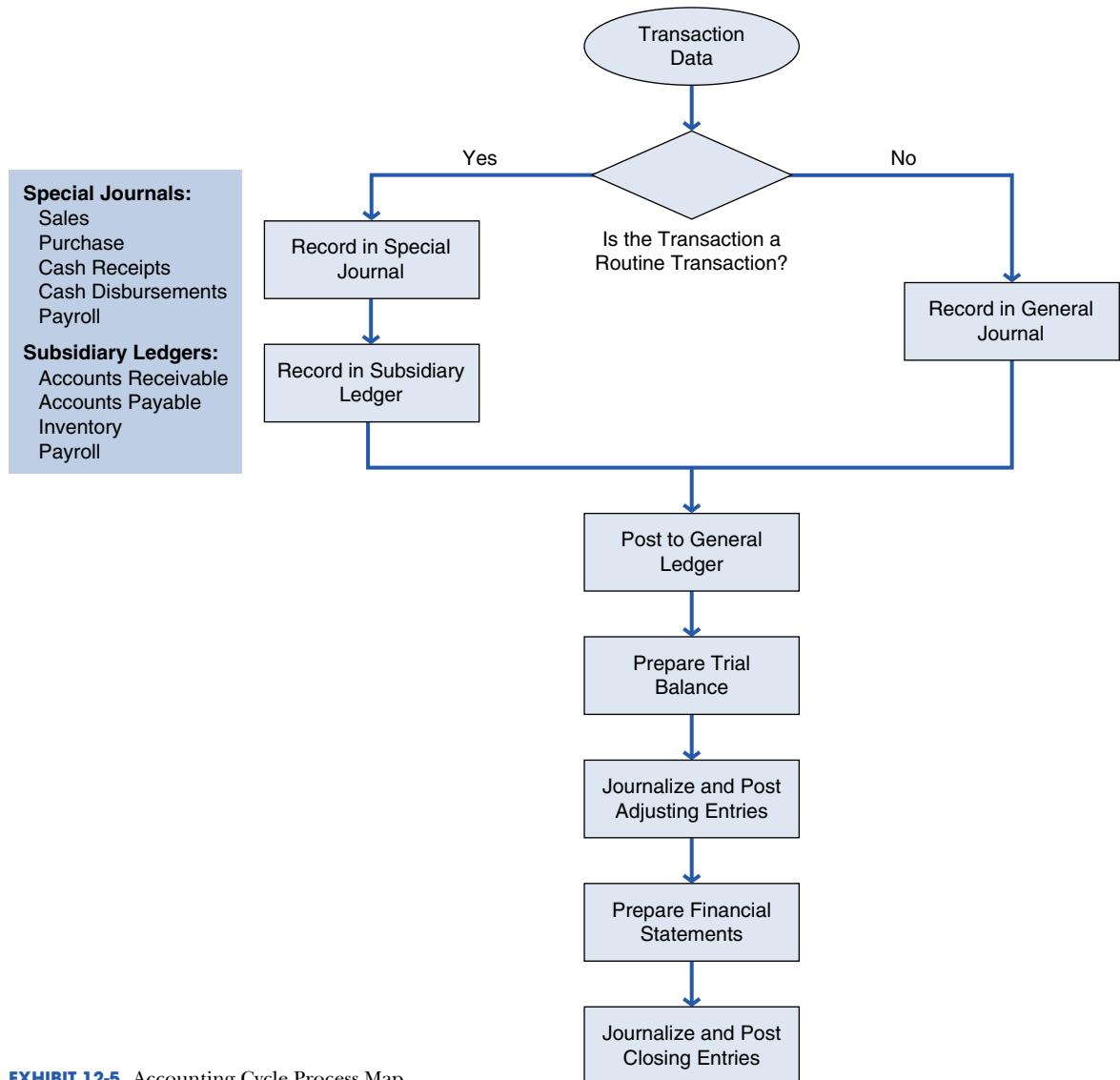
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Reexamine Exhibit 12-2 and notice that each of the processes described in this chapter and previous chapters feed data into the general ledger. The general ledger provides details for all the accounts within the chart of accounts. Recall from your accounting courses that the general ledger is the entire set of T-accounts for the organization. Each set of processes affects general ledger accounts. For example, sales and sales return processes affect the accounts receivable, sales, inventory, and cost of goods sold accounts. For manual accounting systems, the process in which transactions are posted to the general ledger is called the accounting cycle. Exhibit 12-5 is a summary of the processes in the accounting cycle.

Business processes in an organization consist of various accounting transactions. When an event occurs, the accountant must decide whether the transaction is a regular, recurring transaction. If the transaction is regular and recurring, it would be recorded in a special journal. **Special journals** are established to record specific types of transactions. For example, a sale to a customer would be recorded in a special journal called the sales journal. The sales journal is the appropriate place to record all credit sales. A typical sales journal is formatted with columns to record the amount of the sale and the corresponding receivable. That is, one column exists for sales dollar amounts (a credit), and one column for accounts receivable amounts (a debit). In addition, regular, recurring transactions are posted to subsidiary ledgers. **Subsidiary ledgers** maintain the detail information regarding routine transactions, with an account established for each entity. For example, a credit sale to a customer must be recorded in the accounts receivable subsidiary ledger. This subsidiary ledger maintains transaction details and balances for each individual customer. At regular intervals, such as the end of each day or end of each week, the totals from the special journals are posted to general ledger accounts. Exhibit 12-6 shows the sales journal, a special journal. The total of \$41,100 in the sales journal would be posted to the general ledger accounts of accounts receivable and sales. Exhibit 12-7 shows a page from a subsidiary ledger called the accounts receivable subsidiary ledger. Notice that the December 4 and December 11 sales to ABW-Electro World that are recorded in the sales journal are also posted to the subsidiary ledger.

Some transactions are not regular, recurring transactions, and thus are not recorded in special journals and subsidiary ledgers. The transactions in capital and investment processes are examples of nonroutine transactions, which are entered in the general journal and posted to the general ledger.

At period end, it is important to ensure that all revenue, expenditure, payroll, payable, and receivable transactions have been posted to the general ledger. After all these transactions are recorded for the month, accruals and other adjusting

**EXHIBIT 12-5** Accounting Cycle Process Map

entries are recorded in the general journal and then posted to the general ledger. After all transactions are accrued and posted, a trial balance is prepared from the general ledger account balances.

The financial statements are prepared from the adjusted balances in the general ledger. To prepare the general ledger for the next accounting period, and to transfer earnings to retained earnings, closing entries are recorded in the general journal and posted to the general ledger. This ends the accounting cycle for the current fiscal period, and the cycle begins anew in the next fiscal period.

These examples of accounting records focus only on sales and receivables. There are similar special journals and subsidiary ledgers for other regular, recurring transactions such as purchases, cash receipts, cash disbursements, and payroll. Also, there are other subsidiary ledgers such as accounts payable, inventory, payroll, and fixed assets. When a transaction occurs, the accountant must choose the correct set of special journals and subsidiary ledgers in which to record the transaction. In an

SALES JOURNAL		DECEMBER					Debit		Credit
Date	Customer	Invoice or Cr. Memo Number	Subsid. Acct. No.	Subsid. Post	Acct. Rec. G/L 10200	Sales Returns G/L 30200		Sales G/L 31000	
Dec. 4	ABW-Electro World	836	516	X	15,000.00			15,000.00	
Dec. 5	Windover Electronics	837	518	X	5,600.00			5,600.00	
Dec. 11	ABW-Electro World	838	516	X	7,580.00			7,580.00	
Dec. 13	Windover Electronics	839	518	X	1,820.00			1,820.00	
Dec. 18	Clean Imagery, Inc.	840	517	X	11,100.00			11,100.00	
		<b>Monthly Totals</b>			41,100.00		—	41,100.00	

EXHIBIT 12-6 A Special Journal

ACCOUNTS RECEIVABLE SUBSIDIARY LEDGER								
ABW-Electro World 675 Main Street Covington, KY 41011					Credit Limit: \$ 20,000.00			
Date	Description		Debit	Credit	Balance			
Oct. 1	Balance Forward							—
Nov. 2	Invoice #832		19,400.00					19,400.00
Nov. 13	Partial payment #832			16,000.00				3,400.00
Dec. 4	Invoice #836		15,000.00					18,400.00
Dec. 9	Payment #836			15,000.00				3,400.00
Dec. 11	Invoice #838		7,580.00					10,980.00
Dec. 23	Invoice #838			3,400.00				7,580.00
								7,580.00
								7,580.00

EXHIBIT 12-7 A Subsidiary Ledger

automated ERP system, when a transaction is entered, the appropriate special journals and subsidiary ledgers are automatically updated.

While very few organizations use manual accounting systems, much of the accounting software in use today is built on the concepts underlying manual accounting cycle processes. For example, when entering transactions in Microsoft Dynamics GP accounting software, the correct module must be selected from the menu. This module selection is similar to choosing the correct special journal. Exhibit 12-8 has a screen capture of the module selection menu from Microsoft Dynamics GP. Within the software, if a payroll transaction is to be processed, the user chooses “Payroll,” and for sales transactions the user chooses “Sales.” Therefore, whether the accounting system is manual or computerized, we must understand the processes and the special journals, subsidiary ledgers, and general ledger accounts in an accounting system.

Transaction recording in special journals and subsidiary ledgers takes place at the time the transaction occurs, so they are updated gradually throughout the period as transactions occur. The revenue transactions, such as those described in



**EXHIBIT 12-8** Transaction Modules in Microsoft Dynamics GP

Chapter 8, would be recorded in the correct special journal when the related shipping transaction takes place. Only the posting to the general ledger occurs at a later time. The remainder of this chapter focuses only on the general ledger process. Thus, the discussion of the general ledger processes assumes that transactions have already been recorded in special journals and subsidiary ledgers as the transactions occurred.

## Risks and Controls in General Ledger Processes (Study Objective 6)

In terms of the five internal control activities described in Chapter 3, following are common procedures associated with the general ledger.

### Authorization of Transactions

The general ledger accumulates totals from the various journals and subsidiary ledgers used in each of the company's previous processes. For example, totals from the sales journal are posted to the general ledger sales account. Each of those

individual sales included in the sales journal was authorized when the sale occurred. Chapter 8 describes the authorization of sales. However, there must also be proper authorization to begin the process of posting from the sales journal to the general ledger.

In the case of a manual accounting system, a journal voucher is prepared by a manager in the sales department, and that approved journal voucher is forwarded to the general ledger department. The journal voucher includes the dollar amounts, the accounts affected, and an authorized signature. Posting to the general ledger should not occur without a signed, authorized journal voucher from the department that accounted for the process. For example, wages and deductions are not posted to the general ledger until the payroll department forwards a signed journal voucher. The signed journal voucher serves as authorization to post the payroll data to the general ledger.

In a computerized accounting system, paper journal voucher documents may not exist. In these systems, individual transactions may be entered into special modules, but not posted to the general ledger until the batch of transactions is completely entered and errors are corrected. For example, sales for an entire day may be entered in the Sales module, but not posted to the general ledger until the end of the day.

Approvals for each journal voucher are general authorizations rather than a specific authorization. Through the assignment of limited access to the general ledger module, management can limit responsibility for general ledger postings to selected employees. One set of employees would have a user ID and password that would allow them to enter individual sales transactions in the Sales module. Other employees have access that allows them to post to the general ledger. Employees who have not been given access to general ledger posting will be unable to post to the general ledger. This assignment of separate duties enables management to give authority to designated employees to post to the general ledger.

Computerized accounting systems have different levels of automation. As the computerized accounting systems become more complex and integrated, there are usually fewer manual processes. With more automation and fewer manual steps, responsibility for authorization gets moved to lower and lower levels of employees. For example, if a computerized accounting system automatically updates the general ledger as individual transactions are entered, there is no need for a separate posting step. Thus, the employee who enters the details of the sale has, in effect, authorized the general ledger posting. In many IT systems today, the accounting systems are extremely complex, automated, and integrated, so authorization may be the responsibility of lower-level employees.

## The Real World

Consider the checkout lanes at a department store such as Walmart. All around the world, there are employees working checkout lanes who are scanning products by passing them over the bar code scanner and accepting payment. In a large company such as Walmart, it would be tremendously inefficient for the system to

delay the general ledger posting until a specific employee logs in to conduct the posting. Rather, when the checkout lane employee completes a sale by accepting payment and printing a sales receipt, he or she has authorized an event that will automatically update sales, inventory, and cash balances.

Many large corporations that sell to other companies have even more complex IT accounting systems, often connected to vendor and customer IT systems. In these systems, a sale might actually be authorized by the customer. Therefore, these systems require preexisting and negotiated relationships between buyer and seller companies. Both parties must have already approved these processes and established IT systems that execute the processes.

Whether the system is manual or computerized, posting to general ledger accounts should occur only when proper authorization exists. In manual systems and less complex computerized systems, the authorization to post is vested in the journal voucher. In more complex accounting systems, certain employees are authorized to record specific events that automatically post transactions to the general ledger. Whether the authority is vested in employees or in connected IT systems, management must establish the method of authorization it desires in its accounting system.

## Segregation of Duties

In manual accounting systems, segregation of duties is a desirable internal control. Employees who post journal vouchers have responsibility for record keeping. For proper segregation, those employees should never have authorization or custody functions. General ledger employees should only record journal vouchers from other operational departments that have been authorized by managers in those departments. The general ledger employees should never be given responsibility for authorizing any journal vouchers. Also, general ledger employees should never have custody of any assets that they record in the general ledger. If these employees have both custody and record keeping functions, they have a capability to steal assets and alter the records.

A third segregation in a manual general ledger system is that general ledger functions should be segregated from special journal and subsidiary ledger tasks. The special journals, subsidiary ledgers, and general ledger serve important, but separate, record keeping and control functions. Special journals and subsidiary ledgers have details of many subaccounts, such as sales revenues and an account balance for each customer in the accounts receivable subsidiary ledger. The general ledger sales and accounts receivable accounts maintain overall increases, decreases, and a balance in those accounts. At all times and for each special journal and subsidiary ledger, total balances should equal the balance in the corresponding general ledger account. As examples, the total of the sales in the sales

## The Real World

Walmart and Procter & Gamble (P&G) have interconnected IT systems. P&G sells consumer products such as soap, shampoo, and diapers to Walmart. A sale by P&G to Walmart is actually triggered by Walmart's IT inventory system. As Walmart's inventory levels of P&G products fall below established reorder points, the systems

interact and authorize a transfer of products from P&G to Walmart. This means that P&G's sale and the subsequent update of its sales and receivable accounts are activated by its customer's computer system. Similarly, Walmart's purchase and update of its inventory and payables accounts are triggered by this system.

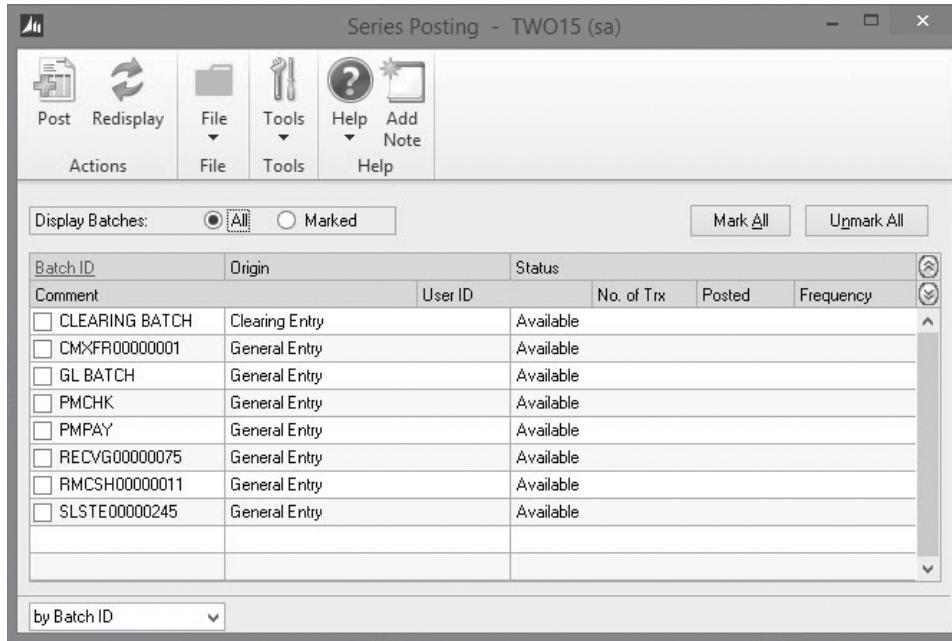
journal should equal the balance of sales in the general ledger, and the total of the accounts in the accounts receivable subsidiary ledger should equal the balance of accounts receivable in the general ledger. By separating the record keeping function for these two types of records, control is enhanced. Two separate parties are keeping independent, but related records. If there are problems with the reconciliation of the two records, it may be the case that errors or fraudulent acts have occurred. Separating general ledger from special journal and subsidiary ledger functions increases the likelihood that errors or fraud will be prevented or detected.

In summary, three important segregations should be in place in a manual general ledger system. General ledger employees should record journal vouchers, but they should not

1. authorize journal vouchers
2. have custody of assets
3. have recording responsibility for any special journals or subsidiary ledgers

Computerized accounting systems may not have the same types of segregation of duties, as segregating functions may not be possible in IT systems if manual functions have been computerized. Whether segregation of functions is possible depends on the complexity of the IT accounting system. Some accounting systems may have rich features for segregating functions for general ledger record keeping, while more complex systems may not. Microsoft Dynamics GP software is an example of an accounting/ERP software system that has built-in functionality to assist with the segregation of duties. Throughout Microsoft Dynamics GP there are a variety of options that allow a company to segregate duties. First, all users are assigned a user ID and password. Every user ID can be set up differently with access granted to certain functions and denied for other functions. A second feature is the ability to assign roles to each user. When a role is assigned, there is default functionality assigned to the user based on that role. Users' profiles can then be further defined to fit their exact job requirements. For example, in the General Ledger there may be a role for an accounting specialist and an accounting manager. The accounting specialist may have the ability to enter general ledger entries but not post the transactions or batches. The accounting manager can be assigned the responsibility to review general ledger entry batches and approve and post the transactions. Another example of segregating duties in the financial modules is the separation of the recording of bank transactions, such as bank deposits, from the preparation of the bank reconciliation. The role-based security and granular nature of the security assignments are very helpful for companies who require a high level of security and segregation of duties. Essentially, general ledger functions and posting can be assigned to certain employees by the limiting of access to the general ledger functions on the basis of log-in IDs. Exhibit 12-9 shows a general ledger posting window in Microsoft Dynamics GP accounting software. User IDs and passwords can limit access to this window to only selected employees. The employee who is given access to this window would choose which batches to post, place a checkmark in the box next to the batch, and select the Post option.

More complex accounting software may post to the general ledger system automatically as transactions are processed. In this case, segregation of general ledger functions is not likely, because there are no employee functions within the general ledger system. However, incompatible duties in processes that eventually post to the general ledger can still be segregated.



**EXHIBIT 12-9** General Ledger Posting in Microsoft Dynamics GP

Notice in this ERP example that if one person's user ID and password allowed the authorization of both the purchase and receiving entry, he or she could execute processes that automatically match goods to invoices and prepare a payment. Therefore, as user IDs and passwords are assigned, proper segregation must be considered. A user should not be able to process incompatible duties, such as those cited in the foregoing purchase and receiving example. In addition, an ERP system should segregate authorizing a transaction from updating the related master file. As an example, a user's profile should not allow the initiation of a purchase and the maintenance of the approved vendor list (the master file). Since incompatible

## The Real World

In an ERP system with potentially thousands of users and processes that automatically trigger other processes, how is segregation of duties managed? A typical ERP system has many automated triggering processes. Following is an example of automatic triggering and the effect on segregation of duties:

Customer orders for goods may automatically trigger production runs, which in turn trigger inventory purchases communicated by

electronic data interchange to specified suppliers. When the warehouse clerk receives inventory from the supplier, he or she makes an entry to the system from the receiving dock, changing the status of the purchase order from "open" to "received." When accounts payable receives the invoice, which may occur electronically, the system matches goods received to invoices received, automatically creating a payable and scheduling payment.<sup>2</sup>

<sup>2</sup> S.S. Lightle, and C.W. Vallario, "Segregation of Duties in ERP," *Internal Auditor*, October 2003, p. 28.

duties may allow one person to process potentially fictitious or fraudulent transactions that would eventually be posted to the general ledger, these transactions would automatically be included in the company's financial statements. Therefore, in order to promote accurate financial reporting, ERP systems must control access so that incompatible duties cannot be performed by any employee. Chapter 6 discusses more details of segregation of duties in ERP systems.

## Adequate Records and Documents

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To maintain adequate records and documents, there are two important requirements. First, the organization must have a well-defined chart of accounts. To reduce the chance of misclassified transactions that are posted to an incorrect account, the chart of accounts must be designed in a way that minimizes confusion about the types of transactions that belong in each individual account. The chart of accounts should have a sufficient number and type of accounts that facilitate the accurate classification of transactions. For example, if there is no "Rent Expense" ledger account, users will be uncertain where to post a payment for rent. Different users could post it to different accounts. This nonconsistency would make the balances in those accounts less useful, since no one could easily tell whether rent is included.

Second, there must be an adequate audit trail to allow tracing transactions back to the source. All transactions of the organization should have an audit trail that allows the transaction to be tracked from its initiation through its recording in the general ledger. In a manual system, the source documents, special journals, subsidiary ledgers, journal vouchers, and general ledger make up the audit trail. Using this documentation, a transaction can be traced from the source document to the general ledger. Transaction tracing can also occur in the opposite direction, starting with the general ledger and tracing the amounts back to the original source documents.

In computerized IT accounting systems, the audit trail may be made up of electronic images in files, with no supporting paper documents or records. Thus, the audit trail could be either of these extremes—paper documents or computer files—or the audit trail could be partially paper based and partially electronic images. For example, the audit trail would be made up of paper source documents, transaction logs, transaction files, and master files.

## Security of the General Ledger and Documents

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IT accounting systems protect records by limiting access through the proper use of user IDs, passwords, and resource authority tables. These general controls establish which employees have access to specific records or files.

## Independent Checks and Reconciliation

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In a general ledger system, the reconciliation of special journals and subsidiary accounts to the general ledger control accounts is an independent check on the accuracy of recording regular, recurring transactions. In addition, appropriate managers should regularly review general ledger reports for accuracy and completeness. In an IT system, reports are checked for correctness by printing and cross-checking the reports against each other to ensure their accuracy. Exhibit 12-10 summarizes the controls and risks in general ledger processes.

