

ACCOUNTING
INFORMATION
SYSTEMS

8e

James A. Hall

sample

Accounting Information Systems

EIGHTH EDITION

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Australia • Brazil • Japan • Korea • Mexico • Singapore • Spain • United Kingdom • United States

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James A. Hall

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To my wife Eileen, and my children Elizabeth and Katie

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PREFACE

Welcome to the Eighth Edition

The eighth edition of *Accounting Information Systems* includes a range of new and revised homework assignments and up-to-date content changes, as well as several reorganized chapters. All of these changes add up to more student and instructor enhancements than ever before. As this preface makes clear, we have made these changes to keep students and instructors as current as possible on issues such as business processes, systems development methods, IT governance and strategy, security, internal controls, and relevant aspects of Sarbanes-Oxley legislation.

Focus and Flexibility in Designing Your AIS Course

Among accounting courses, accounting information systems (AIS) courses tend to be the least standardized. Often, the objectives, background, and orientation of the instructor, rather than adherence to a standard body of knowledge, determine the direction the AIS course takes. Therefore, we have designed this text for maximum flexibility:

- This textbook covers a **full range of AIS topics** to provide instructors with flexibility in setting the direction and intensity of their courses.
- At the same time, for those who desire a [structured model](#), the first nine chapters of the text, along with the chapters on electronic commerce and general IT controls, provide what has proven to be a **successful template for developing an AIS course**.
- Previous editions of this book have been used successfully in **introductory, advanced, and graduate-level AIS courses**.
- **The topics in this book are presented from the perspective of the managers' and accountants' AIS-related responsibilities under the Sarbanes-Oxley Act.**
- Although this book was written primarily to meet the needs of accounting majors about to enter the modern business world, we have also developed it to be an **effective text for general business, industrial engineering, and computer science students who seek a thorough understanding of AIS and internal control issues as part of their professional education.**

Key Features

CONCEPTUAL FRAMEWORK

This book employs a conceptual framework to emphasize the professional and legal responsibility of accountants, auditors, and management for the design, operation, and control of AIS applications. This responsibility pertains to business events that are narrowly defined as financial transactions. Systems that process nonfinancial transactions are not subject to the standards of internal control under Sarbanes-Oxley legislation. Supporting the information needs of all users in a modern organization, however, requires systems that integrate both accounting and nonaccounting functions. While providing the organization with unquestioned benefit, a potential consequence of such integration is a loss of control due to the blurring of the lines that traditionally separate AIS from non-AIS functions. **The conceptual framework presented in this book distinguishes AIS applications that are legally subject to specific internal control standards.**

EVOLUTIONARY APPROACH

Over the years, accounting information systems have been represented by a number of different approaches or models. Each new model evolved because of the shortcomings and limitations of its predecessor. An interesting feature in this evolution is that older models are not immediately replaced by the newest technique. Thus, at any point in time, various generations of legacy systems exist across different organizations and often coexist within a single enterprise. Modern accountants need to be familiar with the operational characteristics of all AIS approaches that they are likely to encounter. **Therefore, this book presents the salient aspects of legacy and state-of-the-art systems.**

EMPHASIS ON INTERNAL CONTROLS

The book presents a conceptual model for designing and assessing internal controls based the Committee of Sponsoring Organizations of the Treadway Commission (COSO) framework. We use the COSO model to explore control issues related to both the manual and the IT aspects of AIS. In addition to the classic controls designed to influence human behavior, such as segregation of duties, independent verification, and supervision, special emphasis is placed on controls that address the following IT risks and concerns:

- computer application integrity
- operating systems security
- database management systems security
- electronic data interchange (EDI)
- electronic commerce and network security
- enterprise resource planning (ERP) systems
- systems development and program change procedures
- organization of the corporate IT function
- IT outsourcing and cloud computing
- data center security

EXPOSURE TO SYSTEMS DESIGN AND DOCUMENTATION TOOLS

This book examines various approaches and methodologies used in **systems analysis and design**, including:

- structured design
- objectoriented design
- computer-aided software engineering (CASE)

- prototyping

In conjunction with these general approaches, professional systems analysts and programmers use a number of documentation techniques to specify the key features of systems. The modern auditor works closely with systems professionals during IT audits and must learn to communicate in their language. **The book deals extensively with documentation techniques, such as data flow diagrams (DFDs), systems flowcharts, entity relationship diagrams (ERDs), and program flowcharts.** It contains **numerous systems design and documentation cases and assignments** intended to develop students' competency with these tools.