**EXHIBIT 12-10****General Ledger Controls and Risks**

<b>Control</b>	<b>Minimizes the Related Risk of:</b>
<b>Authorization:</b> Journal vouchers signed or approved electronically  Log-in procedures such as user ID and passwords to limit authority to designated employees	Fraudulent posting to cover theft; errors caused by posting batches before errors are corrected in the batch  Fraudulent entries or transactions
<b>Segregation of Duties:</b> Segregate (1) authorization from general ledger recording; (2) asset custody from general ledger recording; (3) special journal and subsidiary ledger recording from general ledger recording	Theft and fraud; undetected errors that cause accounts, special journals, or subsidiary ledgers to be out of balance
<b>Records and Documents:</b> Well-defined and complete chart of accounts Audit trail of supporting documentation and records (electronic and hard copy documents and transactions)	Amounts posted to wrong accounts Transactions not recorded or recorded incorrectly
<b>Security:</b> IT controls over computer records and physical controls in general ledger record storage areas	Invalid general ledger postings
<b>Independent Checks and Reconciliations:</b> Subsidiary ledgers reconciled to general ledger control accounts  Regular, periodic general ledger reports reviewed by appropriate managers	Fraud and errors  Fraud and errors

## Reporting as an Output of the General Ledger Processes (Study Objective 7)

The information in the general ledger accounts provides important feedback for both internal and external parties. External parties such as investors and creditors use summarized accounting data in the general purpose financial statements to evaluate business performance. Internal managers need financial and nonfinancial feedback for proper planning and control of operations. Internal managers need much more frequent and detailed reports than external users. The sections that follow describe the external and internal reporting concepts.

### External Reporting

The four general purpose financial statements—balance sheet, income statement, statement of cash flows, and statement of retained earnings—are created from general ledger account balances. These financial statements are generated at the end of the accounting cycle. The dollar amounts reported are all derived from general ledger account balances. Usually, accounts are combined and summarized when reported in general purpose financial statements. External users do not need

detailed balance information on every existing account in the general ledger. For example, a large company may have several general ledger accounts for various types of cash and cash equivalents. These individual cash accounts are combined, or “rolled up,” into one dollar amount reported as Cash on the balance sheet. This same summary process occurs for all of the line items on the general purpose financial statements. Sales revenue as reported on the income statement may be a combination of many revenue accounts in the general ledger. There may be a revenue account for each product or product line so that managers can track sales of individual products. However, external users would be overwhelmed by the detail in several revenue accounts. Therefore, the revenue accounts are rolled up into one or a few lines on the income statement.<sup>3</sup>

The IT accounting systems are programmed to combine, or roll up, accounts when the system processes the financial statements. The financial statements are designed and programmed into the IT system when the system is implemented. When these financial statement reports are needed at the end of the period, they may be printed by the IT system. Prior to the printing and distribution of these reports, the CFO and the accounting staff oversee the closing process to ensure that the dollar amounts are correct and complete, usually by printing various reports in the IT system and reconciling them to ensure their accuracy.

## Internal Reporting

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The internal reports to be provided to managers vary greatly depending on several factors. Internal reports are usually not general-purpose financial statements, but reports that are tailored to the specific needs of each management level and function. The many factors that affect the type of report provided to internal users can be summarized so that they fall into three categories: the type of organization, the underlying function managed, and the time horizon.

**Type of Organization** Although this may seem obvious, the type of organization affects the type of reports that are needed to manage the organization. For example, manufacturing firms need different reports than retail firms or service firms. Manufacturing firms must have internal reports to help manage the flow of raw materials, work in process, and manufacturing labor. Retail firms do not have these processes. However, both retail and manufacturing firms manage inventories, while service firms do not. Therefore, service firm internal reports are more likely to focus on sales and the status of projects. Certainly, all three types of firms use revenue and profitability reports. Some organizations, such as governmental or charitable foundations, are not profit-oriented, so their internal reports tend to focus on cash flows, funding sources, and expenditures.

**Function Managed** The type of business function that a manager oversees also affects the type of reports needed. An operations manager needs reports about operations, such as reports about machine hours, down time of machines, units produced, defective units, and material usage. These types of operational reports may not be prepared from data in the general ledger. However, as transactions are recorded in the accounting processes, financial as well as nonfinancial data are

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<sup>3</sup> While the details are beyond the scope of this chapter, the FASB has issued guidelines for segment reporting that direct a company how to report revenue and expense items by major segments.

accumulated. Therefore, the accounting system often records both financial and operational data that can be used in reports.

Managers who direct financial aspects of a business need financial data in reports. For example, an accounts receivable manager needs reports that show aged accounts receivable. Higher-level managers examine financial reports regularly to properly manage sales, expenditures, cash flows, inventories, and many other financial aspects. These financial reports are prepared directly from ledgers, journals, and other accounting records.

**Time Horizon** The relevant time horizon impacts the type of reports needed by management. In day-to-day business activities, managers are likely to use details such as unit measures, physical counts, and other non-financial data. However, as the time horizon expands, the types of reports that are useful are likely to involve financial measures. For example, on a day-to-day basis a purchasing manager is likely to focus on physical counts such as quantities ordered; yet, as the time horizon lengthens to a month, financial data such as purchase price variances become more useful. Therefore, for time horizons of one month or longer, reports generated from general ledger information are likely to be very important.

## Ethical Issues Related to Administrative Processes and Reporting (Study Objective 8)



As in any business process, unethical or fraudulent behavior can occur in administrative processing and the reporting functions of an organization. However, in the processes described in this chapter, unethical and fraudulent behaviors are much more likely to be initiated by management, not employees. Employee fraud is more prevalent in the routine processes of sales, purchases, payroll, and other processes described in previous chapters, while management fraud is more prevalent in administrative processes and reporting. There are several reasons that unethical and fraudulent behavior tends to be management- rather than employee-initiated.

First, in a properly controlled system of administrative and reporting functions, employees do not have access to related assets or source documents. A review of the previous chapters reveals processes where employees have daily access to assets, source documents, and records. In processes related to sales, purchasing, and payroll, employees have access to assets such as inventory and cash. In addition, employees have access to source documents or records that can be fraudulently used. As examples, employees can inflate hours in their time card, steal cash or checks if they work in the mail room, steal inventory if they work in the warehouse, or process fictitious vendor payments if they work in accounts payable.

Second, administrative processes are tightly controlled and supervised by top management, as they require specific authorization. Employees do not have the authority to approve or initiate processes such as capital sources and investing. However, in processes such as sales, purchasing, cash receipts, and cash disbursements, employees are given general authorization to initiate and process transactions. This general authority can allow employees to initiate fraudulent transactions. Many relevant examples have been described in previous chapters, but another example may illustrate employee fraud when general authorization exists: If an accounts receivable employee is given general authorization to write off

uncollectible accounts, that employee might write off the account of a friend or relative even when it could be collected.

Finally, a huge volume of transactions is often generated by sales, purchasing, payroll, and conversion processes. The routine nature and volume of these processes make it easier for employees to hide fraudulent transactions or unethical behavior within the masses of transactions. As an analogy, think about the differences in very large classes and very small classes. The large classes with hundreds of students create an atmosphere that makes it easier for an individual student to remain anonymous, to not read material for class, to sleep in class, or to cheat on exams or assignments. However, the intimacy of smaller classes makes it much harder to hide such behaviors. Likewise, the huge volume of transactions in routine processes makes it easier to hide fraudulent or unethical behavior. On the other hand, administrative processes are nonroutine, and the number of transactions varies. Thus, unethical or fraudulent behavior is harder to conduct or conceal within administrative processes.

## Unethical Management Behavior in Capital Sources and Investing

Source of capital processes and investment processes, described in the early part of this chapter, present important sources and uses of capital in an organization. These processes should be undertaken for the overall good of the organization and in an ethically responsible manner. Accordingly, the related reports and other disclosures must be complete and accurate. Unfortunately, such processes can be misused or abused by management. For example, when raising capital, it is imperative that the investors or creditors be fully informed of all relevant information for making investment or credit decisions. Managers may sometimes be tempted to hide negative information when borrowing funds or selling stock. Such a lack of full and complete disclosure is unethical, because it is an attempt to mislead potential investors or creditors.

### The Real World

The following excerpted paragraphs describe a July 2004 lawsuit filed against Krispy Kreme Doughnuts, Inc., alleging that the company misled investors in the sale of its stock:

The Complaint alleged that Krispy Kreme, along with certain of its officers and directors, violated the federal securities laws by issuing a series of materially false and misleading statements to the market. These misstatements have had the effect of artificially inflating the market price of Krispy Kreme's securities.

Specifically, the Complaint alleged that the Company failed to disclose and

misrepresented the following material adverse facts which were known to defendants or recklessly disregarded by them: (1) that the Company used aggressive bookkeeping to boost its earnings when it acquired a franchise; (2) that its core businesses were actually underperforming; (3) that it had expanded too quickly, and would shut down factory stores and doughnut shops in an effort to improve productivity.<sup>4</sup>

It took more than two years for Krispy Kreme to resolve this lawsuit and correct its financial reporting processes. Its negative operating results, however, persisted for nearly six years.

<sup>4</sup> Press release of July 12, 2004, by Much, Shelist, Freed, Denenberg, Ament, & Rubenstein, P.C. Carol V. Gilden, Esq.

This Krispy Kreme example illustrates the fact that management can mislead investors by altering or omitting key data. To conduct stock sales ethically, management should fully and honestly disclose relevant information to investors.

The lawsuit against Krispy Kreme also emphasizes that investors depend on data over and above the numbers in financial statements. Certainly, the financial statements should be accurate and complete. But in addition, all footnote disclosures and other disclosures in the annual report should be complete and honest. Likewise, when borrowing funds from a bank or through bonds payable, management should fully disclose all relevant information to creditors. Management should be completely honest in providing information for the financial statements, footnote disclosures, and any related disclosures. Management should avoid misleading creditors about the financial status of the company or its ability to repay any borrowing.

## **Internal Reporting of Ethical Issues**

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To manage ongoing operations, management must review many reports. In addition, proper management of operations requires that reports be disseminated to lower-level managers for two important purposes. First, the reports provide feedback to lower-level managers who monitor and control the processes in which they are engaged. Second, these reports are used by upper management to evaluate and reward the performance of lower-level managers.

Top management has an ethical obligation to use financial and other reports to encourage beneficial and ethical behavior. Perhaps it is easier to understand this ethical obligation by looking at how the use of these reports can encourage unethical behavior. There is an old saying: “What gets measured gets done.” So, if top management uses a report such as a division income statement to evaluate and reward division managers, then division managers are motivated to increase profit in their division. A problem may arise when top management places too much emphasis on division profit and does not measure and reward other facets of performance. A heavy emphasis on profitability can lead to unethical behavior, such as manipulating numbers and transactions in order to show a higher profit. The manner in which top management uses reports can set either a proper ethical tone or an improper one.

To set a proper ethical tone, top management should measure several factors of managerial performance without over-emphasizing profitability or cost cutting. Many firms have adopted or are considering a balanced scorecard approach to internal reporting. A balanced scorecard measures several factors balanced among measures focused on four areas: financial, customer, internal processes, and learning and growth. When a firm uses several measures and includes nonfinancial measures, there is less pressure on lower-level managers to focus only on the financial numbers. Such an environment is less likely to encourage unethical behavior.

## **Corporate Governance in Administrative Processes and Reporting (Study Objective 9)**

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The four primary functions of the corporate governance process—management oversight, internal controls and compliance, financial stewardship, and ethical conduct—are each applicable to the administrative and reporting processes. These processes must include a proper corporate governance structure in order

to properly deter instances of fraud, theft, and misuse or manipulation of administrative resources and reports.

The systems, processes, and internal controls described in this chapter are part of a corporate governance structure. When management designs and implements administrative processes, it assigns responsibility for executing the related capital, investment, and general ledger functions to various employees. It must be mindful of the risks of stolen or misused capital, alteration of documents or reports, and other frauds in this process. Accordingly, it must also implement and monitor internal controls to minimize these risks. As management considers these assignments and monitors the underlying processes and controls, it is carrying out its corporate governance functions of proper management oversight and internal controls and compliance.

In recent years, the corporate governance process for many companies has been challenged by the adoption of the Sarbanes–Oxley Act and/or by the company's commitment to converge toward International Financial Reporting Standards (IFRS). These increased reporting requirements have made it imperative for companies to be well organized with the right resources to carry out the new tasks, adjust their systems and controls, and collect the additional information needed for compliance. It is essential that top management provides foresight and oversight in handling these and other transitions where new reporting requirements are introduced. Although this objective may not seem complex, securing dependable data across an entire organization requires a sharp network of high-achieving leaders, employees, and technology.

When management has designed, implemented, and continually manages processes and internal controls, it is helping to insure proper stewardship of the company's assets. Corporate governance requires proper financial stewardship, and since financing and investing transactions that are included in the administrative processes are concerned with proper use of cash—the asset on a company's balance sheet that is most susceptible to theft—financial stewardship is especially important.

One method of exercising corporate governance over administrative processes and financial reporting is through the company's budgeting process. If management is involved in the establishment and monitoring of measurable goals, it can be confident that it is addressing its financial stewardship obligation. Budget information can be monitored to help managers identify problem areas, as well as to establish responsibility for various functions and evaluate employee performance.

Finally, good corporate governance depends upon the ethical conduct of management. When management sets an appropriate tone at the top by consistently demonstrating and encouraging ethical conduct, it is more likely that a stronger system of corporate governance will result. Improved effectiveness and efficiency and reduced risks of fraud tend to accompany workplace environments marked by effective corporate governance.

## Summary of Study Objectives

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**An introduction to administrative processes.** There are three types of administrative processes: source of capital processes, investment processes, and general ledger processes. Source of capital and investment processes are nonroutine, low-transaction-volume processes that occur only as needed. The general ledger processes record data from all other business processes into the general ledger, and involve monthly closing and reporting.

**Source of capital processes.** Organizations undertake processes to raise capital only when necessary. These processes require specific approval by upper management, a determination of the type of capital source, executing the issuance of debt or equity, collecting the proceeds, and properly accounting for these processes.

**Investment processes.** Organizations undertake investment processes when there are excess funds that are not immediately needed in operations. Upper management must determine when to invest excess funds, decide whether to invest in marketable securities or treasury stock, execute the investment, and properly account for the investment processes.

**Risks and controls in capital and investment processes.** Raising capital is specifically authorized by upper management and closely supervised by management. In addition, employees do not usually handle cash or assets in these processes. Therefore, the most important controls are the proper management authorization and supervision of capital and investment processes.

**General ledger processes.** General ledger processes include recording all financial transactions in the appropriate ledger and journal, posting to the general ledger, and period-end processes such as recording adjusting entries and closing entries. In manual systems, the general ledger processes involve special journals, subsidiary ledgers, a general journal, and a general ledger. In IT systems for general ledger processes, there may be few or no paper documents or records. Accounting software modules accomplish functions similar to special journals and subsidiary ledgers. The posting to the general ledger may occur automatically in more complex IT systems.

**Risks and controls in general ledger processes.** Two of the more important internal controls in the general ledger processes are the authorization to record transactions and segregation of duties. In manual systems, the authorization is through a journal voucher and the segregation is accomplished by preventing general ledger employees from authorizing journal vouchers, maintaining custody of assets, and recording special journals or subsidiary ledgers. In IT systems, the authorization for recording transactions may be pushed to lower-level employees or even trading partners. Adequate documents and records, security, and independent checks are also internal controls necessary in the general ledger.

**Reporting as an output of the general ledger processes.** Both external and internal reports are prepared from general ledger information. The external reports are usually general purpose financial statements. Internal reports are numerous and varied. The nature of an internal report can vary with the type of organization, the function managed, and the time horizon.

**Ethical issues related to administrative processes and reporting.** Unethical or fraudulent behavior in administrative processes is more likely to be undertaken by upper level managers than by employees. In capital and investment processes, full and complete disclosure is a very important ethical obligation. Managers should also use internal reports in a manner that encourages ethical behavior.

**Corporate governance in administrative processes and reporting.** The administrative processes described in this chapter are part of the management oversight of

corporate governance. The internal controls and ethical tone and procedures within the administrative and reporting processes are also part of the corporate governance structure. Setting and monitoring financial goals, and establishing and maintaining reliable accounting journals and ledgers so that performance can be properly reported, are important to effective corporate governance. In addition, internal controls and ethical practices within the administrative processes help ensure proper financial stewardship of a company's administrative resources.

## Key Terms

**Administrative processes**  
**Capital**  
**Capital processes**  
**Investment processes**

**Special journal**  
**Subsidiary ledger**  
**Underwriter**

## End of Chapter Material

### Concept Check



- 1 Which of the following is not part of an administrative process?
  - a. The sale of stock
  - b. The sale of bonds
  - c. The write-off of bad debts
  - d. The purchase of marketable securities
- 2 Which of the following statements is not true regarding source of capital transactions?
  - a. These processes should not be initiated unless there is specific authorization by management at a top level.
  - b. Source of capital processes will result in potential dividend or interest payments.
  - c. Retirement of debt is a source of capital process.
  - d. The fact that these transactions and processes cannot occur without oversight by top management means other controls are not necessary.
- 3 The officer within a corporation that usually has oversight responsibility for investment processes is the
  - a. controller
  - b. treasurer
  - c. chief executive officer (CEO)
  - d. chief accounting officer (CAO)
- 4 Which of the following statements is not true regarding internal controls of capital and investment processes?
  - a. Internal controls aimed at preventing and detecting employee fraud in capital and investment processes are not as effective.
  - b. Top management fraud, rather than employee fraud, is more likely to occur.
  - c. Any fraud is likely to involve manipulating capital and investment processes.
  - d. Because of top management oversight, the auditor need not review these processes.
- 5 Which of the following statements is true?
  - a. Routine transactions are recorded in the general journal.
  - b. Nonroutine transactions are entered in the general journal.
  - c. Nonroutine transactions are recorded in a subsidiary ledger.
  - d. Nonroutine transactions are recorded in a special journal.
- 6 Regarding subsidiary ledgers and general ledger control accounts, which of the following is not true?
  - a. Total balances in a subsidiary ledger should always equal the balance in the corresponding general ledger account.
  - b. The general ledger maintains details of subaccounts.
  - c. Control is enhanced by separating the subsidiary ledger from the general ledger.
  - d. Reconciling a subsidiary ledger to the general ledger can help to detect errors or fraud.

- 7 Which of the following statements regarding the authorization of general ledger posting is not true?
- Posting to the general ledger always requires specific authorization.
  - User IDs and passwords can serve as authorization to post transactions to the general ledger.
  - A journal voucher serves as authorization for manual systems.
  - As IT systems become more automated, the authorization of general ledger posting is moved to lower levels of employees.
- 8 In a manual system with proper segregation of duties, an employee in the general ledger department should only
- authorize posting to the general ledger
  - post transactions to the general ledger
  - reconcile the subsidiary ledger to the general ledger
  - post transactions to the subsidiary ledger
- 9 Which of the following statements about reporting is true?
- External users need detailed, rather than summarized, information.
  - All reports, internal and external, are derived only from general ledger data.
  - All organizations need similar internal reports.
  - Internal reports are tailored to the specific needs of each management level and function.
- 10 Which of the following is not typically an area of measure in a balanced scorecard?
- Vendor
  - Customer
  - Financial
  - Learning and growth
- 15 (SO 2) How does the specific authorization and management oversight of source of capital processes affect internal controls?
- 16 (SO 3) Describe when an organization would have a need to undertake investment processes.
- 17 (SO 3) Why is the monitoring of funds flow an important underlying part of investment processes?
- 18 (SO 3) How are IT systems potentially useful in monitoring funds flow?
- 19 (SO 4) Explain how cash resulting from source of capital processes may be handled differently than cash in revenue processes.
- 20 (SO 4) What advantages would motivate management to conduct fraud related to source of capital processes?
- 21 (SO 4) Why are internal controls less effective in capital and investment processes?
- 22 (SO 5) How is a special journal different from a general journal?
- 23 (SO 5) How is a subsidiary ledger different from a general ledger?
- 24 (SO 5) In what way are subsidiary ledgers and special journals replicated in accounting software?
- 25 (SO 6) Within accounting software systems, what is the purpose of limiting the number of employees authorized to post to the general ledger?
- 26 (SO 6) In a complex IT system, how may a customer actually authorize a sale?
- 27 (SO 6) To properly segregate duties, what are the three functions that general ledger employees should not do?
- 28 (SO 6) In an IT accounting system, which IT controls ensure the security of the general ledger?
- 29 (SO 7) Describe the nature of reports for external users.
- 30 (SO 7) Does the general ledger provide all information necessary for internal reports?
- 31 (SO 7) How would operational internal reports differ from financial internal reports?
- 32 (SO 7) How does time horizon affect the type of information in internal reports?
- 33 (SO 8) Why are managers, rather than employees, more likely to engage in unethical behavior in capital and investment processes?
- 34 (SO 8) How do processes with large volumes of transactions make fraudulent behavior easier?
- 35 (SO 8) Explain the importance of full disclosure in source of capital processes.

## Discussion Questions

- 11 (SO 1) What characteristics of administrative processes are different from the characteristics of revenue, expenditures, or conversion processes?
- 12 (SO 1) How do other processes (revenue, expenditures, conversion) affect the general ledger?
- 13 (SO 2) How would you describe capital?
- 14 (SO 2) Describe the nature of the authorization of source of capital processes.

**Brief Exercises**

- 36 (SO 2) Describe the steps in source of capital processes and explain how top management is involved.
- 37 (SO 3) Describe the steps in investment processes and explain how top management is involved.
- 38 (SO 4) Explain the internal control environment of source of capital and investment processes.

- 39 (SO 5) Describe the steps in a manual accounting cycle.
- 40 (SO 6) Describe why there may be two authorizations related to revenue, expenditures, and conversion processes before they are posted to the general ledger.
- 41 (SO 7) For each report shown in the table below, indicate in the appropriate column whether the report is likely to be for internal or external users (some reports may be both), and whether data would come exclusively from the general ledger.

Report Name	Internal or External	Exclusively G/L Data?
Income statement		
Aged accounts receivable		
Inventory stock status		
Open purchase orders		
Machine down-time		
Cash flow statement		
Production units produced		

**Problems**

- 42 (SO 1, SO 2) Compare source of capital processes with sales processes in terms of
- the frequency of transactions
  - the volume of transactions
  - the magnitude in dollars of a single transaction
  - the manner of authorization
- 43 (SO 1, SO 3) Compare investment processes with sales processes in terms of
- the frequency of transactions
  - the volume of transactions
  - the magnitude in dollars of a single transaction
  - the manner of authorization
- 44 (SO 5) Exhibit 12-9 shows a screen capture from Microsoft Dynamics GP accounting/ERP software. The following modules in Dynamics GP are shown:

- Financial
- Sales
- Purchasing
- Inventory
- Payroll
- Manufacturing
- Fixed Assets

For each of the following transactions listed, explain which module you would choose and why:

- Entering an invoice received from a supplier
- Entering the receiving of materials at the shipping dock
- Entering a check received in payment of an account receivable
- Posting a batch of sales invoices to the general ledger
- Entering hours worked by employees
- Printing checks for suppliers

**Case**

- 45 (SO 6) Putnam Sound, Inc. (PSI) is a manufacturer of stereo speaker systems. The company prepares special journals and subsidiary ledgers for its revenue, expenditures, payroll, and conversion processes. For administrative processes, however, journal vouchers

are created for the related general ledger entries. Steve Jamison is the accounting clerk who has responsibility for preparing journal vouchers.

Journal vouchers are prepared on preprinted forms; however, these forms are not prenumbered.

Steve records a sequential journal voucher number on each form that is prepared. This procedure is in place because of the large number of journal vouchers that are typically voided each period at PSI. Because of the nonrouting nature of the underlying processes, it is not unusual for a journal entry to be revised once or twice before it is actually recorded.

Journal vouchers are posted to the general ledger on a biweekly basis. Once a journal voucher has been posted, Steve records it in a voucher log. This log is simply a chronological listing of all journal vouchers

written that allows Steve to account for the numerical sequence of vouchers.

On a bimonthly basis, Steve reconciles the subsidiary accounts to their control accounts in the general ledger and verifies that the general ledger is in balance.

**Required:**

Describe the internal control strengths and weaknesses of PSI's general ledger accounting processes. For any weaknesses, suggest an improvement.

## Solutions to Concept Check

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- 1 (SO 1) The following is not part of an administrative process: **c. The write-off of bad debts.** The write-off of bad debts occurs within revenue processes.
- 2 (SO 2) The following statement is not true regarding source of capital transactions: **d. The fact that these transactions and processes cannot occur without oversight by top management means other controls are not necessary.** Management oversight is an important internal control, but it does not negate the need for other controls.
- 3 (SO 3) The officer within a corporation that usually has oversight responsibility for investment processes is the **b. treasurer.** The treasurer is normally the officer with oversight and decision authority for investment processes.
- 4 (SO 4) The following statement is not true regarding internal controls of capital and investment processes: **b. Because of top management oversight, the auditor need not review these processes.** Even with top management oversight, it is still important for auditors to review these transactions.
- 5 (SO 5) The following statement is true: **b. Nonroutine transactions are entered in the general journal.** Routine transactions are initially posted to special journals and subsidiary ledgers. Nonroutine transactions are initially recorded in the general journal.
- 6 (SO 5) Regarding subsidiary ledgers and general ledger control accounts, the following is not true:
  - b. The general ledger maintains details of subaccounts.** Subsidiary ledgers maintain details of accounts, such as accounts for each customer in the accounts receivable subsidiary ledger.
  - 7 (SO 6) The following statement regarding the authorization of general ledger posting is not true: **a. Posting to the general ledger always requires specific authorization.** Especially in IT systems, general authorization is given to certain employees to post to the general ledger. The employees with this general authorization are given this authority through user ID and password.
  - 8 (SO 6) In a manual system with proper segregation of duties, an employee in the general ledger department should only **b. post transactions to the general ledger.** These employees should never authorize general ledger posting, post to subsidiary ledgers, or reconcile subsidiary ledgers to general ledger accounts.
  - 9 (SO 7) The following statement about reporting is true: **d. Internal reports are tailored to the specific needs of each management level and function.** Internal reports do vary greatly and are tailored specifically to the management level and function.
  - 10 (SO 8) **a. Vendor** is not typically an area of measure in a balanced scorecard. The areas of measure in a balanced scorecard are financial, customer, internal processes, and learning and growth.

# Data and Databases

### STUDY OBJECTIVES

This chapter will help you gain an understanding of the following concepts:

- 1.** The need for data collection and storage
- 2.** Methods of storing data and the interrelationship between storage and processing
- 3.** The differences between batch processing and real-time processing
- 4.** The importance of databases and the historical progression from flat-file databases to relational databases
- 5.** The need for normalization of data in a relational database
- 6.** Data warehouse and the use of a data warehouse to analyze data
- 7.** The use of OLAP and data mining as analysis tools
- 8.** Distributed databases and advantages of the use of distributed data
- 9.** Cloud-based databases
- 10.** Big Data and data analytics
- 11.** Controls for data and databases
- 12.** Ethical issues related to data collection and storage, and their use in IT systems

### The Need for Data Collection and Storage (Study Objective 1)

The Real World example on the next page will help you understand the context of many concepts covered in this chapter. Please read the Real World example to begin effective reading and studying of this chapter.

Each day that a business operates, it may have hundreds or thousands of transactions with customers and vendors. Every one of these transactions generates data that must be processed to fill customer orders and purchase inventory and supplies. **Data** is the set of facts collected from transactions, whereas **information** is the interpretation of data that has been processed. For example, to process a sale to a customer, the business must collect many data items from the customer such as name, address, credit card number, items ordered, and shipping address. The collection of data from all transactions that occur represents a large amount of data. This may be more obvious when you think of the volume of sales that occur at large companies such as Amazon, L.L. Bean, Lands' End, J.Crew, and Walmart, as presented in the Real World example on the next page. Similarly, each purchase of inventory or supplies involves collecting and processing a large amount of data. It is necessary to collect and process this data so that it can be translated into information that is useful to the business. Some describe this extensive data as Big Data and the process of making Big Data meaningful as Data Analysis or Data Analytics. Previous chapters described the accounting information systems that capture and process this large volume of data. However, those chapters did not describe the detail regarding the storage, retrieval, and use of this data.

The data collected in any transaction must be stored for many reasons, such as those listed below:

- 1.** To complete transactions from beginning to end, detailed data must be available regarding each step of the transaction.

## The Real World



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Think about the volume of sales transactions that occur on the websites of large Internet retailers such as Amazon, L.L. Bean, Lands' End, and J.Crew. It is estimated that these companies each process in excess of 120,000 transactions each day on their websites. For each transaction, important data must be collected about the customer, location, payment, and items sold.

Even more overwhelming is the volume of sales transactions processed by Walmart on any given day. In addition to its Web-based sales, consider Walmart's thousands of retail centers with several check-out lines at each location and long hours of operation. Consider the number of accountants and computers that might be required to manage all of the related records. It is no wonder that Walmart has one of the largest databases of any business organization in the world.

The Walmart database continually grows with new transactions. Some estimate that Walmart adds 1 billion rows of data per day. The company attaches RFID chips to merchandise so that inventory purchases, movement to stores, and sales are tracked in real time. Since the data for these events gets added to the database so quickly, the database grows and becomes more useful for immediate analysis. This allows Walmart to more quickly analyze and forecast inventory needs.

For a sale, this may involve taking the order, pulling items from the warehouse, shipping items, billing the customer, receiving the cash, and updating the customer account for sales and collections. For example, warehouse employees will not know which items to pull from warehouse shelves to be shipped to customers if they cannot see a record of the items ordered.

2. To follow up with customers or vendors and to expedite future transactions. For example, if a company stores name, address, and other details about its customers, those details will not need to be reentered when the customer places future orders. Many companies have added Customer Relationship Management (CRM) functionality to track customer information, buying trends, and consumer behavior. CRM systems are also able to target potential customers to promote specials or products that may address a particular customer's interests. For example, if Amazon had a CRM system and you purchased pool supplies from Amazon, Amazon would identify you as a pool owner or someone interested in purchasing pool supplies in the future. Amazon can then target its Internet marketing campaigns for all customers in the pool category when there is a sale on pool equipment or supplies.
3. To create accounting reports and financial statements. Without the underlying data for each transaction, it would be impossible for the system to provide information about assets, liabilities, revenues, and expenses for any accounting period.
4. To provide feedback to management so the company can operate as effectively and efficiently as possible.

Data collected from transactions is in the form of structured data. **Structured data** easily fits into rows and columns. These columns usually are fields of fixed length. An example would be 10 digits for a phone number. Customer name, credit card number, and total dollar amount of sales are other examples of data that easily fits into rows and columns. Companies also collect unstructured data. **Unstructured data** does not easily fit into rows and columns of fixed length. An example of unstructured data is the free-form text of a customer's online review of a product. Since accounting data is primarily structured data, the remainder of this chapter describes the typical storage and processing techniques used in organizations to manage the mountain of structured data resulting from their transactions. The topics described in this chapter include the following:

1. The storage media types for data: sequential and random access
2. Methods of processing data: batch and real time
3. Databases and relational databases
4. Data warehouses, data mining, and OLAP
5. Distributed data processing and distributed databases

After studying this chapter, you should have an understanding of how data is processed and stored, how it is used for processing and inquiries, and what considerations pertain to physical location of the processing and storage of data. There are many details and concepts in each of these areas, and this chapter provides only an overview of each of these. However, it should give you, an accountant, the general understanding you need to use, audit, and assist in the design of IT systems. In addition, ethical concerns related to data and the controls over data are discussed in this chapter.

## Storing and Accessing Data (Study Objective 2)

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The storage of data and the way in which data is used are strongly interrelated. To understand this concept, it may be helpful to think of how you store and use things in your personal life. Things that you need to find and use frequently are placed where you can easily grab them and go. For example, you frequently need your car keys, and you usually don't have time to search for them. So, you probably have a habit of keeping your keys in a handy spot at home to make them easy to get and use. In other words, the need to quickly access and use your keys has led you to store them in a fashion that makes it easy to find them and use them. On the other hand, you have items that you need less frequently. For example, you may have kept an accounting book from a previous class in case you ever needed it for reference. Since you probably will not refer to it often, your book can be put in a less accessible location, such as on a closet shelf. As you know, there is a limit to how much you can store in easy-to-access locations. Therefore, some items, such as your old accounting book, have to be put in less accessible places.

This personal life example leads us to an important concept about storing and using data. Data that will be needed quickly and frequently must be stored in a manner that allows frequent and quick access. The reverse is true also: Data that is stored in a manner that allows frequent and quick access is easy to access and use. By contrast, data that is needed less frequently or less quickly can be stored in a manner that does not allow frequent or quick access. This general principle of the relationship between intended data usage and method of storage is key to the underlying concepts within this chapter.

## Data Storage Terminology

The terminology used in data storage must first be mastered for you to properly understand the storage and usage of data in an IT system. The typical hierarchy of data is character, field, record, file, and database. A **character**, or byte, is a single letter, number, or symbol. A **field** is a set of characters that fill a space reserved for a particular kind of data. For example, last name, address, and hire date are all fields within a payroll data set. A field can be thought of as a column of data in a table. A set of related fields make a record. A **record** is the entire set of fields for a specific entity. For example, each employee must have a record in the payroll system. Each employee record includes fields such as last name, address, and hire date. The entire set of related records is a **file**. Exhibit 13-1 shows the concepts of field, record, and file.

An entire set of files is a **database**. For example, a payroll file, accounts receivable file, inventory file, and all other files in the IT system make up the database.

## Data Storage Media

The media on which data is stored has evolved and improved over the years, in the same way that the speed and power of computers have evolved and improved. In the early days of mainframe computers, data was stored on magnetic tape. **Magnetic tape** is a storage medium that allows only a sequential access type of storage. **Sequential access** means that data is stored in sequential or chronological order. This sequential storage can be thought of in the same way that music used to be stored on cassette tapes. If music is on cassette tape, it must be played in the order it was recorded. Using tape makes it more difficult to listen to songs in any order other than the sequence on the tape. Likewise, magnetic tape stores data in sequential order, and the data must be read in that sequence. To read record 10, the system must first read records 1–9. This is a very limiting type of storage because it is difficult and time consuming to access, read, or modify any specific record. The entire tape must be read in sequence to find that single record.

A magnetic tape of data storage media would not work well in modern IT systems. As described in the previous section of this chapter, data processing and storage methods are interrelated. Storing records in sequential order prevents the quick and easy access of a single record. Within organizations today, much of the data must be stored in a way that allows a single record to be accessed quickly. For

Field	→	EmplID	Last Name	First Name	Title	Hire Date	Address	City	State	Zip Code
Record	→	101	Labbe	John	Sales Representative	02/28/99	9065 Arlington Road	Cincinnati	OH	45238
		102	Grissom	Andrew	Accountant	03/05/98	312 Production Dr	Dayton	OH	45239
		103	Laver	Mitchell	Finance Manager	04/08/01	1062 Whirlway Dr	Aurora	IN	45226
		104	Prosser	Margaret	Accountant Staff 1	02/21/97	919 New Haven Road	Cincinnati	OH	45248
		105	Buckhalter	Nancy	Maintenance Specialist	09/07/98	8595 Stonebridge Dr	Florence	KY	41042-3563
		106	Singh	Ravi	Accountant Staff 2	10/27/01	677 Ridge Ave	Cincinnati	OH	45241
		107	Klinger	Robert	Accountant Staff 2	09/30/01	1605 Deercroft Court	Harrison	OH	45030-2009
		108	Courdell	Anne	HR Coordinator	07/21/02	8425 North Bend Rd	Cincinnati	OH	45242-3706
		109	Sampson	Jessica	Sales Representative	09/06/99	617 Sheppard Dr	Villa Hills	KY	41017

EXHIBIT 13-1 Data Hierarchy

example, to process a customer order, it is important to access that particular customer record without necessarily accessing all customer records. When a single record must be easily and quickly accessed from a file, random access (rather than sequential access) is needed. **Random access** means that any data item on the storage media can be directly accessed without reading in sequence. Therefore, random access is often referred to as direct access. Random, or direct, access is similar to the manner in which music is stored on an MP3 player. While there appears to be some order in which songs are stored, they can in fact be played in any order. If you choose to play only one song from an MP3 player, your MP3 player can quickly find, access, and play that song. Likewise, random access media will allow a single data item to be accessed or modified without reading the data in sequence. **Disk storage** is an example of random access media. A large number of IT systems use disk storage. This **direct access storage** is much more flexible because data can be accessed in sequence or directly. Much as you can choose to play songs on an MP3 player in any order you choose, data on disk can be accessed in sequence or in any other order.

## Data Processing Techniques (Study Objective 3)

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In transaction processing systems, transactions are processed either in batches or one at a time. **Batch processing** occurs when similar transactions are grouped together, and the group is processed as a batch. A familiar example of batch processing is processing payroll checks. All time cards for the pay period are collected, and the resulting pay checks are processed and printed in a group, or batch. Accounts payable and accounts receivable transactions are often processed in batches. For example, payments to vendors are often processed in batches. The alternative to batch processing is real-time processing. **Real-time processing** occurs when transactions are processed immediately. This processing is interactive because the transaction is processed when it is entered.

When determining whether batch or real-time processing is appropriate, system professionals must consider the following characteristics:

1. **Response Time.** Batch systems have slow response times, because the transactions are not processed until the whole group is ready to be processed. Real-time systems have fast response times, because transactions are processed as they are entered.
2. **Efficiency.** Batch processing is more efficient for a large volume of similar transactions. This is true for two reasons: First, persons who focus on gathering and processing similar types of transactions become efficient at handling those transactions. That is, they become more specialized. Second, there are economies of scale. Much as an assembly line is efficient, moving many like transactions through a system at the same time is efficient in terms of optimizing the use of personnel and computer resources. On the other hand, real-time processing is less efficient for large volumes of transactions, since there is duplication of effort involved in processing all transactions individually.
3. **Complexity.** Batch systems are much simpler than real-time systems because their hardware, processes, and audit trail are less complex. Batch systems have a very distinct and obvious audit trail, since there are well-defined start and end dates and a defined set of transactions between those dates. Payroll is, again, a good example of this. If payroll is processed every two weeks, then

Characteristic	Batch Processing	Real-Time Processing
Response Time	Slow	Rapid
Efficiency	Very efficient for large volumes of transactions	Less efficient for large volumes of transactions
Complexity	Simple	Complex
Control	Easier to control and to maintain an audit trail	More difficult to control and to maintain an audit trail
Storage	Data can be stored sequentially	Data must be stored on random access media

**EXHIBIT 13-2** Comparison of Batch and Real-Time Processing

there is a well-defined beginning date, ending date, and transaction group that belong in this batch. Conversely, real time systems require more complex hardware and software systems to properly manage the ongoing and interactive flow of data.

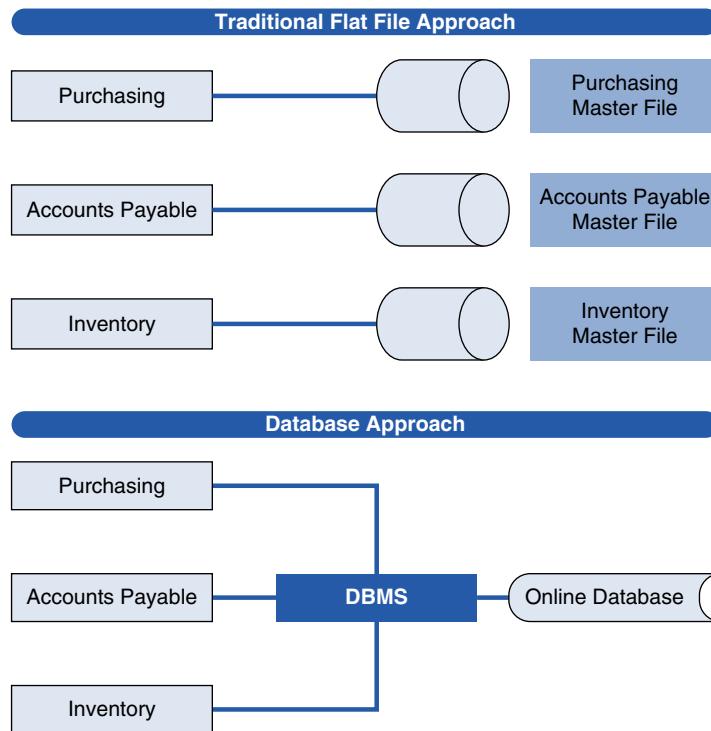
4. **Control.** In batch systems, control is easier to maintain. Since there are well-defined dates and transaction sets, control totals can be used to ensure accuracy and completeness. For example, the total number of hours on all time cards can be manually added, and this total can be compared with the computer-generated total for hours worked. This will ensure that the batch was accurately and completely entered and processed. Within real-time systems, control totals are difficult to use because there are no groups of transactions for which totals can be derived. Also, the interactive nature of real-time processing creates complexities in terms of maintaining an audit trail of file changes.
5. **Storage Media.** Batch processing systems can use either sequential or random access storage media. On the other hand, if real-time processing is to occur, records must be stored on random access media. To process a single record at a time, it is necessary to access that single record.

Exhibit 13-2 summarizes the characteristics of batch and real-time processing. Since Exhibit 13-2 shows that batch and real-time processing are opposite in each characteristic, system designers must weigh the trade-offs in deciding which is more appropriate. For example, if rapid response time is critical, system designers will choose real-time processing, even though it may mean less processing efficiency, more complexity, and more difficult control. Sales order systems are often designed as real-time processing systems to provide better customer service because the customer may need a rapid response. By contrast, there is no need for rapid response in a payroll system, since workers expect to wait until the end of the pay period to receive paychecks. Therefore, batch processing is often used in payroll.

## Databases (Study Objective 4)

A **database** is a collection of data stored on the computer in a form that allows the data to be easily accessed, retrieved, manipulated, and stored. The term “database” usually implies a shared database within an organization. Rather than each computer application having its own file, a database implies a single set of data that is shared by each application that uses the data. Exhibit 13-3 illustrates this data sharing concept.

The top half of the exhibit shows a traditional file-oriented approach to data storage. Each application owns the data file that it uses, and there is no sharing of data even though these applications do in fact use some of the same type of data



**EXHIBIT 13-3** Traditional File-Oriented Approach and the Database Approach

(such as inventory part numbers and descriptions). This lack of sharing leads to data redundancy. **Data redundancy** occurs when the same data is stored in more than one file. In this case, inventory part numbers and descriptions may exist in all three files. Data redundancy causes concurrency problems. **Concurrency** means that all of the multiple instances of the same data are exactly alike. If the same records are stored in many different locations, it is difficult to make sure that they all are updated at the same time (concurrently). For example, changing the address of a customer may mean changing it in three different places. In such cases of data redundancy, errors in updating the data are much more likely to occur. Thus, the data is more likely to have errors. Due to this data redundancy, errors in the data are likely to result from adding records, deleting records, and editing or changing records.

The lower half of Exhibit 13-3 illustrates a shared database approach. All data is stored once in a shared database, and the data is available to all applications that use the data. Notice that this eliminates data redundancy and concurrency problems. Since the data is stored only once, any and all changes to a record are immediately available to those who share the data. Adding records, deleting records, and editing records are less likely to cause erroneous data when the data is stored only once.

The DBMS symbol in Exhibit 13-3 represents the database management system. The **database management system (DBMS)** is a software that manages the database and controls the access and use of data by individual users and applications. The DBMS determines which parts of the database can be read or modified by individuals or processes. Before beginning the technical discussion of databases, it is useful to define database terms and to examine a brief history of databases. This history is useful in understanding the current environment and database use in organizations.

Data reveals relationships between records. These relationships can be thought of as parent–child relationships. One parent can be related to one or more children. The types of relationships in data are one-to-one, one-to-many, and many-to-many. **One-to-one relationships** are those where one entity in the data is related to only one other entity. An example of one-to-one would be employees and Social Security numbers. Each employee has only one Social Security number, and each Social Security number belongs to only one person. **One-to-many relationships** are those where one entity in the data is related to more than one other entity. Each individual employee can have several time cards in a given year. Notice, however, that this one-to-many relationship is in one direction only. That is, while an employee is related to several time cards, each time card belongs to only one employee. Most data in accounting transactions exhibit one-to-many relationships. Examples are a vendor to many invoices, a customer to many orders, a customer to many payments, and an order to many items in the order. **Many-to-many relationships** are those in which one entity is related to many other entities, and the reverse is also true. An example of a many-to-many relationship is vendors to items and items to vendors. That is, a single vendor can supply several items, and any single item can be supplied by many vendors.

## The History of Databases

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**Flat File Database Model** The earliest databases, from the period of the 1950s and 1960s, are called **flat file databases**. The term flat file comes from the idea that data is stored in two-dimensional tables with rows and columns. In a flat file table, each row is a record and each column is a characteristic related to the records. For example, each employee has the characteristic of a certain hire date. In database terminology, columns are called attributes. Therefore, **attributes** are characteristics of a related record. Exhibit 13-4 illustrates such a table.

Flat file records are stored in text format in sequential order, and all processing must occur sequentially. No relationships are defined between records. These systems must use batch processing only, and batches must be processed in sequence. The system makes the processing of large volumes of similar transactions very efficient. However, it does not allow a single record to be quickly and easily retrieved or stored. Therefore, interactive, real-time processing is not possible with sequential, flat file databases.

Each table in a database must meet the following conditions:

1. Items in a column must all be of the same type of data. The column in Exhibit 13-4 titled “Last Name” must have only last names from each record.
2. Each column must be uniquely named.
3. Each row must be unique in at least one attribute (one column). If there were no differences in any column, the rows would be identical and one row could be deleted since it is a duplicate of another row.
4. Each cell at the intersection of a row and column must contain only one data item. In this example, each employee can have only one hire date.

The flat file database and each database model described next are based on tables with the four characteristics just listed.