Significant Changes in the Eighth Edition

[Chapter 1](#), “The Information System: An Accountant’s Perspective”

This chapter has been significantly revised to provide a broad overview of key topics that are examined in detail in subsequent chapters. Toward this end, the chapter is divided into three major sections, each dealing with a different aspect of accounting information systems. The first section describes the flows of information through an organization and presents a framework for viewing AIS in relation to other information systems components. The second section deals with the interrelationship of the various functions within the firm and the impact of organization structure on AIS. It demonstrates that the so-called “accounting” information system actually involves a diversity of accounting and nonaccounting activities and personnel. The final section discusses the unique responsibility of accountants as domain experts in the design of AIS and as auditors of AIS. The chapter has an expanded treatment of various types of audit services including external (financial) audits, internal audits, and fraud audits. It draws an important distinction between the external auditor’s traditional attestation function and the rapidly growing field of advisory services, which many public accounting firms offer.

[Chapter 2](#), “Introduction to Transaction Processing”

This chapter has been updated to include a discussion of digital file structures, which broadly fall into two classes: (1) flat files and (2) databases. The flatfile approach is often associated with legacy systems, which are large mainframe systems that were commonplace in the 1960s and 1970s but still exist today. The discussion focuses on the operational and control problems inherent to flatfile systems. Most modern system implementations employ database technologies. The chapter outlines the key feature of the database approach and explains how flatfile data processing concerns are resolved through database technologies. This overview is expanded upon in [Chapters 9](#) and [10](#).

[Chapter 3](#), “Ethics, Fraud, and Internal Control”

This chapter has been revised to include the most recent research results published by the Association of Certified Fraud Examiners (ACFE). The ACFE study provides estimates of losses due to fraud, categorizes fraud by various factors, and creates a profile of fraud perpetrators. In addition, the chapter has been expanded to include a discussion of IT application controls. This material had previously been the subject matter of [Chapter 17](#), but it has been brought forward in the book to permit an integrated and more comprehensive treatment of internal control issues in [Chapters 4](#), [5](#), [6](#), [7](#), and [8](#).

[Chapter 4](#), “The Revenue Cycle” [Chapter 5](#), “The Expenditure Cycle [Part I: Purchases and Cash Disbursements Procedures](#)” [Chapter 6](#), “The Expenditure Cycle [Part II: Payroll Processing and Fixed Asset Procedures](#)” [Chapter 7](#), “The Conversion Cycle” and [Chapter 8](#), “Financial Reporting and Management Reporting Systems”

These chapters have been significantly revised to achieve two broad objectives: (1) illustrate AIS functionality and work flow patterns under different levels of technology, and (2) demonstrate how the internal control profile changes as the technology/ human-activity mix changes. Physical accounting information systems are a combination of computer technology and human activity. The technology/human mix creates a continuum of alternative design options. At one end of the continuum are systems that employ minimal technology and rely heavily on human involvement and manual procedures. At the other end are advanced technology systems, which to a great extent replace human activity with automated processes. The nature of the technology/human mix employed in a particular system has a direct bearing on the nature of internal controls needed to control the system. To demonstrate this relationship, we review

examples of systems at different points on the technology continuum.

The end-of-chapter material for these chapters has been significantly revised. This entailed revising all the end-of-chapter internal control cases and creating new ones. In particular, great attention was given to internal control case solutions to ensure consistency in appearance and an accurate reflection of the cases in the text. All case solution flowcharts are numerically coded and cross-referenced to text that explains the internal control issues. This approach, which has been classroom tested, facilitates effective presentation of internal control case materials.

Chapter 12, “Electronic Commerce Systems”

The chapter has been revised to include a discussion of cloud computing. Recent years has seen rapid growth in an array of computing services to business entities that are collectively referred to as cloud computing. The chapter examines the key elements of this concept including Software as a Service (SaaS), Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and virtualization. We examine the business drivers and purported advantages of cloud computing as well as the risks and control issues that management and accountants need to recognize.

Chapter 15, “General IT Controls Part I: Sarbanes-Oxley and IT Governance”

A new section in this chapter deals with internal control and governance issues associated with the structure of the corporate IT function. The section reviews the benefits, the disadvantages, and control problems of both centralized and distributed data processing configurations. The completely centralized and the fully distributed models represent extreme positions on a continuum of structural alternatives. The needs of most firms fall somewhere between these end points.

Chapter 17, “General IT Controls Part III: Systems Development, Program Changes, and Application Auditing”

This chapter has been reorganized and revised to expand its treatment of tests of IT application controls and substantive testing. The chapter presents a five-step process for designing and performing tests of application controls. This process is supported with several specific examples of tests of controls. The end-of-chapter material has also been extensively revised.

Organization and Content

PART I: OVERVIEW OF ACCOUNTING INFORMATION SYSTEMS

Chapter 1, “The Information System: An Accountant’s Perspective”

Chapter 1 places the subject of accounting information systems in perspective for accountants. It is divided into three major sections, each dealing with a different aspect of information systems.