**Hierarchical Database Model** As computer processing power increased, databases evolved into the hierarchical model. **Hierarchical databases** define relationships between records by an inverted tree structure. These relationships are called

EmpID	Last Name	First Name	Title	Hire Date	Address	City	State	Zip Code
101	Labbe	John	Sales Representative	02/28/99	9065 Arlington Road	Cincinnati	OH	45238
102	Grissom	Andrew	Accountant	03/05/98	312 Production Dr	Dayton	OH	45239
103	Laver	Mitchell	Finance Manager	04/08/01	1062 Whirlway Dr	Aurora	IN	45226
104	Prosser	Margaret	Accountant Staff 1	02/21/97	919 New Haven Road	Cincinnati	OH	45248
105	Buckhalter	Nancy	Maintenance Specialist	09/07/98	8595 Stonebridge Dr	Florence	KY	41042-3563
106	Singh	Ravi	Accountant Staff 2	10/27/01	677 Ridge Ave	Cincinnati	OH	45241
107	Klinger	Robert	Accountant Staff 2	09/30/01	1605 Deercroft Court	Harrison	OH	45030-2009
108	Courdell	Anne	HR Coordinator	07/21/02	8425 North Bend Rd	Cincinnati	OH	45242-3706
109	Sampson	Jessica	Sales Representative	09/06/99	617 Sheppherd Dr	Villa Hills	KY	41017

EXHIBIT 13-4 Database Table

parent-child, and they represent one-to-many relationships. Therefore, the hierarchical model of a database could incorporate one-to-one and one-to-many relationships in the data. These relationships are permanently and explicitly defined in the database by data linkages. The data is linked by these explicit relationships in a record linkage structure such as record pointers. A **record pointer** is a column value in the table that points to the next address with the linked attribute. This linkage allows quick retrieval of records in that linkage chain. For example, a payroll database could have linkages from plant location to department to employee. Exhibit 13-5 illustrates a hierarchical relationship linkage.

If the desire is to quickly retrieve records for employees in Plant 1, the record access can be quick because of the built-in linkage. However, if we desired to retrieve only records of all employees who work in Department 1, there is no single set of linkages that make the retrieval easy. Each record would be read in sequence to see whether that employee worked in Department 1. Hierarchical databases are efficient in processing large volumes of transactions, but they do not allow for easy retrieval of records except for those within an explicit linkage. This means that hierarchical databases are not flexible enough to allow various kinds of inquiries of the data.

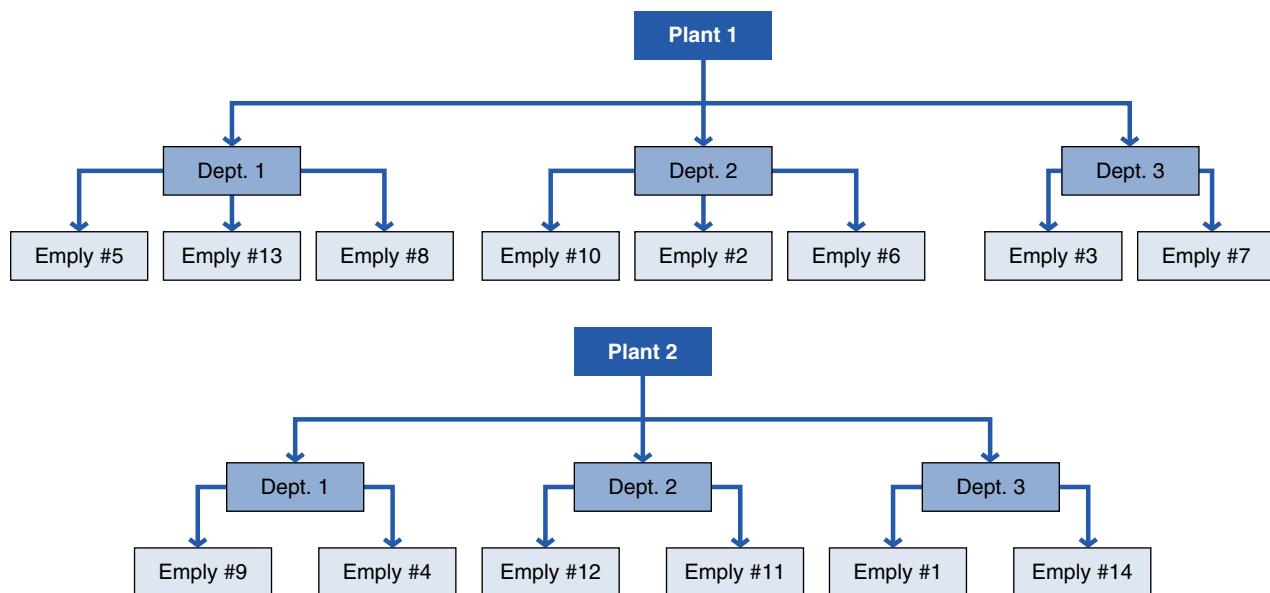


EXHIBIT 13-5 Linkages in a Hierarchical Database

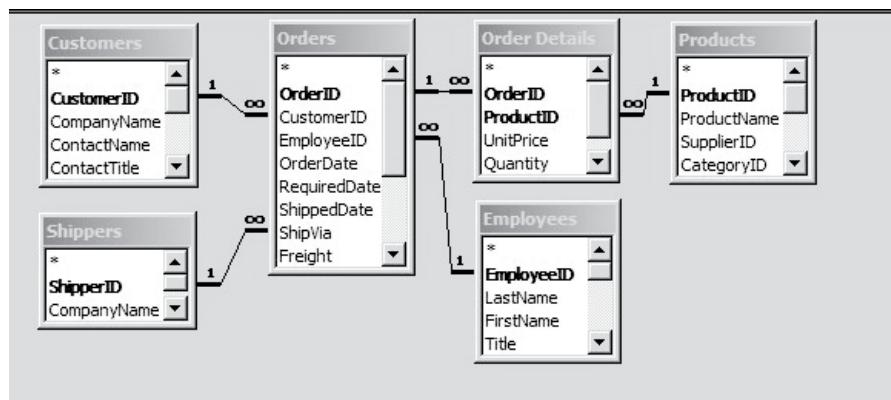
**Network Database Model** To slightly improve the recognition of relationships in databases, the network model of databases was developed next. **Network databases** are also built on the inverted tree structure, but they allow more complex relationship linkages by the use of shared branches. This essentially means that there is more than one set of inverted tree branches into the data. However, the network model has not been very popular, and it is rarely used today. Both the hierarchical and network models have many disadvantages. In both models it is impossible to add new data unless all related information is known. A new vendor cannot be added to a database until it is known which items will be purchased from that vendor. In addition, deleting any parent record will also delete all child records.

**Relational Database Model** In 1969, a mathematician named E.F. Codd developed a model of databases that allows the inclusion of more complex data relationships. He termed this model the relational database. A **relational database** stores data in two-dimensional tables that are joined in many ways to represent many different kinds of relationships in the data. Although it took many years for the computing technology to be available to implement his ideas broadly, the relational database structure is the most widely used database structure today. IBM DB2, Oracle Database, and Microsoft Access® are all examples of relational databases.

## The Need for Normalized Data (Study Objective 5)

Relational databases consist of several small tables, rather than one large table as in the flat file database. The small tables in a relational database can be joined together in ways that represent relationships among the data.

For example, examine the tables and relationships of a Microsoft Access database in Exhibit 13-6. Each box is a table, and the field names are listed in each box. The bolded field is the primary key. The **primary key**, the unique identifier for each record in each table, is used to sort, index, and access records from that table. The lines between boxes indicate the relationships between the tables. The relationships indicated in these tables are one to many. For example, one customer (CustomerID), can have many orders listed in the Orders table. Note that the Customers table and the Orders table are linked by CustomerID. In the Orders table, the CustomerID field is a foreign key field. In other words, CustomerID is in a different (foreign)



**EXHIBIT 13-6** A Relational Database in Microsoft Access

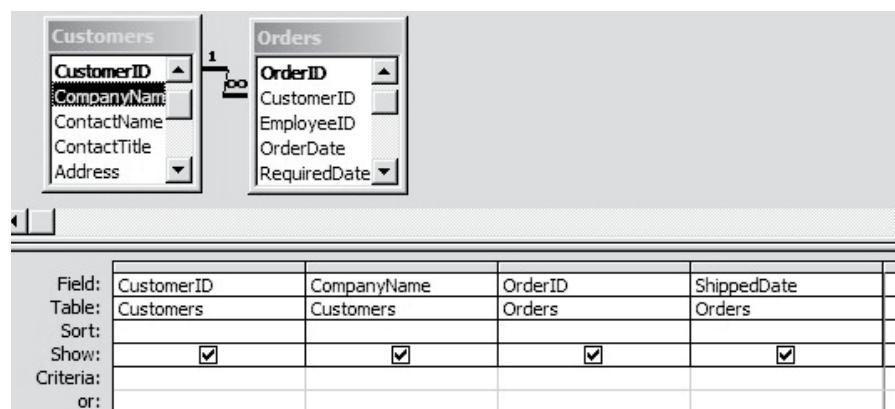
table, but is needed in the Orders table to establish the link between Customers and Orders.

These separate tables and the relationships between the tables are what establish the advantage of a relational database. The advantage is that a relational database has flexibility in retrieving data from queries. The developer of the relational database envisioned an English-like query language that could be used to directly access data from the relational database. The query language that has become the industry standard is **structured query language**, or **SQL**. By using SQL and joining these tables together in certain ways, nearly any query about customer orders can be answered. If a manager wants to know which customers have placed orders that have been shipped, the Customers and Orders tables can be joined to extract the columns (fields) for CustomerID, Company-Name, OrderID, and ShippedDate. The view of this query and the SQL to extract the data are shown in Exhibit 13-7.

Notice that the SQL query language is relatively plain English. It identifies which fields are selected from which tables and how the tables are to be joined. The tables are joined by OrderID. That relationship is a one-to-many relationship. Any customer may have more than one order.

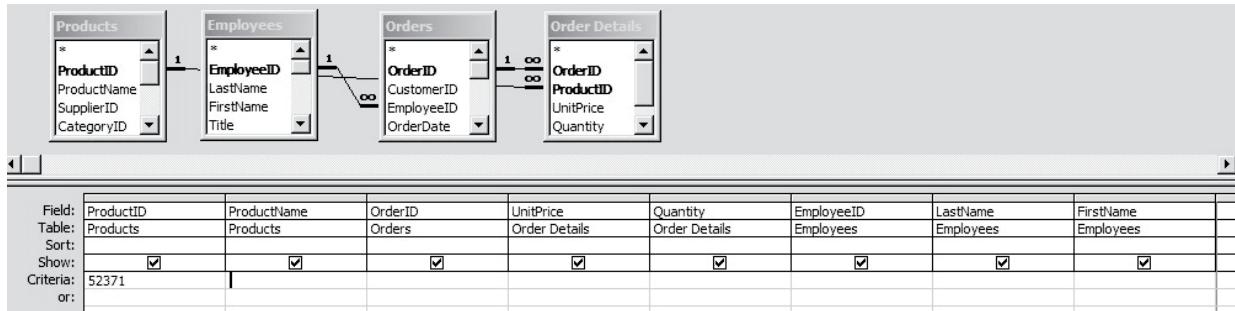
A more complex example involves a manager who needs to know which employees have sold product 52371. By using SQL, the manager can join the Orders, Employees, Order Details, and Products tables to retrieve this data. Exhibit 13-8 shows the Access design view of this query. Notice that this query has a “WHERE” condition. The extracted data is filtered in the sense that the ProductID must be equal to 52371. These queries show the flexibility of the relational database that is constructed with many tables. The relational database is flexible because any number of different queries can be answered by joining tables in various ways. Some examples of queries that could be answered from the tables in Exhibit 13-6 are as follows:

1. Quantity and price of orders by customer
2. Customers who purchased from a specific employee
3. Orders shipped by a specific shipping method
4. Number of products sold between certain dates



```
SELECT Customers.CustomerID, Customers.CompanyName,
Orders.OrderID, Orders.ShippedDate FROM Customers INNER
JOIN Orders ON Customers.CustomerID = Orders.CustomerID;
```

**EXHIBIT 13-7** Design View and SQL of a Simple Query



```

SELECT Products.ProductID, Products.ProductName, Orders. OrderID, [Order
Details].UnitPrice, [Order Details]. Quantity, Employees.EmployeeID,
Employees.LastName, Employees.FirstName FROM Products INNER JOIN ((Employees
INNER JOIN Orders ON Employees.EmployeeID = Orders. EmployeeID) INNER JOIN
[Order Details] ON Orders.OrderID = [Order Details].OrderID) ON
Products.ProductID = [Order Details].ProductID WHERE
(((Products.ProductID)=52371));

```

**EXHIBIT 13-8** Design View and SQL of a Complex Query

There are very few queries that could not be answered by joining these tables in various ways. The tables are flexible enough to answer an unlimited number of queries. To obtain this flexibility, the tables within a relational database must be designed according to specific rules. The process of converting data into tables that meet the definition of a relational database is called **data normalization**. There are seven rules of data normalization, and these rules are additive. The additive characteristic means that if a table meets the third rule, it has also met rules one and two. Most relational databases are in third normal form, which means they met the first three rules of data normalization. The first three rules of data normalization are as follows:

1. *Eliminate repeating groups.* This rule requires that any related attributes (columns) that would be repeated in several rows must be put in a separate table. Exhibit 13-6 presents an example of the application of this rule. There is an order table and an order details table. If these were not separate tables, basic information about the order, such as customer ID and ship date, would have to be repeated for each item ordered.
2. *Eliminate redundant data.*
3. *Eliminate columns not dependent on the primary key.*

The flexible querying within relational databases is possible only when the tables are constructed to achieve third normal form.

## Trade-Offs in Database Storage

As discussed in the beginning of this chapter, the method of storage affects the usage of the data. While the relational database is very flexible for queries, it is not the most efficient way to store data that will be used in other ways. The quickest way to access and process records from a database when their intended use is the processing of a large volume of transactions is the hierarchical model. But, the hierarchical model is not flexible for querying. Thus, there is a trade-off of transaction processing efficiency for flexibility. If the major use of the data is for processing

transactions and not for answering queries, the hierarchical model is a more efficient storage choice. If the major usage of the data is to answer queries, the relational model is superior.

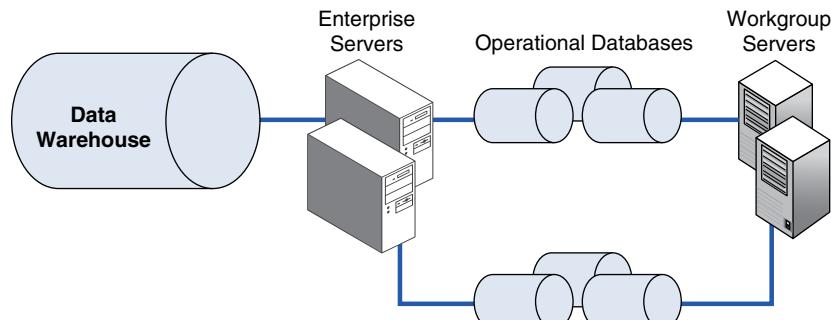
Obviously, much of the data from transactions requires both operations: processing transactions and querying. In today's IT environment, most organizations are willing to accept less transaction processing efficiency for better query opportunities. Therefore, most organizations use relational databases. The transaction processing efficiency loss is not problematic because computing power has tremendously increased while the cost has decreased.

The relational database has become very widely used in organizations because of this flexibility. Using relational databases and SQL, managers are able to query and extract data from the database on their own. They do not need to make requests to the IT department to design certain reports. This gives managers much more timely and flexible feedback information about operations. This improved access to information can help managers manage better.

## Use of a Data Warehouse to Analyze Data (Study Objective 6)

In many instances, the data that managers need is much broader than the set of data currently used in day-to-day operations. Management often needs data from several fiscal periods from across the whole organization. A data warehouse can serve as this source of broader information for management. A **data warehouse** is an integrated collection of enterprise-wide data that includes multiple years of nonvolatile data used to support management in decision making and planning. The data warehouse can be better understood if we compare it with the operational database. The **operational database** is the data that is continually updated as transactions are processed. Usually, the operational database includes data for the current fiscal year and supports day-to-day operations and record keeping for the transaction processing systems. Each time a new transaction is completed, parts of the operational data must be updated. For example, recording a sale means that sales, inventory, and receivables balances must be updated. This type of update does not occur in a data warehouse. Exhibit 13-9 shows the data warehouse and operational data layout.

The data is enterprise-wide because it is pulled from each of the operational databases, and this data is maintained in the data warehouse for many fiscal periods. Ideally, the data warehouse should contain five to ten years of data. The data in the data warehouse is pulled from sales order processing, inventory systems, receivables,



**EXHIBIT 13-9** The Data Warehouse and Operational Databases

and many other transaction processing systems within the organization. The data in a data warehouse is called nonvolatile because it does not change rapidly in the same way that operational data changes. Periodically, new data is uploaded to the data warehouse from the operational data, but other than through this updating process, the data in the data warehouse does not change.

## Build the Data Warehouse

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To ensure the usefulness of a data warehouse, it must be built correctly. The data in the data warehouse must support users' needs and must be standardized across the enterprise. Rather than collect and incorporate all of the available data into the data warehouse, it is important to include only data that meets user needs. Management, accounting, finance, production, and distribution functions will be using this data warehouse to budget, plan, forecast, and analyze profitability.

## Identify the Data

---

The data in the data warehouse must provide the right kind of information to the various user groups. To determine data that should be in a data warehouse, it is important to examine user needs and **high-impact processes (HIPs)**. HIPs are the critically important processes that must be executed correctly if the organization is to survive and thrive. The identification of HIPs must take into account the long-term strategic objectives of the organization.

An organization must set up cross-functional teams to identify the HIPs and the data that flows in and out of those processes. Each team must consider which critical processes help the company achieve its long-term strategic objectives. The cross-functional teams also must ask users what data they need and what kinds of business problems they face. By identifying and examining both HIPs and user data needs, the set of data needed in the data warehouse can be determined.

## Standardize the Data

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The data in the data warehouse will come from many different processes and subunits across the enterprise. Different applications within the enterprise might use the same information, but in a different manner. For example, both sales order

### The Real World

Anheuser-Busch Companies, Inc. must work to keep convenience stores and liquor stores well-stocked with the right quantities and varieties of beer. If too little is stocked, Anheuser-Busch will lose sales; if too much is stocked, excessive stocking costs may be incurred and freshness concerns arise. Therefore, the company's distribution system is a high-impact process.

Conversely, warranty repairs are not important at all to Anheuser-Busch. However, warranty repair processes are likely to be high-impact processes for a company such as Hewlett-Packard (HP) Co. HP sells computer products that typically carry warranties of 90 days to 1 year. Without customer responsive warranty repair systems, HP would very likely lose sales.

processing and marketing functions may use a field called “customer number.” The marketing system may have a customer account number that is five digits with three leading zeros. So, a customer account number might be 00053425. Sales order processing systems may use a customer field with five digits and two leading zeros. Therefore, the same customer in the sales order application would be 0053425. To incorporate all information about this customer from both the marketing and sales order systems, the account number must be standardized within the data warehouse. One could fairly ask, *Why not change the underlying marketing or sales order systems so that they agree?* Most companies do not feel that they can afford the time or effort to rewrite source code in their older, legacy systems. Rather than change existing systems, it is easier to standardize data in the data warehouse.

## Cleanse, or Scrub, the Data

Since the data in a data warehouse is likely to come from many different sources within the enterprise, there will probably be errors and inconsistencies in the data. To the extent possible, the data should be cleansed, or “scrubbed,” to remove or fix errors and problems in the data.

### The Real World

A large service company with project tracking, multiple lines of business and services throughout the United States decided to replace its legacy ERP system. Instead of taking the opportunity to update and improve its business processes, the company required the software vendor to highly customize the new ERP software so that it matched the prior business processes from the legacy system. Millions of dollars later, the project failed to be fully implemented and the company ended up with many disparate, nonintegrated business functions instead of an efficient, fully integrated ERP solution. First lesson: always take the time to do a business process review and invest in business process reengineering when implementing a new ERP system. Second lesson: minimize customizations when possible.

With multiple disparate systems where the same data had to be entered multiple times, there were many errors in the data and reports. A consulting firm later proposed that the solution to the problem would be to develop a data warehouse to pull the data from the different ERP modules and make it meaningful. Desperate for a solution, the company contracted with the consulting firm and invested several million

dollars more on this data warehouse project. Much to the company’s dismay, the consulting firm was not able to produce meaningful reports and data utilizing the data warehouse strategy. At that point, the company realized that it needed to implement a fully integrated ERP solution.

Upon completion of the final ERP project, the company realized that most of the reports that were promised from the data warehouse project were produced automatically from the new ERP solution. From this, it is concluded that data warehouse projects are complex and require internal or external IT resources that have extensive expertise in creating meaningful data warehouses, data analytics, and reporting. A strong ERP solution should be able to produce many standard reports without customization or addition of a data warehouse. Lastly, if the data put into an ERP system is not streamlined, entered once, and efficiently processed, the data that comes out of the system will be problematic, referred to as *garbage in, garbage out (GIGO)*. For accounting professionals, this is a good lesson, as many CFOs are ultimately responsible for the IT projects for their companies, or at a minimum for those that impact the ERP and financial systems.

## Upload the Data

Data from each of the HIP systems must be uploaded to the data warehouse. Also, on a regular basis, new data should be uploaded to the data warehouse. Between the dates when data is uploaded, the data warehouse is static—it does not change. As an example, if data is uploaded at the end of every month, there are no changes in the data warehouse until the last day of the month.

# Data Analysis Tools (Study Objective 7)

The purpose of a data warehouse is to give managers a rich source of data that they can query and examine for trends and patterns. The data warehouse allows managers to examine important patterns or trends so that they can better plan and control the business. The data warehouse can help managers examine trends such as sales by product, region, or model over a long time frame. Data in the data warehouse is analyzed by data mining and analytical processing.

Various techniques and tools have been developed to analyze data in a data warehouse, and this analysis enhances the ability of the business to meet customer needs, improve strategic planning, and increase performance. While there are many data analysis tools and techniques, this section will describe one important technique: data mining. The tools used in data mining are generally called online analytical processing (OLAP). There are special variations of OLAP called relational online analytical processing (ROLAP), and multidimensional analytical processing (MOLAP; also called data cubes). But these special types of OLAP are much more technical topics that are beyond the scope of this chapter. The descriptions here will focus on the general characteristics of data mining and OLAP.

## Data Mining

**Data mining** is the process of searching for identifiable patterns or systematic relationships in data that can be used to predict future behavior. This is often called predictive analytics. Although there are many reasons to predict future behavior, the most popular use of data mining is to predict future buying behavior of customers. If businesses are able to more accurately predict customer buying behavior, they can plan appropriately to produce, distribute, and sell the right products to customers at the right time. Data mining techniques have considerable potential in a variety of areas. In the 1998 book *Discovering Data Mining*,<sup>1</sup> the following are offered as examples of the questions that data mining can answer:

- What kind of behavior pattern does your customer emulate?
- How can the organization make more sales to existing customers?
- In the sales databases, are there hidden patterns of buying?
- Who are the better customers, and who are the high-risk customers?
- How can you maintain loyalty from current customers?
- How can you identify unknown buying habits and specifically market to those habits?
- What are customer perceptions of company products?
- How do you improve operational and strategic business plans based on data mining results?

<sup>1</sup> Peter Cabena et al., *Discovering Data Mining: From Concept to Implementation*, Upper Saddle River, N.J., Prentice Hall PTR, 1998.

## The Real World

Anheuser-Busch uses data mining to track and predict beer buying behavior. Using a combination of its own data, market data, and data from a third party, Anheuser-Busch can track its own sales and competitors' sales, revise marketing strategies, and design promotions targeted to ethnic groups. Anheuser-Busch has a name for its database and the process of using it: BudNet. The company attributes its market share growth to BudNet. Anheuser-Busch even maintains a website for sales reps and distributors to use in accessing and analyzing data. The website, [www.budnet.com](http://www.budnet.com), is protected to allow use only by authorized parties.

Anheuser-Busch collects its own sales data by providing its salespeople with a handheld computer to use when they visit stores that stock Anheuser-Busch beer brands. Salespeople enter data such as new orders, shelf space devoted to Anheuser-Busch and competitor brands, and marketing promotions in use by competitors. The data is transmitted daily to regional Anheuser-Busch distributors and then to corporate headquarters. Brand managers examine the data and provide sales and demand information

and new promotion campaigns to distributors. Anheuser-Busch uses this data and computer technology to model and predict retail outlet buying patterns for the next 14–28 days. The model uses information such as sales history, price-to-consumer, holidays, special events, daily temperature, and forecasted data such as anticipated temperature, to create forecasts of sales by store and by product. Data is used by salespeople and distributors to rearrange displays, rotate stock, and inform stores of promotion campaigns.

In addition to using the internal data, Anheuser-Busch contracts with Information Resources, Inc. (IRI), to collect market sales data. IRI tracks every bar-coded purchase of beer at convenience stores and liquor stores. IRI also conducts consumer surveys of beer buyers. Using these buying trends, Anheuser-Busch creates promotional campaigns, new products, and local or ethnic targeting of markets. For example, more beer is sold by the can in blue-collar neighborhoods, whereas more bottles are sold in white-collar neighborhoods.<sup>2</sup>

Although it is difficult to describe the exact size of a data warehouse such as the one used by Anheuser-Busch, certainly it must be very large because it incorporates historical sales, shelf space information, and competitor information on a store-by-store basis. A data warehouse that large would require specific software tools to examine and analyze trends or patterns in the data. This is also true for any organization that maintains a large data warehouse. Software must be used to search for trends and patterns in the data. The general term for these software tools is **online analytical processing**, or **OLAP**, described in the following section.

## OLAP

**OLAP** is a set of software tools that allow online analysis of the data within a data warehouse. The analytical methods in OLAP usually include the following:

1. **Drill down** is the successive expansion of data into more detail, going from high-level data to lower levels of data. For example, in analyzing sales, drill

<sup>2</sup> [www.cnn.com/2004/TECH/ptech/02/25/bus2.feat.beer.network](http://www.cnn.com/2004/TECH/ptech/02/25/bus2.feat.beer.network)

down would involve examining sales for the year, then by month, then by week or day. This examination of successive levels of detail is drill down. Drill down capabilities can provide financial statement readers with excellent visibility into financial data details. Microsoft Dynamics GP is bundled with a financial reporting product called FRx that allows readers to drill down on the Revenue number and see revenues for each subunit of a consolidated company. Then they are able to drill into a subunit and see the revenue for each location or department in the subunit. Further drill downs could allow the user to see the totals in all of the accounts that rolled up into the location's revenue line item. This tool is especially helpful when completing a variance analysis and looking for which units or accounts contributed most to unexpected revenue or expense fluctuations.

2. **Consolidation**, or roll-up, is the aggregation or collection of similar data. It is the opposite of drill down in that consolidation takes detailed data and summarizes it into larger groups, while drill down takes high level data and breaks it into more detail.
3. **Pivoting**, or rotating, data is examining data from different perspectives. As an example, sales of beer can be examined by time (months), by store type (convenience store or liquor store), by container type (cans or bottles), etc.
4. **Time series analysis** is used to identify trends by comparing figures (such as sales) over several successive time periods.
5. **Exception reports** present variances from expectations.
6. **What-if simulations** present potential variations in conditions that are used to understand interactions between different parts of the business.

OLAP is the software tool that allows managers to access and analyze the data in the data warehouse. OLAP finds and highlights trends or patterns in the data.

## Distributed Data Processing (Study Objective 8)

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Many small companies house all of their operations in a single building. For these companies there is usually no need to consider the physical location of their database. A small company with only a single building would obviously store its data on a computer within that building. However, most mid-sized or large organizations have multiple locations, sometimes located throughout the world. Large and mid-sized organizations must decide where their data should be physically stored and in which locations it should be processed. For a fast-food franchise like McDonald's Corp., for example, management could decide to maintain one database of prices for the food products that it sells. Should that price data be in one location and all restaurant computer systems access that one database, or should prices be stored in regions or localities so that each location can charge different prices? This is only an example of the problems of physical data storage facing large organizations. The location of the data storage and the location of the processing of the data can have tremendous impact upon the efficiency and effectiveness of the company.

Like the McDonald's example that follows, all large organizations must make decisions about the data they maintain—decisions involving where data is physically stored and which locations process various data.

## The Real World

McDonald's has restaurants, warehouses, and offices located throughout the world; yet its corporate headquarters is in Oakbrook, Illinois. If McDonald's management decided that all data, including prices, must be stored in a database at corporate headquarters, what would have to happen when you order a cheeseburger at a McDonald's in Los Angeles? The cash register system would have to read pricing data from the database in Oakbrook, Illinois. This would be inefficient for several reasons. First, each McDonald's restaurant would be trying to read the same database simultaneously in order to

fill customer orders all around the world. Each of the McDonald's restaurants would need to be networked to the data in Illinois and would need to be able to access price data quickly to process the sale. This would generate so much network traffic that it would very likely overwhelm the network and computer system. In addition, if prices are stored only at corporate headquarters, it would become more difficult for each location to set its own prices. Certainly, it would be much more efficient for McDonald's to maintain pricing data at the local restaurants or in regional centers.

This question of locations for data storage and processing is usually considered in the context of choosing from two general approaches: centralized or distributed. Data can be stored in a central location, or it can be distributed across various locations. Similarly, the processing of data and transactions can occur only in a central location, or distributed across the various locations. In the early days of computing, data processing and databases were stored and maintained in a central location. These are called **centralized processing** and **centralized databases**. However, in today's IT environment, most processing and databases are distributed. In **distributed data processing (DDP)** and **distributed databases (DDB)**, the processing and the databases are dispersed to different locations of the organization. A distributed database is actually a collection of smaller databases dispersed across several computers on a computer network. The data is stored on different computers within the network, and the application programs access data from these different sites.

### DDP and DDB

Current IT systems use networks such as LANs and WANs extensively, enabling the easy distribution of processing and databases. Distributing the processing and data offers the following advantages:

1. **Reduced hardware cost.** Distributed systems use networks of smaller computers rather than a single mainframe computer. This configuration is much less costly to purchase and maintain.
2. **Improved responsiveness.** Access is faster, since data can be located at the site of the greatest demand for that data. Processing speed is improved, since the processing workload is spread over several computers.
3. **Easier incremental growth.** As the organization grows or requires additional computing resources, new sites can be added quickly and easily. Adding smaller, networked computers is easier and less costly than adding a new mainframe computer.
4. **Increased user control and user involvement.** If data and processing are distributed locally, the local users have more control over the data. This control also allows users to be more involved in the maintenance of the data, and users are therefore more satisfied.

5. **Automatic integrated backup.** When data and processing are distributed across several computers, the failure of any single site is not as harmful. Other computers within the network can take on extra processing or data storage to make up for the loss of any single site.

However, it is important to recognize that there are also disadvantages to the use of DDP and DDB, namely, increased difficulty of managing, controlling, and maintaining integrity of the data. A large database that is stored, maintained, and accessed at a central location is much easier to manage and control. To consider why this is true, think of a large building with only a single door. Controlling access to items stored in the building can be controlled by having security at that single door. However, every door that is added to the building affords another opportunity for someone to gain unauthorized access. Therefore, every door represents a point at which security must be enhanced. The same is true of distributed systems, wherein several sites within the organization can access the databases. The increased number of sites accessing the data causes a greater need for security and control of the database.

In addition, when data is located at several sites, concurrency control is a problem. Think about the McDonald's pricing situation presented earlier in this section. If McDonald's decides to increase the price of cheeseburgers by 10 percent, that pricing change has to be made at every locality which maintains pricing data. Notice that this price change would be much easier to implement if there were only one centralized price database. The price could be changed in this single centralized database, and the price change would immediately be seen by all those who use that database. These disadvantages do not cause organizations to avoid the use of DDP and DDB, but they do cause greater attention to be paid to security and control issues. Organizations that use DDP and DDB must have better controls in place to ensure the security and concurrency of the data.

There are also management issues that are more difficult to control in DDP and DDB. If local users have more control over the systems, there is a greater chance that local sites will have incompatible hardware, systems, or data. For example, a local site may buy hardware that is incompatible with the larger network system of the organization. Management can lessen these problems by enforcing policies regarding the purchase and use of hardware and software, and through tighter management of the databases.

To database users, the question of how or where data is stored continues to become less important; whereas, it's more critical to determine whether the data is easily accessible and whether it can easily be analyzed. As described in Chapter 2, many companies are moving some or all databases to cloud storage. Another name for this is Database as a Service, or DaaS. The next section explains cloud databases.

## Cloud-Based Databases (Study Objective 9)

**Cloud-based database** services are a fast-growing area of IT. Many of the largest computer-related companies are providers of cloud-based database services. These companies include Amazon (Amazon Elastic Compute Cloud), Google (Google Cloud Storage), Microsoft (Windows Azure), and IBM (IBM Smart-Cloud). A company can buy data storage from any of these providers or many other cloud vendors. Such an arrangement is Database as a Service (DaaS). The cloud provider generally provides not only the data storage space but also the software tools to manage and control the database. The customer company must have some IT structure to access and use the data stored in a cloud. However, the amount of IT structure maintained would be less if the database were stored onsite rather than at a cloud provider.

## The Real World

Procter & Gamble (P&G) is a multinational consumer products manufacturer of popular products such as Tide, Pampers, Swiffer, and numerous others. Over 4.8 billion customers world-wide use P&G products. Desiring an enhanced way to analyze buying patterns, customer desires, or customer feedback, P&G

contracted with cloud-based data analytics firm Teradata. This cloud solution allows P&G to store all global consumer data in one location and to use powerful data analytics tools to search for patterns and relationships in the data. The system is called "1, Consumer Place" and it is used for digital marketing optimization.<sup>3</sup>

Chapter 2 included a section describing general concepts of cloud-based computing and its advantages. Those same advantages apply to cloud-based databases, or DaaS, but they are slightly reworded below to focus on cloud databases:

1. **Scalability.** As a company grows, it can easily purchase new capacity from the cloud provider; it need not buy servers or new data storage, as the cloud provider already has the capacity. This scalability is also a tremendous advantage for spikes in business activity. If a company has a large increase in business volume during certain seasons, it can easily scale up the capacity purchased from the cloud provider. When the seasonal volume declines, it then can scale down the services it buys.
2. **Expanded access.** Once stored in the cloud, the data can be accessed by multiple devices from many different locations. This gives the company much more flexibility for those who use or analyze data. It also makes it easier for users to start up new computing capabilities.
3. **Reduced infrastructure.** The company has less need for servers and data storage, since most of these resources are provided by the cloud provider. It also means that data security and backups are provided by the cloud provider.
4. **Cost savings.** For many companies, the advantages of cloud computing translate into cost savings. This is not always the case, however. A cost-benefit analysis is generally required when considering adopting a cloud solution. Cloud computing is usually a pay-for-service model, where the company pays the cloud provider only for the level of services it actually uses. The scalability of the cloud means that the company no longer needs to maintain an IT system large enough for the peak demand periods. Cloud computing also allows a company to reduce its investment in IT hardware and IT support personnel. This eliminates the financial risk because the user company avoids making a significant up-front financial investment in technology-related resources that may have uncertain returns.

A company that stores all or part of its database in the cloud not only gains all of these advantages, but also recognizes certain risks. As discussed in Chapter 4, a user of cloud-based services is dependent upon the security, availability, processing integrity, and confidentiality controls of the provider. A company using DaaS from a vendor must investigate and monitor the IT controls that the cloud provider uses to protect the data.

A small to medium-size enterprise (SME) can more easily use cloud databases as its only database. Large companies, such as Fortune 1000 corporations, would probably store some databases onsite and other parts in a DaaS environment. The example of Procter & Gamble illustrates how a large company can use cloud databases for specific purposes.

<sup>3</sup> <http://www.teradatamagazine.com/v14n02/Features/Procter-Gamble-Journey-of-a-Lifetime/>.

# Big Data and Data Analytics (Study Objective 10)

**Big Data** is difficult to define, but generally it is considered as data that is so large and complex that usual database software and tools are not adequate to handle it. Big Data is of extremely large volume, variety, and velocity. These terms are constantly under refinement with regard to Big Data, but for our purposes, we will define them as follows:

- **Volume.** The quantity of data is so large that it goes beyond the bounds of the capacity of traditional databases and DBMS software. This data would likely be in the size of hundreds or thousands of terabytes, or a petabyte. The entire Library of Congress is approximately 235 terabytes.
- **Variety.** Computer stored data used to be structured data of fixed field lengths, such as 5 spaces for a zip code. Increasingly, data is becoming more varied and now includes such things as photos, unstructured comments on Facebook or Twitter, product reviews, and other textual data. Big Data can also include video and audio streams. In addition, this data comes from many different sources. Therefore, there is a large variety in type of data and source of data.
- **Velocity.** This term refers to how quickly the data is generated or changed. For example, the velocity of Twitter data would change by the second or even faster.

Companies are currently collecting, storing, and using Big Data to help improve sales or other strategic priorities.

## The Real World

As of 2015, Walmart was collecting and storing 2.5 petabytes of unstructured data from 1 million customers every hour. The company uses Big Data analytical tools to do data mining and to discover patterns in point of sales data.

"Data mining helps Walmart find patterns that can be used to provide users with product recommendations based on which products were bought together or which products were bought before the purchase of a particular product. Effective data mining at Walmart has increased its conversion rate of customers. A familiar example of effective data mining through association rule learning technique at Walmart is—finding that strawberry Pop-Tarts sales increased by 7 times before a Hurricane. After Walmart's data mining activities identified this association, it places

all the strawberry Pop-Tarts at the checkouts before a hurricane.

Walmart tracks and targets every consumer individually. Walmart has exhaustive customer data for close to 145 million Americans of which 60% of the data is of U.S. adults. Walmart gathers information about what customers buy, where they live, and what products they like through in-store Wi-Fi. The Big Data team at Walmart Labs analyzes every clickable action on Walmart.com—what consumers buy in-store and online, what is trending on Twitter, local events such as the San Francisco Giants winning the World Series, how local weather deviations affect buying patterns, etc. All the events are captured and analyzed intelligently by Big Data algorithms to discern meaningful insights for the millions of customers to enjoy a personalized shopping experience."<sup>4</sup>

<sup>4</sup> <https://www.dezyre.com/article/how-big-data-analysis-helped-increase-walmarts-sales-turnover/109>

Storing, analyzing, and understanding Big Data requires database tools and data analysis tools above and beyond what has been described previously in this chapter. Most companies are using a Big Data storage and analysis system called Hadoop. Organizations which are storing and using Big Data find that the sorting and analyzing of data allows them to better forecast or predict things that were difficult to forecast previously. Often, about 80–90 percent of Big Data is unstructured data that traditional data analysis tools cannot easily analyze. Hadoop is the tool that many companies use to store and analyze Big Data and its mixture of structured and unstructured data.

Traditionally, accounting practice has always used structured data. Structured data easily fits into two-dimensional tables of fixed lengths. For example, sales data has predefined and expected structured data such as the name of the customer, address, quantity purchased, price per item, and terms of the sale (such as net 30). Increasingly, companies are collecting and storing unstructured data such as in the Walmart example discussed previously. One such example would be Facebook or Twitter comments about their products and services. Accountants are in the process of finding ways to use unstructured data, and especially unstructured data in databases that are called Big Data.

Accountants are exploring ways to use Big Data and the following examples illustrate some of the ways Big Data is being used or may be used in the near future.

- Accountants within a company have usually been the source of much data for management control systems. An example of this would be cost accounting and the related variances. Big Data may enhance the types of data analysis that accountants could accomplish and improve the feedback in management control systems.
- The Big Four CPA firms are finding that the use of Big Data analysis tools allows them to analyze all transactions (not just a sample of transactions as was the typical audit practice).
- Internal auditors at companies such as BlueCross are using these analytics to find duplicate insurance claims within the millions of claims they process.
- The Securities and Exchange Commission (SEC) is using Big Data analytics to find financial statement fraud or audit failures. By analyzing the huge amount of financial data that it receives from all publicly traded companies, it can find companies with unusual data patterns that might be indicative of fraud.
- Big Data such as video and audio might become a supplement to financial reporting. For example, rather than just reporting the historical cost dollar amount of fixed assets, a company might be able to provide video that gives a better understanding of the nature and value of the fixed assets.

While the exact details of how accountants will use Big Data analytics are not yet fully fleshed out, it is fairly certain that accountants and auditors will need to incorporate Big Data in their analyses and reports. It is likely to become more important to you as you advance in your accounting or auditing career. However, it is too early to fully understand the impact of Big Data on accounting and auditing practice.

## IT Controls for Data and Databases (Study Objective 11)

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A company's database is a critically important component of the organization. The data is a valuable resource that must be protected with good internal controls. Chapter 4 described many of the IT internal controls that should be used to protect

the security and integrity of database. A brief summary of some of the IT controls is offered here. Three of the major control concerns related to databases are unauthorized access, adequate backup of the data, and data integrity.

IT general controls assist in preventing unauthorized access and in ensuring adequate backup. To help prevent unauthorized users from accessing, altering, or destroying data in the database, it is important to use authentication and hacking controls such as log-in procedures, passwords, security tokens, biometric controls, firewalls, encryption, intrusion detection, and vulnerability assessment. In addition to these control procedures, the database management system (DBMS) must be set up to allow each authorized user limited view (schema) of the database. That is, an employee who logs in as an accounts receivable processor should not have access to payroll data. Each user's schema of the data limits the user's view to only a subset of the data. Controls such as these are intended to keep unauthorized users from accessing or using data in the database. Business continuity planning, data backup procedures, and disaster recovery planning can help ensure adequate backup of databases.

To ensure integrity (completeness and accuracy) of data in the database, IT application controls should be used. These controls are input, processing, and output controls such as data validation, control totals and reconciliation, and reports that are analyzed by managers.

## Ethical Issues Related to Data Collection and Storage (Study Objective 12)

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There are many ethical issues related to the collection, storage, and protection of data in databases. Companies collect and store a wealth of information about customers in their databases. These ethical issues related to such data in databases can be examined from three perspectives:

1. Ethical responsibilities of a company to its customers
2. Ethical responsibilities of employees to the company and its customers
3. Ethical responsibilities of customers to the company

The ethical responsibilities that companies have to customers revolve around collecting only necessary data from customers, properly protecting customer data, limiting the sharing of customer data, and correcting errors in customer data. The ethical responsibilities of employees is to avoid browsing through data or customer records unless necessity dictates, not selling customer data to competitors, and not disclosing customer data to related parties. Customers also have ethical responsibilities related to their providing data to companies that they deal with. These would include providing accurate and complete data when those data is necessary, and upholding the obligation not to disclose or use company data that they may have access to. Each of these types of responsibilities is discussed in detail in the following sections. This discussion of ethical issues is not intended to list and describe all ethical issues related to databases, but to describe many of the important ethical considerations.

### **Ethical Responsibilities of the Company**

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The data collected and stored in databases in many instances consists of information that is private between the company and its customer. For example, your bank has your Social Security number in customer records, as well as the Social Security numbers of all its customers. This is an example of nonpublic data that your bank

should not share with anyone else. The bank has an ethical obligation to maintain the privacy of your data, such as your Social Security number, account balance, and telephone number. All companies collect at least some private data from customers. The sensitivity and privacy of that data depends on the nature of the business and the type of services or products sold. For example, a medical office has very private and confidential files on each patient. The medical office has an extremely high level of responsibility to protect the privacy of client information. On the other hand, a bookstore has very few pieces of private or confidential information from customers. However, a bookstore may have some data that is private, such as credit card numbers and data on buying habits and types of books purchased. Even companies that do not sell to end consumers collect and store private data. For example, Anheuser-Busch sells beer to convenience store chains and grocery store chains. Each chain it sells to has data that it wishes to keep from competitors, such as data on credit limits, prices paid, and quantities purchased.

Online companies that sell via websites have an even higher duty to maintain customer privacy and confidentiality. In fact, the AICPA Trust Services Principles (described in Chapter 4) have an entire section devoted to online privacy. Within the Trust Services Principles, the privacy framework lists 10 privacy practices that should be adhered to by online companies:

1. **Management.** The responsibility for an organization's privacy practices should be assigned to a specific person or persons. That responsible person should ensure that the organization has defined and documented its privacy practices, and that they have been communicated to both employees and customers. Management would also include the responsibility to ensure 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" as detailed in Point 2. 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 ensure 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 addition to these ethical obligations to customers, companies have an ethical obligation to shareholders to ensure that company data is properly protected. For example, competitors may try to gain access to company data through what is generally called **industrial espionage**. Data is a valuable commodity, and the company value to shareholders can be harmed if sensitive data falls into the hands of competitors.

To properly protect data, companies should have appropriate internal controls as described in Chapter 4. These controls help prevent unauthorized access and browsing of data. Controls, including log-in procedures, passwords, smart cards, biometric controls, encryption of data, and firewalls, can provide some protection from unauthorized access to data.

## Ethical Responsibilities of Employees

Within organizations, many employees must have access to private data about clients and customers. These employees have an ethical obligation to avoid misuse of any private or personal data about customers. Three examples may help illustrate this ethical responsibility. Internal Revenue Service (IRS) employees regularly must

### The Real World

No matter how extensive the controls in place, it is never possible to completely eliminate unauthorized access. In April 2011, Netflix disclosed that it had fired an unnamed call center employee for stealing credit card information from customers he had spoken with on the phone. The company declined to disclose the number of customers affected. The

“monitoring and enforcement” mentioned earlier is intended to help discover problems such as this and to fix them quickly. In this case, a Netflix spokesperson said, “We do everything we can to safeguard our members’ personal data and privacy, and when there’s an issue like this, we deal with it swiftly and decisively.”<sup>5</sup>

<sup>5</sup> <http://www.networkworld.com/news/2011/050411-netflix-fires-call-center-worker.html>.

see and work with tax returns. However, they should never browse through, disclose, or improperly use tax return data. This is a legal duty, as well as an ethical duty, in the case of the IRS. Medical offices also maintain very private data about personal medical histories. The protection of those data from improper use is both an ethical and a legal responsibility. In the third case, the duty to avoid misuse of customer data is an ethical duty, but not necessarily a legal obligation. For example, a payroll clerk in a company may have access to employee pay rates. While it may not be illegal for the clerk to disclose these pay rates to others, it is certainly unethical to do so.