- The first section explores the information environment of the firm. It identifies the types of information used in business, describes the flows of information through an organization, and presents a framework for viewing AIS in relation to other information systems components. The section concludes with a review of the key elements of the general model for AIS.
- The second section of the chapter deals with the impact of organization structure on AIS. It presents the business organization as a system of interrelated functions. Extensive attention is given the IT and accounting segments, which play collaborative roles as the purveyors of financial information for the rest of the organization.
- The third section discusses the role of accountants as designers and auditors of AIS. The nature of the responsibilities shared by accountants and computer professionals for developing AIS applications are examined.

Chapter 2, “Introduction to Transaction Processing”

Chapter 2 divides the treatment of transaction processing systems into six major sections.

- The first section provides an overview of transaction processing, showing its vital role as an information provider for financial reporting, internal management reporting, and the support of day-to-day operations. Three transaction cycles account for most of a firm’s economic activity: the revenue cycle, the expenditure cycle, and the conversion cycle.
- The second section describes the relationship among accounting records, both hard copy and digital, in forming an audit trail.
- The third section describes the key features of flat file and database structures used to store accounting data.
- The fourth section of the chapter presents an overview of documentation techniques used to describe the key features of systems. This section presents several documentation techniques for representing manual procedures and computer operations. These include data flow diagrams, entity relationship diagrams, system flowcharts, program flowcharts, and record layout diagrams.
- The fifth section addresses alternative transaction processing approaches. It reviews the fundamental features of batch and realtime technologies, and their implication for transaction processing.
- The final section examines data coding schemes, their role in transaction processing and AIS as a means of coordinating and managing a firm’s transactions, and the advantages and disadvantages of the major types of numeric and alphabetic coding schemes.

Chapter 3, “Ethics, Fraud, and Internal Control”

Chapter 3 deals with the related topics of ethics, fraud, and internal control.

- The chapter first examines ethical issues related to business and specifically to computer

systems. The questions raised are intended to stimulate class discussions.

- The second section deals with the subject of fraud and its implications for accountants. Although the term *fraud* is very familiar in today's financial press, it is not always clear what constitutes fraud. This section distinguishes between management fraud and employee fraud. The chapter presents techniques for identifying unethical and dishonest management and for assessing the risk of management fraud. Employee fraud can be prevented and detected by a system of internal controls. The section discusses the results of a research study conducted by the Association of Certified Fraud Examiners.
- The final section of the chapter describes the internal control structure and control activities specified in the COSO framework. The controls presented in this chapter, both physical and IT controls, are applied to specific applications in chapters that follow.

PART II: TRANSACTION CYCLES AND BUSINESS PROCESSES

Chapter 4, "The Revenue Cycle" **Chapter 5, "The Expenditure Cycle Part I: Purchases and Cash Disbursements Procedures"** and **Chapter 6, "The Expenditure Cycle Part II: Processing and Fixed Asset Procedures"**

The approach taken in these three chapters is similar. First, the respective cycle is reviewed conceptually using data flow diagrams to present key features and control points of each major subsystem. We then examine physical systems with two objectives in mind: (1) illustrate how system functionality changes under different levels of technology, and (2) demonstrate how the internal control focus shifts as the mix between technology and manual procedures changes. To accomplish this, we review examples of systems at different points on the technology continuum. The first examples are basic technology systems that use independent PCs, which function primarily as record keeping devices. We then move on to examples of advanced technologies that integrate key business functions.

Under each technology, the effects on operational efficiency and internal controls are examined. This approach provides the student with a solid understanding of the business tasks in each cycle and an awareness of how different technologies influence changes in the operation and control of the systems.

Chapter 7, "The Conversion Cycle"

Manufacturing systems represent a dynamic aspect of AIS. **Chapter 7** discusses the technologies and techniques used in support of two alternative manufacturing environments: traditional mass production (batch) processing and lean manufacturing. These environments are driven by information technologies, such as materials requirements planning (MRP), manufacturing resources planning (MRP II), and enterprise resource planning (ERP). The chapter addresses the shortcomings of the traditional cost accounting model as it compares to two alternative models: activitybased costing (ABC) and value stream accounting.

Chapter 8, "Financial Reporting and Management Reporting Systems"

Chapter 8 examines an organization's nondiscretionary and discretionary reporting systems.

- First, it focuses on the general ledger system (GLS) and on the files that constitute a GLS database.
- Next, it examines how financial statement information is provided to both external and internal users through a multistep reporting process. The emerging technology of XBRL is changing traditional financial reporting for many organizations. The key features of XBRL and the internal control implications of this technology are considered.

- The chapter then looks at discretionary reporting systems that constitute the Management Reporting System (MRS). Discretionary reporting is not subject to the professional guidelines and legal statutes that govern nondiscretionary financial reporting. Rather, it is driven by several factors, including management principles; management function, level, and decision type; problem structure; responsibility accounting; and behavioral considerations. The impact of each factor on the design of the management reporting system is investigated.

PART III: ADVANCED TECHNOLOGIES IN ACCOUNTING INFORMATION

Chapter 9, “Database Management Systems”

Chapter 9 addresses the design and management of an organization’s data resources.

- The first section demonstrates how problems associated with traditional flatfile systems are resolved under the database approach.
- The second section describes in detail the functions and relationships among four primary elements of the database environment: the users, the database management system (DBMS), the database administrator (DBA), and the physical database.
- The third section is devoted to an in-depth explanation of the characteristics of the relational database model.
- The fourth section examines database design topics including data modeling, deriving relational tables from ER diagrams, the creation of user views, and data normalization techniques.
- The chapter concludes with a discussion of distributed database issues. It examines three possible database configurations in a distributed environment: centralized, partitioned, and replicated databases.

Chapter 10, “The REA Approach to Database Modeling”

Chapter 10 presents the resources, events, and agents REA model as a means of specifying and designing accounting information systems that serve the needs of all users within an organization. The chapter is composed of three major sections.

- The chapter begins by defining the key elements of REA. The basic model employs a unique form of ER diagram called an REA diagram. The diagram consists of three entity types (resources, events, and agents) and a set of associations linking them.
- Next, the rules for developing an REA diagram are explained and illustrated in detail. An important aspect of the model is the concept of economic duality, which specifies that each economic event must be mirrored by an associated economic event in the opposite direction. The section illustrates the development of an REA database for a hypothetical firm, following a multistep process called view modeling. The result of this process is an REA diagram for a single organizational function.
- The chapter’s fourth section explains how multiple REA diagrams (revenue cycle, purchases, cash disbursements, and payroll) are integrated into a global or enterprisewide model. The enterprise model is then implemented into a relational database structure, and user views are constructed. The section concludes with a discussion of how REA modeling can improve competitive advantage by allowing management to focus on the value-added activities of their operations.

Chapter 11, “Enterprise Resource Planning Systems”

Chapter 11 presents a number of issues related to the implementation of enterprise resource planning (ERP) systems. It is composed of five major sections.

- The first section outlines the key features of a generic ERP system by comparing the function and data storage techniques of a traditional flatfile or database system to that of an ERP.
- The second section describes various ERP configurations related to servers, databases, and bolt-on software.
- Data warehousing is the topic of the third section. A data warehouse is a relational or multidimensional database that supports online analytical processing (OLAP). Issues discussed include data modeling, data extraction from operational databases, data cleansing, data transformation, and loading data into the warehouse.
- The fourth section examines risks associated with ERP implementation. These include “big bang” issues, opposition to change within the organization, choosing the wrong ERP model, choosing the wrong consultant, cost overrun issues, and disruptions to operations.
- The fifth section reviews several control and auditing issues related to ERPs. The discussion follows the COSO framework.

Chapter 12, “Electronic Commerce Systems”

Driven by the Internet revolution, electronic commerce is dramatically expanding and undergoing radical changes. Although electronic commerce has brought enormous opportunities for consumers and businesses, its effective control present challenges to organization management teams and accountants. To properly evaluate the potential exposures and risks in this environment, the modern accountant must be familiar with the technologies and techniques that underlie electronic commerce. **Chapter 12** and its associated appendix deal with several aspects of electronic commerce.

- The body of the chapter examines Internet commerce including business-to-consumer and business-to-business relationships. It presents the risks associated with electronic commerce, including hardware failures, software errors, unauthorized access from remote locations, and denial of service attacks that can prevent an organization from conducting business.
- The chapter also reviews security and assurance techniques to reduce risk and promote trust.
- The chapter concludes with a discussion of how Internet commerce impacts the accounting and auditing profession.
- The internal usage of networks to support distributed data processing and traditional business-to-business transactions conducted via EDI systems are presented in the appendix.

PART IV: SYSTEMS DEVELOPMENT ACTIVITIES

Chapter 13, “Managing the Systems Development Life Cycle,” and Chapter 14, “Construct, Deliver, and Maintain Systems Projects”

The chapters in **Part IV** examine the accountant’s role in the systems development process.

- **Chapter 13** begins with an overview to the systems development life cycle (SDLC). This multistage process guides organization management through the development and/or purchase of information systems.
- Next, **Chapter 13** presents the key issues pertaining to developing a systems strategy, including its relationship to the strategic business plan, the current legacy situation, and feedback from the user community. The chapter provides a methodology for assessing the feasibility of proposed projects and for selecting individual projects to go forward for construction and

delivery to their users.