In addition, some employees have access to proprietary data that would be harmful to the company if disclosed. An example would be sales information by product. Competitors such as PepsiCo, Inc., and Coca-Cola Co. could gain competitive advantage if one of them acquired detailed knowledge about the other's sales data. Employees should never disclose proprietary or confidential data about their company to outsiders. One recent study reports that 60 percent of employees who quit or are asked to leave a company will steal data from their employer upon leaving. Often the purpose is to steal proprietary company data and give it to competitor.

There are no specific IT controls that would always prevent authorized employees from disclosing private information, but having and enforcing a code of ethics within the organization can reduce the chances of such disclosure. Proper IT controls, such as log-in procedures, passwords, smart cards, biometric controls, encryption of data, and firewalls, can help reduce unauthorized access by employees.

## Ethical Responsibilities of Customers

Certainly, customers have an obligation to provide accurate and complete information to companies that they deal with when the requests for such data are legitimate business needs. For example, when you apply for a new credit card, the issuing company deserves full and complete disclosure of your credit history. In addition to this obligation, customers in some cases may have access to company data that should be kept confidential. Customers have an ethical obligation to avoid the improper use of data that they gain from accessing a database as a customer.

### The Real World

Near Lexington, Kentucky, the breeding and racing of thoroughbred horses is a significant industry. Tracking the bloodlines of the thoroughbreds used as studs in breeding is important information to those who breed and race these horses. During the 1970s, a company named Bloodstock began maintaining a database of stud horse and mare bloodlines and race handicapping data. Breeders and others could establish an account with Bloodstock and access this computer database in choosing a stud horse to use for breeding or for handicapping races. Eventually, this database became a web-based resource called BRISNET.

In 1997, someone began establishing and using fictitious customer accounts to access the BRISNET database. Over a period of months, this person accessed and downloaded BRISNET data. He then posted this data to his own database and website and began selling the data at prices below those charged by Bloodstock. Upon discovery of this unethical act, the United States Attorney of the district surprisingly declined to charge the violator with federal crimes. However, Bloodstock settled out of court with the violator for an undisclosed dollar amount.<sup>6</sup>

<sup>6</sup> "The Bluegrass Conspiracy," *AJPLA Quarterly Journal*, Summer 2001, vol. 29, no. 3, pp. 319–322.

## Summary of Study Objectives

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**The need for data collection and storage.** Businesses need to collect and store data so that they can properly record and complete transactions in their day-to-day operations. This enables the company to carry out transactions in a manner that will satisfy customers and suppliers. It also allows the company to maintain detailed records that facilitate follow-up, feedback for future decision making, and preparation of financial statements.

**Methods of storing data and the interrelationship between storage and processing.** Data may be stored in characters, fields, records, files, and databases. The media on which data is stored may be sequential access or random access. The choice of data storage media may depend on the use of the data. Data that is accessed sequentially may be stored on magnetic tape, whereas disk storage is used for data that needs to be accessed randomly or directly.

**The differences between batch processing and real-time processing.** Batch processing involves the grouping of similar transactions into a batch and processing all of these items together. On the other hand, real-time processing involves continuous processing, where transactions are processed as soon as they occur or as soon as they are entered into the system. Although real-time processing is preferred because of the timely response, batch systems are still used for processing large volumes of data due to their lower cost and ease of control.

**The importance of databases and the historical progression from flat-file databases to relational databases.** A database makes it possible for an organization to share data, often across widely distributed users. Flat-file databases store data in two-dimensional tables in text format. Hierarchical databases use an inverted tree structure to define relationships among data. Network databases are an advanced version of a hierarchical database because they use the inverted tree structure; however, networks share branches. Relational databases are used in practice today more than the other types of databases. A relational database stores data in two-dimensional tables that are joined in many ways to represent many different kinds of relationships in the data.

**The need for normalization of data in a relational database.** The two-dimensional tables used in a relational database must be flexible enough to handle an unlimited number of queries. To obtain this flexibility, the database tables must be designed according to precise specifications. Data must be translated, or normalized, in order to meet these specifications.

**Data warehouse and the use of a data warehouse to analyze data.** A data warehouse is an integrated set of data that spans a long period (up to 10 years). The data is nonvolatile; however, it is used to support the company's strategic planning and the ongoing decision making of its managers. In order to build a data warehouse, the data must be identified, standardized, and cleansed before it is uploaded. An operational database, on the other hand, contains current-period data that is continually updated to support current operations and reporting.

**The use of OLAP and data mining as analysis tools.** Data mining involves analyzing data for patterns that can be used to predict future behavior. Data mining techniques are used in business organizations to predict customers' buying behaviors. OLAP is also used to find trends or patterns in data. OLAP is the software tool that allows managers to access and analyze the data in a data warehouse.

**Distributed databases and the advantages of the use of distributed data.** Distributed data processing is very important in companies where operations are dispersed among multiple locations. A distributed database is a dispersed system of networked databases. Centralized data processing, on the other hand, requires that the database is maintained at one centralized location, usually the company's headquarters.

**Cloud-based databases.** A growing trend is the use of cloud databases. A company that stores its data in a cloud database has the advantages of scalability, expanded access, reduced IT infrastructure, and cost savings. However, it must rely on the cloud provider's controls pertaining to security, availability, processing integrity, and confidentiality.

**Big Data and data analytics.** The amount and variety of data collected and stored by companies continues to expand dramatically. Big Data is a data that is so large and complex that typical database software and tools are not adequate to handle it. Accountants are trying to determine how to use data analytics on these large databases to improve accounting information, reporting, and audits.

**Controls for data and databases.** Business organizations must exercise care in ensuring the protection and security of its data. The most crucial controls for data protection include unauthorized access, adequate backup of the data, and data integrity. These topics were discussed in detail in Chapter 4.

**Ethical issues related to data collection and storage.** Companies have ethical obligations to their customers and employees, while customers and employees have ethical obligations to each other and to the companies with whom they do business. Each of these parties must be discreet in their business dealings so that privileged information is not divulged to outsiders. Employees also have an ethical duty to protect information obtained in the course of their jobs; such information should not be shared with others. Finally, customers have an obligation to provide complete and accurate information to the companies with whom they are doing business.

## Key Terms

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Attributes	Data warehouse	Hierarchical database	Random access
Batch processing	Database	High-impact processes	Real-time processing
Big Data	Database	Industrial espionage	Record
Centralized processing	management systems	Information	Record pointer
Character	Direct storage access	Magnetic tape	Relational database
Cloud-based database	Disk storage	Many-to-many relationships	Sequential access
Concurrency	Distributed processing	Network databases	Structured data
Consolidation	Drill down	OLAP	Structured query language
Data	Exception reports	One-to-many relationships	Time series analysis
Data mining	Field	One-to-one relationships	Unstructured data
Data normalization	File	Pivoting	What-if simulations
Data redundancy	Flat file database	Primary key	

# End of Chapter Material

## Concept Check



- 1 Which of the following best describes the relationship between data and information?
  - a. Data is interpreted information.
  - b. Information is interpreted data.
  - c. Data is more useful than information in decision making.
  - d. Data and information are not related.
- 2 A *character* is to a field as
  - a. water is to a pool
  - b. a pool is to a swimmer
  - c. a pool is to water
  - d. a glass is to water
- 3 Magnetic tape is a form of
  - a. direct access media
  - b. random access media
  - c. sequential access media
  - d. alphabetical access media
- 4 Which of the following is not an advantage of using real-time data processing?
  - a. Quick response time to support timely record keeping and customer satisfaction
  - b. Efficiency for use with large volumes of data
  - c. Provides for random access of data
  - d. Improved accuracy due to the immediate recording of transactions
- 5 If a company stores data in separate files in its different departmental locations and is able to update all files simultaneously, it would not have problems with
  - a. attributes
  - b. data redundancy
  - c. industrial espionage
  - d. concurrency
- 6 When the data contained in a database is stored in large, two-dimensional tables, the database is referred to as a
  - a. flat file database
  - b. hierarchical database
  - c. network database
  - d. relational database
- 7 Database management systems are categorized by the data structures they support. In which type of database management system is the data arranged in a series of tables?
  - a. Network
  - b. Hierarchical
  - c. Relational
  - d. Sequential
- 8 A company's database contains three types of records: vendors, parts, and purchasing. The vendor records include the vendor number, name, address, and terms. The parts records include part numbers, name, description, and warehouse location. Purchasing records include purchase numbers, vendor numbers (which reference the vendor record), part numbers (which reference the parts record), and quantity. What structure of database is being used?
  - a. Network
  - b. Hierarchical
  - c. Relational
  - d. Sequential
- 9 Which of the following statements is not true with regard to a relational database?
  - a. It is flexible and useful for unplanned, ad hoc queries.
  - b. It stores data in tables.
  - c. It stores data in a tree formation.
  - d. It is maintained on direct access devices.
- 10 A collection of several years' nonvolatile data used to support strategic decision-making is a(n)
  - a. operational database
  - b. data warehouse
  - c. data mine
  - d. what-if simulation
- 11 Data mining would be useful in all of the following situations except
  - a. identifying hidden patterns in customers' buying habits
  - b. assessing customer reactions to new products
  - c. determining customers' behavior patterns
  - d. accessing customers' payment histories
- 12 A set of small databases where data is collected, processed, and stored on multiple computers within a network is a
  - a. centralized database
  - b. distributed database
  - c. flat file database
  - d. high-impact process

- 13 Each of the following is an online privacy practice recommended by the AICPA Trust Services Principles Privacy Framework except
- Redundant data should be eliminated from the database.
  - Notification of privacy policies should be given to customers.
  - Private information should not be given to third parties without the customer's consent.
  - All of the above.

### Discussion Questions

- 14 (SO 1) How does data differ from information?
- 15 (SO 1) Why is it important for companies to store transaction data?
- 16 (SO 2) Which type of data storage medium is most appropriate when a single record of data must be accessed frequently and quickly?
- 17 (SO 3) Identify one type of business that would likely use real-time data processing rather than batch processing. Describe the advantages of real-time processing to this type of business.
- 18 (SO 4) Differentiate between data redundancy and concurrency.
- 19 (SO 4) What is the term for the software program(s) that monitors and organizes the database and controls access and use of data? Describe how this software controls shared access.
- 20 (SO 4) Describe the trade-offs of using the hierarchical model of database storage.
- 21 (SO 4) Describe the organization of a flat file database.
- 22 (SO 4) What four conditions are required for all types of databases?
- 23 (SO 4) Within a hierarchical database, what is the name for the built-in linkages in data tables? Which data relationships can be contained in a hierarchical database?
- 24 (SO 4) Which database models are built on the inverted tree structure? What are the disadvantages of using the inverted tree structure for a database?
- 25 (SO 4) Which database model is used most frequently in the modern business world? Why do you believe it is frequently used?
- 26 (SO 5) How is the primary key used in a relational database?
- 27 (SO 5) What language is used to access data from a relational database? Why is the language advantageous when accessing data?

- 28 (SO 5) Which type of database model has the most flexibility for querying? How does this flexibility assist management?
- 29 (SO 5) What are the first three rules of normalization? What is meant by the statement that the rules of normalization are additive?
- 30 (SO 6) Differentiate between a data warehouse and an operational database.
- 31 (SO 7) How is data mining different from data warehousing?
- 32 (SO 7) How has Anheuser-Busch used data warehousing and data mining successfully?
- 33 (SO 7) Identify and describe the analytical tools in OLAP.
- 34 (SO 8) Differentiate between centralized data processing and distributed data processing.
- 35 (SO 9) Why would a small company with 400 employees find it advantageous to use a cloud database (DaaS)?
- 36 (SO 10) Explain the terms Big Data and data analytics.
- 37 (SO 11) Why is control over unauthorized access so important in a database environment?
- 38 (SO 11) What are some internal control measures that could prevent a hacker from altering data in your company's database?
- 39 (SO 11) Why is data considered a valuable resource worthy of extensive protection?

### Brief Exercises

- 40 (SO 2) Arrange the following data storage concepts in order from smallest to largest, in terms of their size: file, record, database, character, and field.
- 41 (SO 2) Think of a database that would be needed at a professional service firm to maintain the contact list of clients/patients at the office of a CPA, attorney, or medical doctor. Identify the fields likely to be used in this database. If you were constructing this database, how many spaces would you allow for each field?
- 42 (SO 3) Suppose that a large company uses batch processing for recording its inventory purchases. Other than its slow response time, what would be the most significant problem with using a batch processing system for recording inventory purchases?
- 43 (SO 4) Arrange the following database models in order from earliest development to most recent:

- network databases, hierarchical databases, flat file databases, and relational databases.
- 44 (SO 4) Categorize each of the following as one-to-one, one-to-many, or many-to-many:
- Subsidiary ledgers and general ledgers
  - Transactions and special journal
  - General ledgers and trial balances
- 45 (SO 6) How might a company use both an operational database and a data warehouse in the preparation of its annual report?
- 46 (SO 7) Using Anheuser-Busch's BudNet example presented in this chapter, think about the queries that might be valuable if a company like Gap, Inc., used data mining to monitor its customers' buying behavior.

## Problems

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- 47 (SO 3) Differentiate between batch processing and real-time processing. What are the advantages and disadvantages of each form of data processing? Which form is more likely to be used by a doctor's office in preparing the monthly patient bills?
- 48 (SO 4) Arminello, Inc. does not use a database system; rather, it maintains separate data files in each of its departments. Accordingly, when a sale occurs, the transaction is initially recorded in the sales department. Next, documentation is forwarded from the sales department to the accounting department so that the transaction can be recorded there. Finally, the customer service group is notified so that its records can be updated. Describe the data redundancy and concurrency issues that are likely to arise under this scenario at Arminello.
- 49 (SO 6) List and describe the steps involved in building a data warehouse.
- 50 (SO 8) Describe the advantages and disadvantages of using a distributed database and distributed data processing. Do you think the advantages are worthwhile? Explain your answer.
- 51 (SO 6) Read the online article at <http://www.xconomy.com/boston/2010/09/20/netezza-sold-to-ibm-for-1-7b-will-help-big-blue-tackle-big-data/>. Describe the services that Netezza offered and why IBM desired to purchase this company.
- 52 (SO 10) Big Data is increasingly important to companies and to accountants. Using a web search on Google or other search sites, find an article within the last 12 months on "Big Data" and accounting. Summarize how the article describes the use of Big Data in an accounting context.
- 53 (SO 10) Explain how a healthcare organization, such as a hospital or medical clinic, may use Big Data and data analytics as compared to a manufacturing firm.
- 54 (SO 10) Explain how CPA firms are using Big Data and data analytics in the audits of their clients.
- 55 (SO 10) Consider how auditing has changed by comparing auditing techniques prior to the 1980s when many firms prepared manual accounting records and there were manual audits, versus audits today that use computerized techniques to analyze data.
- 56 (SO 10) What are some benefits and outcomes that can result from examining Big Data with regard to a firm's inventory processing?
- 57 (SO 10) What are some benefits and outcomes that can result from examining Big Data with regard to a firm's purchasing transaction processing?
- 58 (SO 10) What are some benefits and outcomes that can result from examining Big Data with regard to a firm's revenue transaction processing?
- 59 (SO 12) Describe the ethical obligations of companies to their online customers.
- 60 (SO 9) Read the article at <http://www.eweek.com/c/a/Enterprise-Networking/IBM-moves-customers-to-SmartCloud-for-Collaboration-147563>. Explain how the IBM customers mentioned in the article are using IBM's Smart Cloud.
- 61 (SO 8) Using a Internet search engine, search using the terms Spanner and "distributed database." Describe how and why Google uses a distributed database. What problems is Google encountering related to its distributed database?
- 62 (SO 11) List and describe the ten 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.



## Cases

- 63** Zip Shuttle Service operates airport shuttle vans in 12 large cities: Los Angeles, San Diego, San Francisco, Phoenix, Las Vegas, Houston, Dallas, Chicago, New York City, Washington DC, Miami, and Orlando. Zip operates passenger vans to shuttle travelers to and from the airports for a \$25 fee per person.

**Required:**

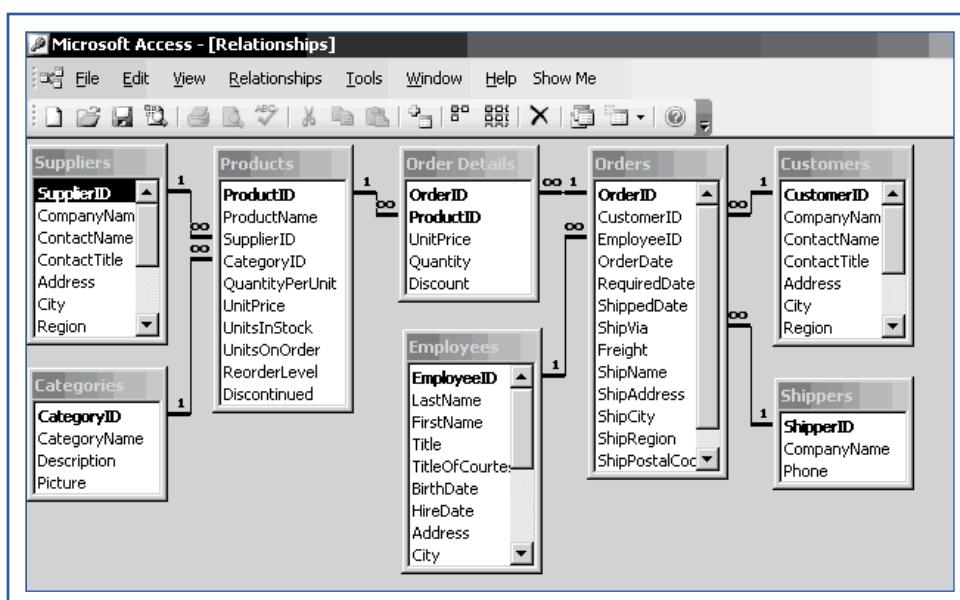
- Design the tables that the company would need in its database to operate these shuttles. Remember that they must collect, record, and track information about customers, payments, flights, gates, vans, drivers, and pick-up and delivery addresses. You may wish to add other types of data. The tables you design should have attributes (columns) for each critical piece of data. See Exhibit 13-4 for the concept of the table layouts. Your tables should meet the first three rules of data normalization.
  - Describe the advantages and disadvantages for Zip of using a centralized database as opposed to a separate database for each location.
- 64** Kroger Co., a large, nationwide grocery chain, maintains a customer reward system titled the

“Kroger Plus” card. Customers who enroll in this system are entitled to discounts on products at Kroger stores and on gasoline. To earn discounts and other rewards, the shopper must use the “Kroger Plus” card at the time of checkout. The card has a bar code that identifies the customer. This system allows Kroger to determine customer buying patterns and to use the data for data mining.

**Required:**

Using a Web search engine, search for “data mining” and “grocery.” Describe what types of information grocery stores collect that they can use for data mining purposes. Also, describe how grocery chains use data mining to improve performance.

- 65** The screen capture that follows shows the relationships in a Microsoft Access database. For each relationship, explain the following:
- The type of parent-child relationship it represents.
  - Which attributes in the table are used to link the relationship?
  - The purpose of the relationship.



## Solutions to Concept Check

- 1 (SO 1) The following statement best describes the relationship between data and information:  
**b. Information is interpreted data.** Information is useful for decision making, whereas data typically requires processing before it becomes practical for use in a decision-making process.
- 2 (SO 2) A *character* is to a *field* as **a. water is to a pool.** In data storage terminology, characters are contained within a field.
- 3 (SO 2) Magnetic tape is a form of **c. sequential access media.** Magnetic tape must be accessed in the order it was recorded.
- 4 (SO 3) The following is not an advantage of using real-time data processing: **b. efficiency for use with large volumes of data.** This is a characteristic of batch processing rather than real-time processing.
- 5 (SO 4) If a company stores data in separate files in its different departmental locations and is able to update all files simultaneously, it would not have problems with **d. concurrency.** Concurrency problems arise when a company has difficulty updating data at its various locations at the same time.
- 6 (SO 4) When the data contained in a database is stored in large, two-dimensional tables, the database is referred to as a **a. flat file database.** The two dimensions for a flat file database are rows and columns.
- 7 (CIA Adapted) (SO 4) Database management systems are categorized by the data structures they support. In a **c. relational** database management system, the data is arranged in a series of tables.
- 8 (CIA Adapted) (SO 4) A company's database contains three types of records: vendors, parts, and purchasing. The vendor records include the vendor number, name, address, and terms. The parts records include part numbers, name, description, and warehouse location. Purchasing records include purchase numbers, vendor numbers (which reference the vendor record), part numbers (which reference the parts record), and quantity. The structure of the database being used is **c. relational**, since the links are contained within the data records themselves. Answers a. and b. are incorrect because these structures would have directional pointers or trees, respectively, rather than explicit data values. Answer d. is incorrect because it is an access method rather than a database structure.
- 9 (CIA Adapted) (SO 4, SO 5) The following statement is not true with regard to a relational database:  
**c. It stores data in a tree formation.** This response is characteristic of a hierarchical database.
- 10 (SO 6) A collection of several years' nonvolatile data used to support strategic decision making is a **b. data warehouse.** The data in a data warehouse do not change except for the occasional upload of new data.
- 11 (SO 7) Data mining would be useful in all of the following situations except **c. assessing customers' payment histories.** Assessing customers' payment history would likely require a data warehouse, whereas data mining is focused on behavioral patterns.
- 12 (SO 8) A set of small databases where data is collected, processed, and stored on multiple computers within a network is a **b. distributed database.**
- 13 (SO 11) Each of the given statements is an online privacy practice recommended by the AICPA Trust Services Principles Privacy Framework except the following: **a. Redundant data should be eliminated from the database.** Redundancy is addressed in the rules of data normalization, but not in the AICPA's Privacy Framework.

# E-Commerce and E-Business

### STUDY OBJECTIVES

This chapter will help you gain an understanding of the following concepts:

- 1.** An introduction to e-commerce and e-business
- 2.** The history of the Internet
- 3.** The physical structure and standards of the Internet
- 4.** E-commerce and its benefits
- 5.** Privacy expectations in e-commerce
- 6.** E-business and IT enablement
- 7.** E-business enablement examples
- 8.** Intranets and extranets to enable e-business
- 9.** Internal controls for the Internet, intranets, and extranets
- 10.** XML and XBRL as e-business tools
- 11.** Ethical issues related to e-business and e-commerce

### Introduction to E-Commerce and E-Business (Study Objective 1)

The Real World example on the next page will help you understand the context of many concepts covered in this chapter. Please read the Real World example to begin effective reading and studying of this chapter.

Organizations use information technology (IT) to improve efficiency and effectiveness of their operations. As presented in the Real World example on the next page, Walmart transitioned to Internet EDI to save costs and to take advantage of the new EDI technology. For Walmart and in many other cases, this transition resulted in major changes, not only for the newly IT-enabled organizations, but also for their 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.