- The chapter concludes by reviewing the role of accountants in managing the SDLC.
- **Chapter 14** covers the many activities associated with inhouse development, which fall conceptually into two categories: (1) constructing the system and (2) delivering the system. Through these activities, systems selected in the project initiation phase (discussed in **Chapter 13**) are designed in detail and implemented. This involves creating input screen formats, output report layouts, database structures, and application logic. Finally, the completed system is tested, documented, and rolled out to the user.
- **Chapter 14** then examines the increasingly important option of using commercial software packages. Conceptually, the commercial software approach also consists of construct and delivery activities. The chapter examines the pros, cons, and issues involved in selecting off-the-shelf systems.
- **Chapter 14** also addresses the important activities associated with systems maintenance and the associated risks that are important to managers, accountants, and auditors.

Several comprehensive cases designed as team-based systems development projects are available online at www.cengagebrain.com. These cases have been used effectively by groups of three or four students working as a design team. Each case has sufficient details to allow analysis of user needs, preparation of a conceptual solution, and the development of a detailed design, including user views (input and output), processes, and databases.

PART V: GENERAL CONTROLS AND IT AUDITING

Chapter 15, “General IT Controls Part I: Sarbanes-Oxley and IT Governance”

Chapter 15 provides an overview of management and auditor responsibilities under Sections 302 and 404 of the Sarbanes-Oxley Act (SOX). The design, implementation, and assessment of internal control over the financial reporting process form the central theme for this chapter and the two chapters that follow. This treatment of internal control complies with the COSO control framework. Chapter presents risks, controls, and tests of controls related to IT governance, including organizing the IT function, controlling computer center operations, designing an adequate disaster recovery plan, and IT outsourcing.

Chapter 16, “General IT Controls Part II: Security and Access”

Chapter 16 continues the treatment of IT controls as described by the COSO control framework. The focus of the chapter is on SOX compliance regarding the security and control of operating systems, database management systems, and communication networks. This chapter examines the risks, controls, audit objectives, and tests of controls that may be performed to satisfy either compliance or attest responsibilities.

Chapter 17, “General IT Controls Part III: Systems Development, Program Changes, and Application Auditing”

Chapter 17 concludes the examination of general IT controls as outlined in the COSO control framework. The chapter focuses on SOX compliance regarding systems development and program change procedures. It examines the risks, controls, audit objectives, and tests of controls that may be performed to satisfy compliance or attest responsibilities. The chapter also examines several computer-assisted audit tools and techniques (CAATs) for testing application controls and for performing substantive tests.

SUPPLEMENTS

Product Website

Additional teaching and learning resources, including access to additional internal control and systems development cases, are available by download from the book's website at www.cengagebrain.com.

PowerPoint® Slides

Completely updated PowerPoint® slides provide colorful lecture outlines of each chapter of the text, incorporating text graphics and flowcharts where needed. The PowerPoint® presentation is available for download from the text website.

Test Bank

The Test Bank, available in Word, contains true/false, multiple-choice, short answer, and essay questions. The files are available for download from the text website.

Solutions Manual

The *Solutions Manual* contains solutions to all end-of-chapter problems and cases. Adopting instructors may download the *Solutions Manual* under password protection at the Instructor's Resource page of the book's website.

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Overview of Accounting Information Systems

Chapter 1 The Information System: An Accountant's Perspective

Chapter 2 Introduction to Transaction Processing

Chapter 3 Ethics, Fraud, and Internal Control

The Information System: An Accountant's Perspective



Learning Objectives

After studying this chapter, you should:

- Recognize the primary information flows within the business environment.
 - Understand the difference between accounting information systems and management information systems.
 - Understand the difference between financial transactions and nonfinancial transactions.
 - Know the principal features of the general model for information systems.
 - Understand the organizational structure and functional areas of a business.
 - Be able to distinguish between external auditing, internal auditing, and advisory services as they relate to accounting information systems.
-

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

The purpose of this chapter is to place the subject of AIS in perspective for accountants. Toward this end, the chapter is divided into three major sections, each dealing with a different aspect of information systems. The first section explores the information environment of the firm. It identifies the types of information used in business, describes the flows of information through an organization, and presents a framework for viewing AIS in relation to other information systems components. The section concludes with a review of the key elements of the general model for AIS. The second section of the chapter deals with the impact of organizational structure on AIS. Here we examine the business organization as a system

of interrelated functions. Extensive attention is given the IT and accounting segments, which play collaborative roles as the purveyors of financial information for the rest of the organization. The final section discusses the unique responsibility of accountants as domain experts in the design of AIS and as auditors of AIS.

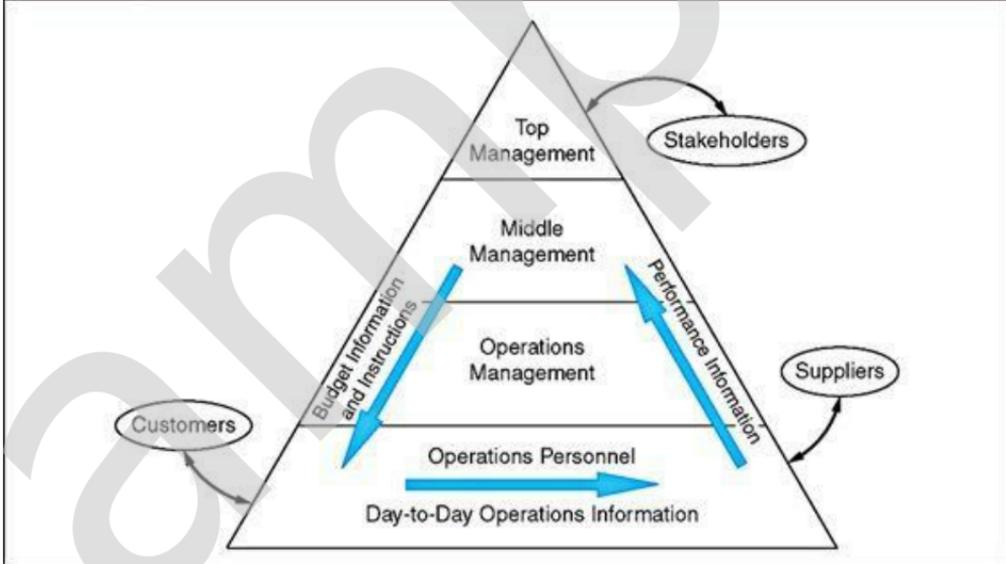
The Information Environment

We begin the study of AIS with the recognition that information is a business resource. Like other business resources such as raw materials, capital, and labor, information is vital to the survival of the contemporary business organization. Every business day, vast quantities of information flow to decision makers and other users to meet a variety of internal needs. In addition, information flows out from the organization to external users, such as customers, suppliers, and stakeholders who have an interest in the firm. [Figure 1-1](#) presents an overview of these internal and external [information flows](#).

The pyramid in [Figure 1-1](#) shows the business organization divided horizontally into several levels of activity. Business operations form the base of the pyramid. These activities consist of the product-oriented work of the organization, such as manufacturing, sales, distribution, billing, and cash receipts. Above the base level, the organization is divided into three management tiers: operations management, middle management, and top management. Operations management is directly responsible for controlling day-to-day operations. Middle management is accountable for the short-term planning and coordination of activities necessary to accomplish organizational objectives. Top management is responsible for longer-term planning and setting organizational objectives. Every individual in the organization, from business operations to top management, needs information to accomplish his or her tasks.

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

FIGURE 1-1 INTERNAL AND EXTERNAL FLOWS OF INFORMATION



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

INFORMATION OBJECTIVES

Specific information objectives will differ from firm to firm as specific user needs vary. Three fundamental objectives are, however, common to all organizations:

1. *To support the stewardship function of management.* Stewardship refers to managers' responsibility to properly manage the resources of the firm and to report on their activities. External users receive stewardship information through traditional financial statements and other mandated reports. Internally, managers receive stewardship information from various responsibility reports.
2. *To support management decision making.* Managers use information to assist them in planning and control decisions related to their areas of responsibility.
3. *To support the firm's day-to-day operations.* Operations personnel use information to assist them in the efficient and effective discharge of their daily tasks.

The level of detail and the nature of the information needed to meet these diverse objectives differ

considerably. For example, managers cannot effectively employ the finely detailed information used to support day-to-day operations. Management decision information tends to be highly summarized and oriented toward reporting on overall performance and trends rather than routine tasks. Similarly, external stakeholders require information very different from that of management and operations users. Financial statement information, based on generally accepted accounting principles (GAAP), is accrual based and unsuitable for most internal uses. The information needed to meet information objectives is the product of the information system.

AN INFORMATION SYSTEMS FRAMEWORK

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

Figure 1-2 shows the information system of a hypothetical manufacturing firm decomposed into its elemental subsystems. Notice that two broad classes of systems emerge from the decomposition: the accounting information system (AIS) and the management information system (MIS). We will use this framework to identify the domain of AIS and distinguish it from MIS. Keep in mind that Figure 1-2 is a conceptual view; physical information systems are not typically organized into such discrete packages. More often, MIS and AIS functions are integrated within physical systems to achieve operational efficiency.

The distinction between AIS and MIS centers on the concept of a transaction, as illustrated by Figure 1-3. The information system accepts input, called transactions, which are converted through various processes into output information that goes to users. Transactions fall into two classes: financial transactions and nonfinancial transactions. Before exploring this distinction, let's first define the term *transaction*:

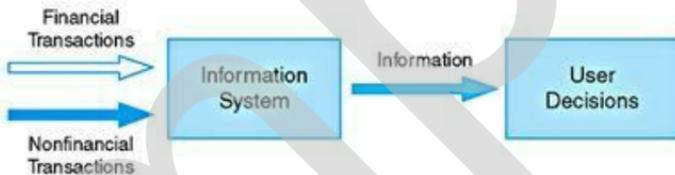
A transaction is an event that affects or is of interest to the organization and is processed by its information system as a unit of work.