Walmart's EDIINT 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 online electronic trading, consumer-based e-commerce, and business-to-business electronic trading and process integration, as well as the 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 e-commerce. In addition, this chapter describes the advantages, disadvantages, security issues, and controls related to e-business.

## The Real World



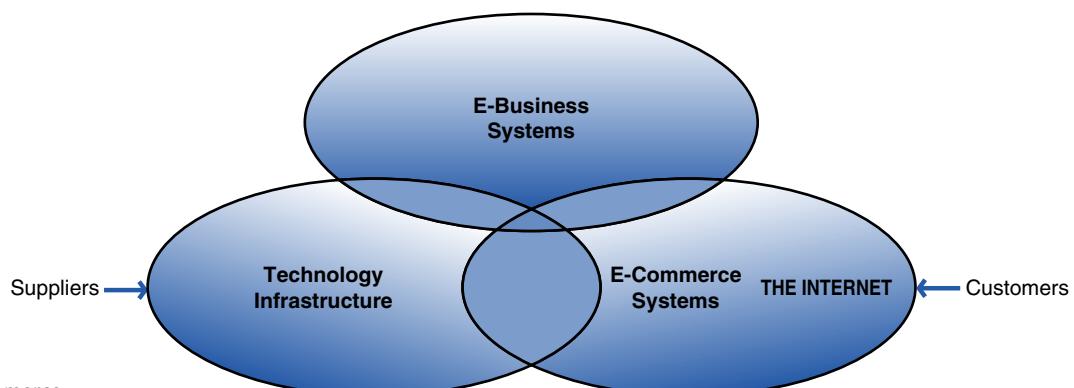
© José Luis Gutiérrez/Stockphoto

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 cost-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 that its 10,000 small and mid-size 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.

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 trading 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 employee services such as access to personnel records and fringe benefits information, travel and expense reporting, and purchases of office supplies and other items. Exhibit 14-1 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 or 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.



**EXHIBIT 14-1**

E-Business and E-Commerce

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, including 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 large in dollar value and each order is likely to include many items. 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 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 details of this infrastructure was described in Chapter 6.

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 widespread application in the business world.

## The History of the Internet (Study Objective 2)

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Much of the technology foundation upon which the Internet is based was developed by university and military researchers over 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 a period of only a few months, NASA, the Rand Corporation, and many other universities were connected to this network.

Two of the technologies developed for ARPANET form the basic foundation of today's Internet. Packet switching and routers are necessary to send data over the network. **Packet switching** sends data over a computer network. Computer data is 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 is sent packet switched, small parts of the data are transmitted, next 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 the data reaches its destination. The ARPANET used both of these technologies, which have continued to be used in the Internet of today.

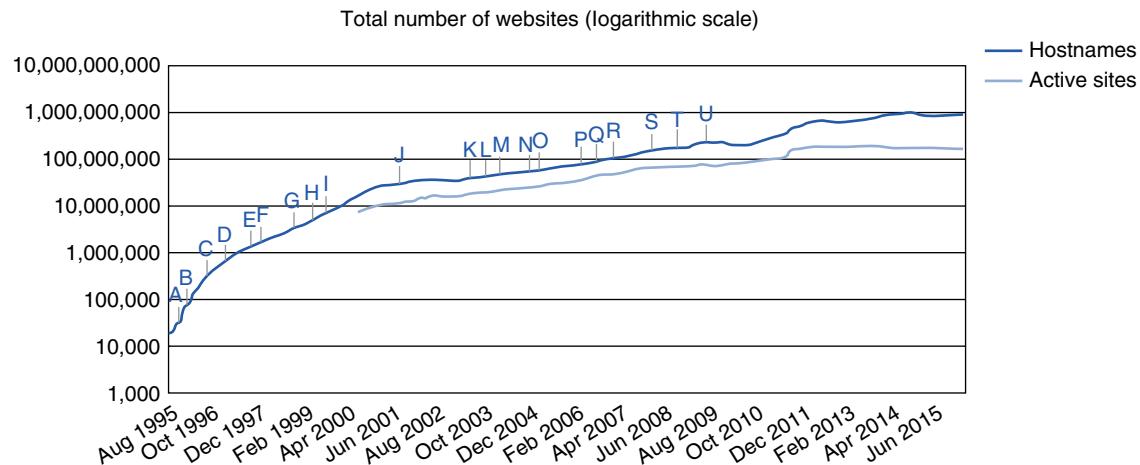
The ARPANET was developed during the height of the Cold War and nuclear weapon proliferation. Thus, the network was designed so that if any of the sites were destroyed by a nuclear attack, the other sites could still function and share the military research data. Therefore, routers were designed to direct 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 user name 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 and 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, consider what might 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 to be used in the Internet today. **TCP/IP** is an abbreviation for transmission control protocol/Internet protocol.

Through the 1970s and 1980s, the ARPANET continued to grow, adding 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 developing 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 superhighway.” The term “Internet” comes from the concept of *interconnected networks*. Thus, the Internet evolved from a variety of university- and government-sponsored computer networks built largely for research. That network became the Internet and now consists 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 Internet user-friendly so that it 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



**EXHIBIT 14-2** Chart of the Number of Websites (Source of data: news.netcraft.com/archives/2016/)

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 explosive growth of the Internet. Retailers and other organizations began conducting 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.

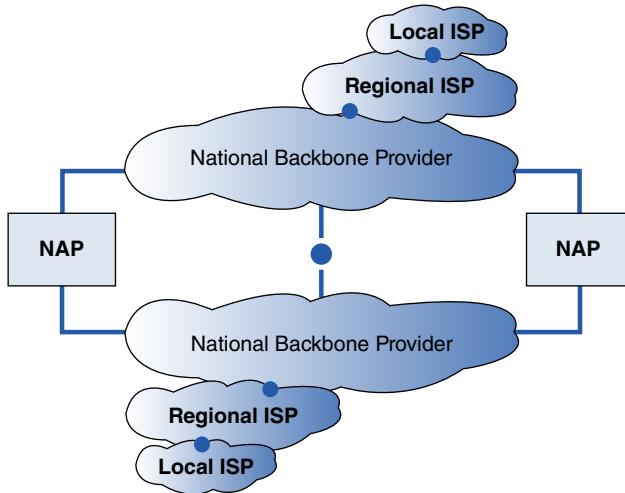
As the Internet grew, the backbone was continually updated and improved to add servers, routers, and networks that transmit data much faster. The speed and amount of network traffic grew very rapidly as new technologies fueled improvements. The exponential growth of the Internet throughout its life can be seen in Exhibit 14-2.

As you will note by looking at Exhibit 14-2, there have been a few periods of decline in the number of websites, such as during economic downturns in 2002 and 2009. However, Exhibit 14-2 shows that the number of websites has continued to grow rapidly, and the overall trend shows exponential growth since the Internet was commercialized.

## The Physical Structure and Standards of the Internet (Study Objective 3)

### The Network

Exhibit 14-3 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.



**EXHIBIT 14-3** Architecture 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 that is a fiber optic trunk. 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 100–200 gigabytes per second. This means that up to 200 billion 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 Level 3 Communications, TeliaSonera International Carrier, NTT, Cogent, GTT, Tata Communications, AT&T Inc., MCI, Sprint, and CenturyLink.

**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. However, the use of four water hoses, all aimed at the same fire, will send four times the volume of water.

**Local ISPs** connect individual users to the Internet. These Internet subscribers are connected to local ISPs using either digital subscriber lines (DSL), or cable TV lines. DSL speed is usually 5–20 mbps and cable broadband speeds are 10–100 mbps. Examples of local ISPs are local telephone and cable companies.

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

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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 all computers 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. Exhibit 14-4 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.

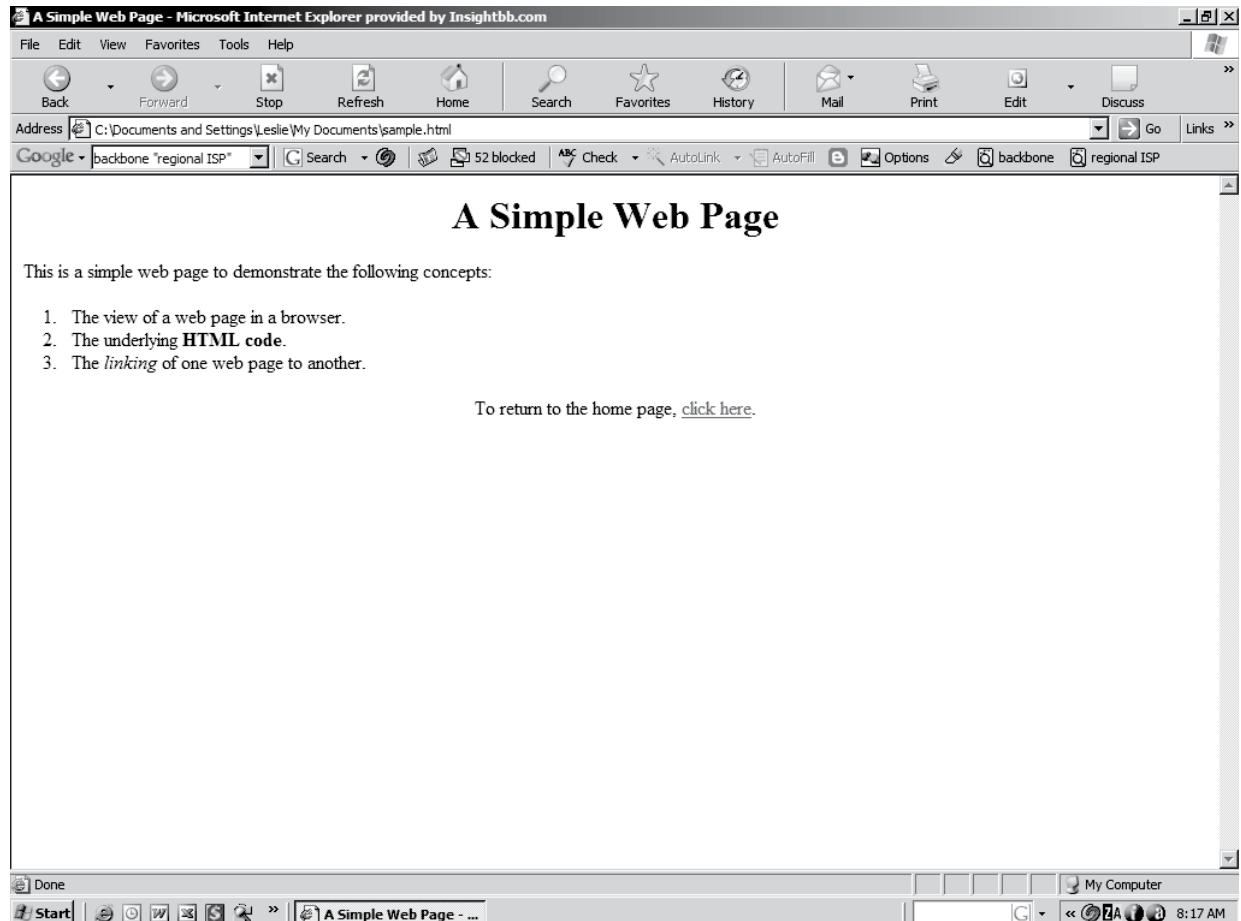
In addition to a standard communication protocol and a standard formatting language for Web pages, there must also be a common addressing method to store and locate Web pages. The addresses of websites and Web pages use a uniform resource locator (URL) address. A **URL** is the address you type in to 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 indicating 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.



```
<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>
```

**EXHIBIT 14-4** A Simple Web Page and the HTML Source Code

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 contains 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 IP addresses 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 risk of exposing 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.

## E-Commerce and its Benefits (Study Objective 4)

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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 a vendor and a 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, e-commerce 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 various products on Amazon.com
2. Buying clothes at L.L. Bean online
3. Buying an airline ticket on Expedia.com
4. Buying a computer at Dell.com

The common aspect in these transactions is 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**

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For a customer buying products or services, the major benefits of e-commerce 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 very broad market for goods and services. By using e-commerce, a 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 make a purchase.
2. E-commerce provides convenient times for shopping. Orders can be placed 24 hours a day, 7 days a week. As mentioned in item 1, an e-commerce customer does not need to go to a store to make a purchase, and is not limited by location or hours of operation as he would be when shopping at a store.
3. Wider access to the marketplace provides more choices to the customer. This may enable the customer to more easily find the same product at a lower 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 addition, the customer may not be required to pay sales taxes for e-commerce purchases. However, in many cases, the 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 provide quick delivery of the product, enabled by fast processing time. To fill an order, the business does not have to undertake time-consuming 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 and websites where they shop. For example, Amazon.com analyzes customer buying patterns and can recommend specific products 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 of the World Wide Web allows the opportunity for fraud, theft of assets, or theft of data. Customers may 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. Security concerns may prevent some customers from purchasing via e-commerce. Businesses that wish to benefit from E-commerce need to 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 before making a purchase decision. Compared with an in-store shopping experience, it is more likely that e-commerce customers will not be satisfied with their purchases.

## **Benefits and Disadvantages of E-Commerce for the Business**

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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 for traditional forms of marketing. For example, suppose that an electronics store can place a local television advertisement at a cost of \$10,000 to reach 10,000 customers. That same amount spent on a Web-based ad could possibly reach millions of potential customers.
3. E-commerce provides the potential for richer marketing concepts that include video, audio, product comparisons, product testimonials, and product tests. On its website, a business can provide links to these marketing tools.
4. Companies can quickly react to changes in market conditions. For example, if market changes lead to price drops, a company can quickly change prices on its website, and all customers can 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 store such as Walmart wishes 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 to make these price changes.

5. Companies using e-commerce are likely to experience reduced order-processing and distribution costs. Order-processing costs are low because e-commerce automates all or most of the order processing. Rather than employees taking sales orders by phone or mail and keying them into the IT system, the customer enters all order information. Distribution costs are low 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 a customer orders, and have the product drop-shipped directly from the supplier to the customer.
6. Due to the customer convenience aspect of e-commerce, the business will likely have more sales and receive higher customer satisfaction ratings.
7. Higher sales coupled with reduced marketing, order processing, and distribution costs can lead to much higher profits.

Businesses may also realize some disadvantages to e-commerce. 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. (The IT software and hardware infrastructure that supports e-commerce and e-business is discussed in Chapter 6.) In addition, the free and open nature of the World Wide Web makes a business more vulnerable to potential fraud, hackers, and compromised customer privacy.

## The Combination of E-Commerce and Traditional Commerce

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Much of the preceding discussion focused on the comparison of e-commerce with traditional forms of commerce, namely, catalog and store commerce. However, in today's business environment, most retailers or service businesses use a combination of traditional commerce and e-commerce. For example, Walmart, Target, and Kohl's are traditional store-based retailers that also offer 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 and mobile device (smartphone) banking apps. 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 businesses 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 it needed some physical office locations to better service its customers. E\*TRADE opened offices around the country and placed a link on its website called "Find a Branch". The Web page that customers access by clicking on that link presents the addresses of regional E\*TRADE offices in large cities.

This merging and melding of forms of commerce led to new terminology in the world of commerce. Companies that work from purely traditional stores are called **bricks and mortar** retailers. 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**. These terms are less frequently used today because the underlying practices are so well-known.

## Privacy Expectations in E-Commerce (Study Objective 5)

Chapter 4 described the relationship between IT risks and controls, using the AICPA's Trust Services Principles and criteria as the framework to examine risks and controls. That section of Chapter 4 provided details regarding four (items 1, 2, 3, and 5) of the five risk areas identified in the Trust Services Principles. 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"<sup>1</sup> 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, organizations may have legitimate reasons to collect and keep customer data. However, to conduct e-commerce, organizations must provide to customers a level of confidence in the privacy and security of the personal information that is shared. To engender such confidence, the organization must demonstrate that it has taken appropriate steps to ensure privacy. The Trust Services Principles explain 10 privacy practices that help an organization to ensure adequate customer confidence regarding privacy of information, as follows<sup>2</sup>:

1. **Management.** The organization should assign a specific person or persons, the responsibility for the organization's privacy practices. That responsible person should ensure that the organization has defined and documented its privacy practices and communicated them to both employees and customers. Management should also be held responsible for ensuring 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 communicates the privacy practices to customers in some manner. 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 options to its customers regarding the collection of data, and should ask for consent to collect, retain, and use the data. Customers should be informed of any choices they

<sup>1</sup>"Suitable Trust Services, Criteria and Illustrations, American Institute of Certified Public Accountants and Canadian Institute of Chartered Accountants, 2009 ([www.aicpa.org](http://www.aicpa.org))."

<sup>2</sup>*Ibid.*

may have to opt out of providing information. Also, customers should have access to descriptions about the choices available and the organization's privacy policies. As in "Notice" in Point 2, these descriptions usually are in the form of a link to the applicable areas of the organization's website where the information is provided.

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" in Point 2. 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.
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 from 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 to 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 their 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 (Study Objective 6)

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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 processing through the use of IT systems. Likewise, there are many external business processes—such as those involving suppliers and distributors—that can be streamlined and enhanced through the use of IT systems.

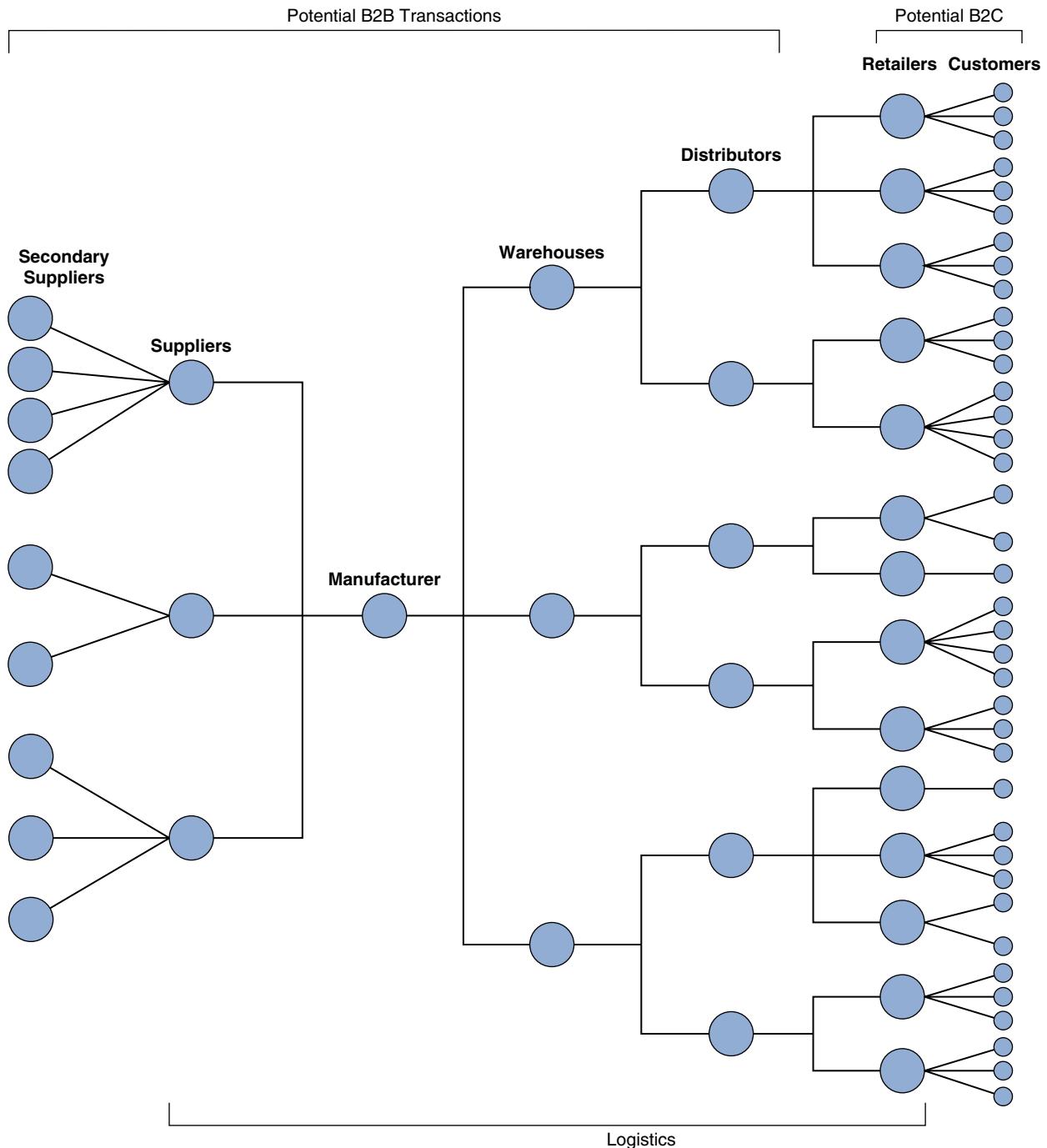
The **supply chain** is the set of linked processes that take place from the initial acquisition and delivery of raw materials, through the manufacturing, distribution, wholesale, and delivery of the product to the customer. The supply chain includes vendors, manufacturing facilities, logistics providers, 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 may be larger at both ends because of the inclusion of secondary suppliers and the customers of the company's immediate customers. Exhibit 14-5 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 causes the PC maker to be 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 process bottlenecks anywhere in the supply chain affect other parts of the supply chain. There is an old saying that a chain is only as strong as its 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 customers. Any of these processes or linkages between entities can be enabled or enhanced by the use of IT systems. Further, any processes 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 side of the diagram in Exhibit 14-5, 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.



**EXHIBIT 14-5** The Supply Chain for a Manufacturing Company

Some companies 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 conducted with an organization that is owned or controlled by the larger corporate entity. Vertical integration occurs when a single company owns all of the entities that make up its supply chain, from the movement of raw materials to the delivery of finished products to customers.

Other companies may choose to focus on only a small part of the supply chain. For example, a company could choose to conduct only the manufacturing portion of the supply chain, while all other entities within the supply chain—suppliers, distributors, wholesalers, and retailers—are separate, unrelated 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 entities. In either case, internal or external, those processes and exchanges can be streamlined or enhanced through e-business.

The “Logistics” label in Exhibit 14-5 illustrates that there are entities within the supply chain whose function is to provide the physical support that moves materials and goods from one part of the supply chain to the next. For example, a manufacturer must have a means of moving raw materials from the supplier to the manufacturing 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 may 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.

## B2B: A Part of E-Business

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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. Much of what you studied in Chapters 8–12 were e-business processes. For example, sales between businesses occur through EDI or EDIINT; shipments and inventory can be tracked using RFID; billing and payment occur through Electronic Invoice Presentment and Payment (EIPP). All of these are examples of IT enablement that enhance, streamline, and reduce the cost of business-to-business transactions. 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 Exhibit 14-6. 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 the buyer and the supplier, and the parties usually have a pre-existing 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 the 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.