FIGURE 1-2 A FRAMEWORK FOR INFORMATION SYSTEMS



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FIGURE 1-3 TRANSACTIONS PROCESSED BY THE INFORMATION SYSTEM



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

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

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

Nonfinancial transactions are events that do not meet the narrow definition of a financial transaction. For example, adding a new supplier of raw materials to the list of valid suppliers is an event that may be processed by the enterprise's information system as a transaction. Important as this information obviously is, it is not a financial transaction, and the firm has no legal obligation to process it correctly—or at all.

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

The Accounting Information System

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

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

The Management Information System

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

The Need to Distinguish between AIS and MIS

SOX legislation requires that corporate management design and implement internal controls over the entire financial reporting process. This includes the financial reporting system, the general ledger system, and the transaction processing systems that supply the data for financial reporting. SOX further requires that management certify these controls and that the external auditors express an opinion on control effectiveness. Because of the highly integrative nature of modern information systems, management and auditors need a conceptual view of the information system that clearly distinguishes key processes and areas of risk and legal responsibility from other (nonlegally binding) aspects of the system. Without such a model, mandated management and audit responsibilities under SOX may not be efficiently or adequately met.

TABLE 1-1 EXAMPLES OF MIS APPLICATIONS IN FUNCTIONAL AREAS

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

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AIS SUBSYSTEMS

We devote separate chapters to an in-depth study of each AIS subsystem depicted in [Figure 1-2](#). At this point, we briefly outline the role of each subsystem.

Transaction Processing System

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

The TPS deals with business events that occur frequently. In a given day, a firm may process thousands of transactions. To deal efficiently with such volume, similar types of transactions are grouped together into transaction cycles. The TPS consists of three transaction cycles: the revenue cycle, the expenditure cycle, and the conversion cycle. Each cycle captures and processes different types of financial transactions. [Chapter 2](#) of this text provides an overview of transaction processing. [Chapter 4](#), [5](#), [6](#), and [7](#) examine in detail the revenue, expenditure, and conversion cycles.

General Ledger/Financial Reporting Systems

The general ledger system (GLS) and the financial reporting system (FRS) are two closely related subsystems. However, because of their operational interdependency, they are generally viewed as a single integrated system—the GL/FRS. The bulk of the input to the GL portion of the system comes from transaction cycle subsystems. Summaries of transaction activity are processed by the GLS to update the general ledger control accounts. Other, less frequent, events such as stock transactions, mergers, and lawsuit settlements, for which there may be no formal processing cycle in place, enter the GLS through alternate sources. The FRS measures and reports the status of financial resources and the changes in those resources. The FRS communicates this information primarily to external users. This type of reporting is called [nondiscretionary reporting](#) because the organization has few or no choices in the information it provides. Much of this information consists of traditional financial statements, tax returns, and other legal documents.

Management Reporting System

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

[A GENERAL MODEL FOR AIS](#)

[Figure 1-4](#) presents the [general model for AIS](#). This is a general model because it describes all information systems, regardless of their underlying technology. The elements of the general model are end users, data sources, data collection, data processing, database management, information generation, and feedback.

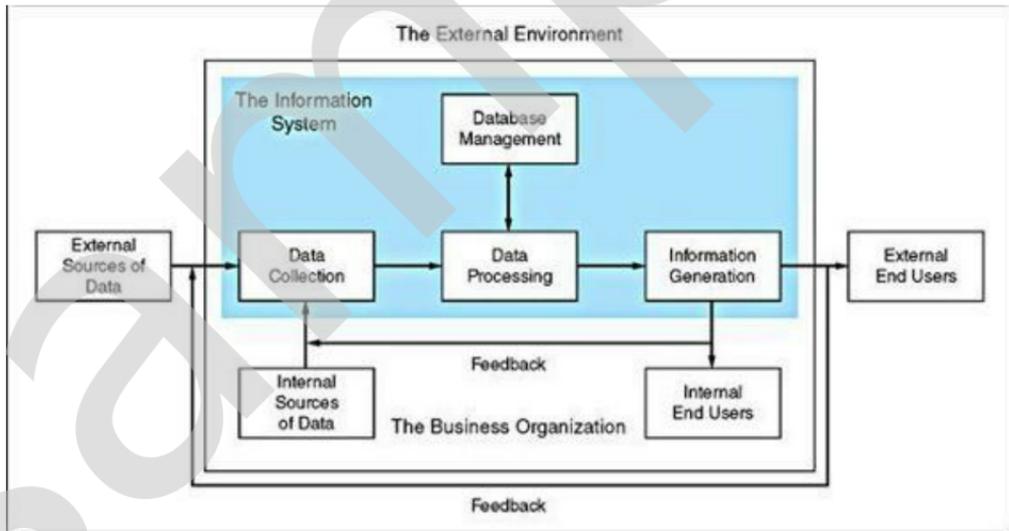
End Users

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

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

proper accountability, and the cost of providing alternative forms of information. Thus, internal reporting poses a less structured and generally more difficult challenge than external reporting.