**EXHIBIT 14-6****E-commerce B2C vs. E-Business B2B<sup>3</sup>****Differences between E-Commerce and E-Business****E-COMMERCE, or B2C**

- Business-to-consumer
- Few line items per order
- Large order volume
- Geared to consumer's ease of use
- Use of credit card purchasing
- No necessity of a preexisting relationship between buyer and seller

**E-BUSINESS, or B2B**

- Business-to-business
- Many line items per order
- Very specific shipping data
- User-selected information content and interaction tools, deeper functionality
- Use of purchase orders
- Sophisticated transaction protocols
- 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 (Study Objective 7)

There is much more to e-business than just B2B transactions. The Internet can be used in so 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. But for any company engaging in e-business, its internal processes, or processes within its supply chain, must be put on the Internet. The following pages show real business examples of the ways in which businesses adopt e-business strategies. These Real World 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

<sup>3</sup>Adapted from Janet Gould, "What's the Difference between E-Commerce and E-Business? And Why Should You Care?" *ID Systems*, vol. 19, issue II, November 1999.

## 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 strategy." Regarding these four areas, he said the following<sup>4</sup>:

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.<sup>5</sup>

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.<sup>6</sup> To achieve this goal, GM planned to "webify"<sup>7</sup> 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.

<sup>4</sup>"GE and the Internet: An Executive Speech Reprint" [http://calcentres.com.au/GE2\\_Jack\\_Welch.htm](http://calcentres.com.au/GE2_Jack_Welch.htm)

<sup>5</sup>"GM Launches E-com Drive," *Ecommerce*, August 10, 1999, <http://www.internetnews.com/ec-news/article.php/179701>

<sup>6</sup>"eGM head pursues broad e-commerce plan," *Infoworld*, March 6, 2000, p. 18.

<sup>7</sup>*Ibid.*

**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**

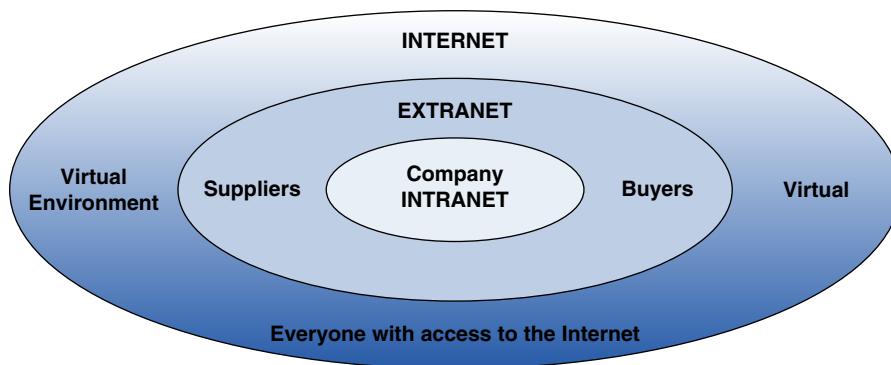
In addition to enhancing existing business, e-business can help build entirely new product or service lines. Using advanced software and cloud computing, 3M developed a revenue-generating service called Visual Attention Service (VAS). 3M allows its customers to scientifically analyze how humans react 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.

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.

## Intranets and Extranets to Enable E-Business (Study Objective 8)

In many cases, interactions within the supply chain occur 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 interact electronically. This interaction within the company would use an intranet. Exhibit 14-7 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



**EXHIBIT 14-7** Internet, Extranet, and 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.

## 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 sales of office supplies. StaplesAdvantage ([www.staplesadvantage.com](http://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 StaplesAdvantage 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 StaplesAdvantage can order supplies online at anytime and at a pricing structure that is advantageous to the StaplesAdvantage customer. The StaplesAdvantage 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 by accepting a slightly smaller profit margin on each sale. The extranet provides benefits to both Staples and the companies that use StaplesAdvantage.

## Internal Controls for the Internet, Intranets, and Extranets (Study Objective 9)

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 Exhibit 14-7, 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 login to the intranet or extranet by unauthorized users. Firewalls prevent external users from accessing the network and data on the extranet or intranet. Chapter 4 described in detail risks and controls for IT systems. Two of the categories of risks and controls that can limit access to intranets and extranets are reproduced in Exhibit 14-8.

### EXHIBIT 14-8

#### Controls to Limit Access to Intranets and Extranets

##### Controls to establish authentication of users:

- User ID
- Password
- Security token or smart card
- Biometric devices
- Login procedures
- Access levels
- Computer logs
- Authority tables

(continued)

**EXHIBIT 14-8** (*Continued*)**Controls to prevent and detect hacking and other network break-ins:**

- Firewall
- Encryption
- Security policies
- Security breach resolution
- Secure socket layers (SSL)
- Virtual private network (VPN)
- Wired equivalency privacy (WEP)
- Service set identifier (SSID)
- Antivirus software
- Vulnerability assessment
- Penetration testing
- Intrusion detection

## XML and XBRL as Tools to Enable E-Business (Study Objective 10)

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

Chapter 9 described EDI (electronic data interchange) 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 adopt EDI only when forced to by a large company in

their supply chain. 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 companies collaborate on a project. Given these 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. Exhibit 14-9 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.

#### EXHIBIT 14-9

#### Traditional EDI Using VAN versus Internet EDI

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 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. The real-time processing of EDI transactions often results in traditional EDI being limited to larger organizations and to the type of data included in standard business documents. The low cost and communication capabilities of the Internet, however, 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.

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 provides 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.

Although EDI through a value-added network or Internet EDI provide significant cost savings and efficiency, not every company uses 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 as much as 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**

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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 the largest companies to provide annual reports and financial statements in XBRL format. Over the next few years, the SEC phased in smaller companies.

Since 2014, every public company that is required to file financial reports with the SEC must provide the reports in XBRL format. The idea behind XBRL is that financial data is 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 (Study Objective 11)



Companies that engage in e-commerce have the same kind of obligations to conduct their business ethically as companies transacting business any other way. Yet 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:

1. Management
2. Notice

3. Choice and consent
4. Collection
5. Use and retention
6. Access
7. Onward transfer and disclosure
8. Security
9. Quality
10. 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 is 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. This data has potential value to many other companies and is 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 that 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.

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

## The Real World

Gateway Learning Corporation, the company behind Hooked on Phonics®, was charged by the Federal Trade Commission with deceptive and unfair practices between 1996 and 2010. Starting in the year 2000, Gateway disclosed a privacy policy on its [www.hop.com](http://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.<sup>8</sup>

<sup>8</sup>Parry Aftab, "Hooked on Phonics Gets Hooked," *Information Week*, August 2, 2004.

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

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**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 transaction 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 locator (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 10 privacy practices that companies should follow: management, notice, choice and consent, collection, use and retention, access, onward transfer and disclosure, security, quality, and monitoring 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.

## KEY TERMS

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<b>B2B</b>	<b>Domain name</b>	<b>Internet EDI</b>	<b>Secure sockets layering</b>
<b>B2C</b>	<b>E-business</b>	<b>Intranet</b>	<b>Supply chain</b>
<b>Backbone</b>	<b>E-commerce</b>	<b>Local ISP</b>	<b>TCP/IP</b>
<b>Backbone provider</b>	<b>E-tailer</b>	<b>Packet switching</b>	<b>URL</b>
<b>Bricks and clicks</b>	<b>Extranet</b>	<b>Protocol</b>	<b>Web server</b>
<b>Bricks and mortar</b>	<b>HTML</b>	<b>Regional ISP</b>	<b>XBRL</b>
<b>Clicks and mortar</b>	<b>Internet</b>	<b>Router</b>	<b>XML</b>

# End of Chapter Material

## Concept Check



- 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 the buyer and the 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?

<i>Employees</i>	<i>Suppliers</i>
a. Intranet	Extranet
b. Intranet	Internet
c. Internet	Extranet
d. Internet	Internet

- 14 An extensible markup language designed specifically for financial reporting is
- Internet EDI
  - XML
  - XBRL
  - XFRL

### Discussion Questions

- (SO 1) How do e-commerce and e-business differ?
- (SO 2) What was the original purpose of the network of computers that eventually became the Internet?
- (SO 2) Why was ARPANET designed with many different alternative routes for network traffic?
- (SO 2) Why is a standard protocol necessary in computer networks?
- (SO 2) How quickly did Internet usage by the public grow after the Internet was opened to business transactions in 1994?
- (SO 3) Describe the relationship between national backbone providers, regional ISPs, and local ISPs.
- (SO 3) What is the importance of a standard formatting language for Web pages and a standard addressing system?
- (SO 4) Which types of costs can be reduced when a company decides to engage in B2C e-commerce on the Internet?
- (SO 4) What are the differences between bricks-and-mortar retailers and clicks-and-mortar retailers?
- (SO 5) According to the Online Privacy section of the AICPA Trust Services Principles, what types of personal information should be protected?
- (SO 5) 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?
- (SO 5) What is meant by "monitoring and enforcement" regarding online privacy practices?
- (SO 6) How is e-business a broader concept than e-commerce?
- (SO 6) Describe the concept of a supply chain.
- (SO 6) Why is it important to ensure an efficient flow of goods throughout the supply chain?

- (SO 6) Which functions within the supply chain can be enhanced through the use of e-business?
- (SO 6) How are activities in the supply chain interdependent?
- (SO 6) In what ways are the characteristics of e-business different from those of e-commerce?
- (SO 8) What are the three levels of network platforms that are utilized in e-business, and which groups use each level?
- (SO 8) Which type of users should have access to an intranet?
- (SO 8) Which type of users should have access to an extranet?
- (SO 9) What types of controls should be used to properly limit access in intranets and extranets?
- (SO 10) Why is the use of XML advantageous in Internet EDI?
- (SO 10) In what ways are XBRL financial statements advantageous compared with traditional paper financial statements?
- (SO 11) What are some of the ethical obligations of companies related to e-commerce?
- (SO 11) Is there a difference between ethical obligations and legal obligations with regard to online privacy?

### Brief Exercises

- (SO 1) 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.
- (SO 3) How does the use of HTML, URLs, domain names, and SSL contribute to an Internet that can be used worldwide?
- (SO 4) Describe the benefits to the **consumer** of B2C sales.
- (SO 4) Describe the benefits to the **company** of B2C sales.
- (SO 6) Describe the benefits to a company that engages in B2B transactions via the Internet.
- (SO 5) What are the ten areas of privacy practices described in the Online Privacy section of the AICPA Trust Services Principles?
- (SO 6) Describe the activities that take place in the supply chain of a manufacturing firm.
- (SO 6) Describe the differences between B2C and B2B.
- (SO 9) Explain the importance of user authentication and network break-in controls in extranets.
- (SO 10) What are the advantages of Internet EDI over traditional EDI?

## Problems

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- 51** (SO 2) Explain the hardware and technology standards that were developed during the ARPANET that were an important foundation for the Internet of today.
- 52** (SO 4) Sweet Susanna's is a local chain of bakeries in Austin, Texas. The chain has 18 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** (SO 5) Using a search website, enter the term "privacy seal" and search. Answer the following questions:
- What is the purpose of a Web privacy seal?
  - Which organizations provide Web privacy seals to Web-based companies?
  - What are the advantages to a company that maintains a Web privacy seal?
  - What are the benefits to a consumer of shopping from a website that has a privacy seal?
- 54** (SO 5) Visit the website [www.cpawebtrust.org](http://www.cpawebtrust.org) and answer the following questions:
- What is a WebTrust seal?
  - Which organization sanctions the WebTrust seal?
  - What kind of professional can provide a WebTrust seal to a company?
  - What must this professional do before providing a WebTrust seal?
- 55** (SO 5) 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** (SO 8) 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** (SO 10) Read the article at <https://xbrl.us/wp-content/uploads/2013/12/20131023-RobertHurt.pdf>. Briefly describe what this article says about how XBRL has affected financial reporting.
- 58** (SO 5) 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** (SO 5) Describe the ethical obligations of companies to their online customers.



## Cases

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- 60** Trudy's Trendy Threads (TTT) is a regional wholesaler of women's casual attire. The company is located in Jacksonville, Florida, and it sells to retail stores in resort communities in Florida, Georgia, and the Carolinas. TTT employs six salespeople, with each one having responsibility for collecting sales orders from one of the following territories: Southern Florida, Florida Gulf Coast, Eastern Florida, Georgia, South Carolina, and North Carolina.

Each sale representative mails seasonal catalogs to the customers in his or her territory. Online catalogs are also provided via the company's website. Sales orders are obtained directly by the sales representatives via e-mail. On a daily basis, the sales representatives submit orders to the corporate office via the Internet; a Web browser client is used to enter the e-mail orders into a dedicated Web server. The sales representatives

maintain files consisting of each customer's e-mail orders, accompanied by a printout of the sales orders entered in the computer. All deliveries are sent via common carrier from the Jacksonville headquarters to each of the customer locations.

Recently, TTT has experienced delivery problems. Namely, a few retail stores located on the eastern Georgia seaboard have claimed that they never received their deliveries. Helen Bain, TTT's controller, has been investigating these problems along with Aaron Shulz, the Georgia sales representative. Through her review of the shipping records, Helen discovered that each of the problem scenarios involved shipment to a warehouse rather than to the customer's retail store. Interestingly, the sales order files maintained by Aaron indicate that shipment should have been set up for delivery to the respective retail store locations.

Upon further investigation, Helen reviewed the company's access log and verified that Aaron's and the other sales representatives' authorized passwords were the only ones used to access the company's Web server.

**Required:**

- Speculate as to potential causes of this problem.
- What additional information would be needed to determine the actual cause of this problem?
- What controls could be implemented to avoid repeated instances of this problem?

61 Clouse Analytics is a financial services consulting firm that assists its clients with financial analyses surrounding proposed business ventures. John Y. Clouse is the firm's founder and project director. As such, he is responsible for preparing most of each client firm's financial analyses and reports, as well as presenting the results to each client's management. Due to the varying numbers of managers who may make up a client's top management, Clouse always prepares at least a dozen report copies so that there are plenty to distribute to all persons in attendance at the presentation.

Data for financial analyses is obtained directly from the accounting and production databases of the

firm's clients. Direct queries are prepared by Clouse's staff accountants, and the resulting presentation reports are prepared by the staff and reviewed by Clouse. This is a time-consuming process, and many of Clouse's clients have demanded more current information. This problem recently led Clouse to investigate the possibility of developing a software package that could produce the financial analyses and reports automatically.

As Clouse considers the significant investment that would be required to program a new system, he is concerned about the loss of control that may be inherent in an automated system. For instance, he worries about the accuracy and completeness of analyses and reports prepared automatically.

**Required:**

Perform an online research of XBRL at [www.xbrl.org](http://www.xbrl.org) and determine whether or not XBRL would be appropriate for Clouse's business. Would XBRL be more effective and reliable? Why, or why not? Your response should focus on the existence of any enhancements or concerns that are likely to result in terms of the timeliness of information, internal controls, and security.

## Solutions to Concept Check

- (SO 1) The following statement is true: **b. E-commerce is a subset of e-business.** E-business is a broader concept that includes e-commerce, as depicted in Exhibit 14-1.
- (SO 2) An electronic hardware device that is located at the gateway between two or more networks is a **c. router.** A router is a hardware device that connects networks at a network gateway.
- (SO 3) The type of organization that serves as the main trunk line of the Internet is called a **d. backbone provider.** Backbone providers provide and maintain the main trunk lines of the Internet, as shown in Exhibit 14-3.
- (SO 4) **c. Reduced order-processing costs** is not a direct advantage for the consumer from e-commerce. Reduced order processing cost is a direct benefit to the seller, not the consumer. Lower cost may lead to lower prices for the consumer also, but this would be an indirect advantage to the consumer. The other answers are direct benefits to the consumer.
- (CIA Adapted) (SO 4) Each of the options represents a characteristic of B2B commerce except **b. electronic retailing,** which is a characteristic of B2C.
- (CIA Adapted) (SO 4) Each of the options represents an application of B2C commerce except **c. data exchanges,** which are a characteristic of B2B.
- (SO 5) Before forwarding customer data, an organization should receive explicit or implicit consent of the customer. This describes **d. onward transfer and disclosure** of the AICPA Trust Services Principles online privacy practices. When an organization will be forwarding customer data to third parties, it should provide a policy to consumers to disclose the onward transfer.
- (SO 6) **a. All processes throughout the supply chain** can benefit from IT enablement. Any process throughout the supply chain is a potential process that could benefit from IT enablement.
- (SO 8) When a company has an e-business transaction with a supplier, it could be using **d. either the Internet or an extranet.** Two companies could transact business using either the Internet or an extranet. An intranet is usually limited to those inside a company, therefore excluding other trading partners.
- (CMA Adapted) (SO 8) Intranets are used for each of the options except **a. customer self-service.** Customers would not access the intranet, as it is for internal use.

- 11 (SO 4) When there is no necessity for a preexisting relationship between the buyer and the seller, that transaction is more likely to be classified as **b. B2C**. This is a characteristic of business to consumer. Business-to-business transactions presume a preexisting relationship.
- 12 (SO 8) Of the given IT controls in an extranet, **e. all are important IT controls**. Each option is either a user authentication or hacking IT control that should be implemented to protect an extranet.
- 13 (CIA Adapted) (SO 8) A company's computer network uses Web servers, HTML, and XML to serve

various user groups. The following type of network best serves the following user:

<i>Employees</i>	<i>Suppliers</i>
<b>a. Intranet</b>	<b>Extranet</b>

An intranet and extranet are similar; however, an intranet aids in internal communication, whereas an extranet facilitates communication (and trading) externally with the company's business partners.

- 14 (SO 10) An extensible markup language designed specifically for financial reporting is **c. XBRL**. XBRL stands for eXtensible Business Reporting Language.



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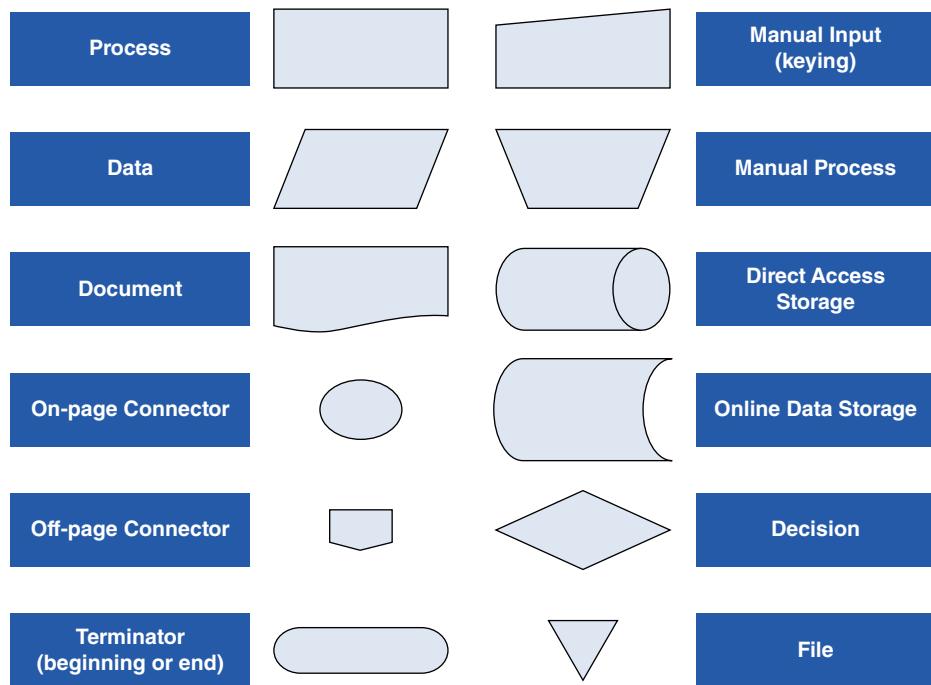
Zikmund, Paul, 75

Zipser, Andy, 290n4



# SYSTEM AND DOCUMENT FLOWCHART SYMBOLS

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# PROCESS MAP SYMBOLS

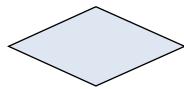
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An oval is used to show the start and/or finish of a process. The start is usually the input of the business process, and the finish is the output. The input and output may be materials, activities, or information.



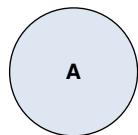
A rectangle shows a task or activity in the process. Typically, only one arrow comes out of a rectangle (one output). However, many arrows can come into a rectangle (inputs).



A diamond represents a point in the process when a decision must be made. In many cases the decision is a yes/no decision, but not always.



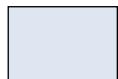
An arrow shows the direction of flow within the process.



A circle with a letter or number inside is used as a connector. A connector is used when there is a break in the process. The connector is used at the beginning of the break in the process, and again where the process resumes.

# DATA FLOW DIAGRAM SYMBOLS

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A square is a terminator. It represents both sources and destinations of data.



A rectangle with rounded corners represents a process. Any tasks or functions performed are depicted by this rectangle.



An open-ended rectangle is a data store or the storage of data. Storage could be in manual records or computer files.



An arrow shows the direction of flow of data.

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Exhibit 2-9	54	Payroll System Flowchart
Exhibit 2-11	56	Restaurant Document Flowchart
Exhibit 8-4	257	Document Flowchart of a Sales Process
Exhibit 8-10	268	Document Flowchart of a Sales Return Process
Exhibit 8-14	274	Document Flowchart of a Cash Receipts Process
Exhibit 8-18	280	Revenue Processes System Flowchart
Exhibit 9-4	314	Document Flowchart of the Purchasing Processes
Exhibit 9-11	328	Document Flowchart of the Purchase Return Processes
Exhibit 9-16	335	Document Flowchart of the Cash Disbursement Processes
Exhibit 9-20	342	Flowchart of Document Matching to Approve and Pay for Purchases
Exhibit 10-4	376	Document Flowchart of the Payroll Processes
Exhibit 10-9	387	Document Flowchart for Fixed Asset Acquisition Processes
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Exhibit 11-6	420	Document Flowchart of the Production Process

---

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Exhibit 9-10	327	Purchase Return Process Map
Exhibit 9-15	334	Cash Disbursement Process Map
Exhibit 10-3	375	Payroll Process Map
Exhibit 10-8	386	Fixed Assets Acquisitions Process Map
Exhibit 10-11	391	Fixed Assets Disposal Process Map
Exhibit 11-5	419	Production Process Map
Exhibit 12-3	445	Source of Capital Process Map
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## A LIST OF DATA FLOW DIAGRAMS IN THIS TEXTBOOK

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Exhibit 2-13	57	Data Flow Diagram Symbols
Exhibit 8-5	258	Sales Processes Data Flow Diagram
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Exhibit 8-15	275	Cash Receipts Processes Data Flow Diagram
Exhibit 9-5	315	Purchasing Processes Data Flow Diagram
Exhibit 9-12	329	Purchase Return Processes Data Flow Diagram
Exhibit 9-17	336	Cash Disbursement Processes Data Flow Diagram
Exhibit 10-5	377	Payroll Processes Data Flow Diagram
Exhibit 10-10	388	Fixed Asset Acquisitions Processes Data Flow Diagram
Exhibit 11-7	421	Conversion Process Data Flow Diagram

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