FIGURE 1-4 GENERAL MODEL FOR ACCOUNTING INFORMATION SYSTEMS



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DATA VERSUS INFORMATION. Before discussing the data sources portion of [Figure 1-4](#), we need to make an important distinction between the terms *data* and *information*. **Data** are facts, which may or may not be processed (edited, summarized, or refined) and have no direct effect on a user's actions. By contrast, **information** causes the user to take an action that he or she otherwise could not, or would not, have taken. Information is often defined simply as processed data, but this definition is inadequate. Information is determined by the effect it has on the user, not by its physical form. For example, a purchasing agent receives a daily report listing raw material inventory items that are at low levels. This report causes the agent to place orders for more inventories. The facts in this report have information content for the purchasing agent. However, this same report in the hands of the personnel manager is a mere collection of facts, or data, causing no action and having no information content.

In other words, one person's information is another person's data. Thus, information is not just a set of processed facts arranged in a formal report. Information triggers users to take actions that support their day-to-day business tasks, resolve conflicts, and plan for the future. We should note that action does not necessarily mean a physical act. For instance, a purchasing agent who receives a report showing that inventory levels are adequate will respond by ordering nothing. The agent's action to do nothing is a conscious decision, triggered by information and different from doing nothing because of being uninformed. The distinction between data and information has pervasive implications for the study of information systems. If output from the information system fails to cause users to act, the system serves no purpose.

Data Sources

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

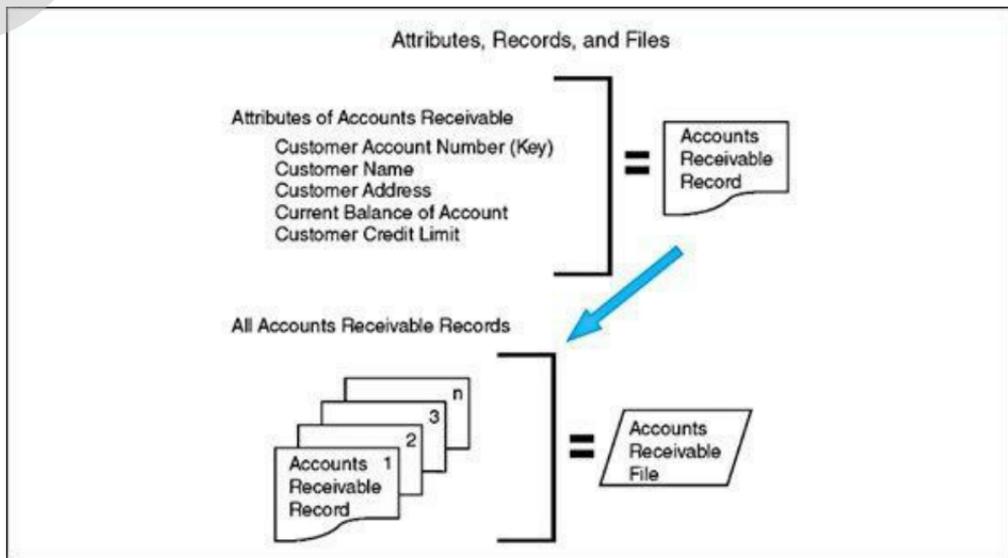
Data Collection

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

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

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

FIGURE 1-5 THE DATA HIERARCHY



Data Processing

Once collected, data usually require processing to produce information. Tasks in the [data processing](#) stage range from simple to complex. Examples include mathematical algorithms (such as linear programming models) used for production scheduling applications, statistical techniques for sales forecasting, and posting and summarizing procedures used for accounting applications.

Database Management

The organization's [database](#) is its physical repository for financial and nonfinancial data. We use the term *database* in the generic sense. The term could apply to a filing cabinet or a computer disk. Regardless of the database's physical form, business data are organized in a logical hierarchy. The levels in the data hierarchy—attribute, record, and file—are illustrated in [Figure 1-5](#).

DATA ATTRIBUTE. The data attribute is the most elemental piece of potentially useful data in the database. An attribute is a logical and relevant characteristic of an entity about which the firm captures data. The attributes shown in [Figure 1-5](#) are logical because they all relate sensibly to a common entity—accounts receivable (AR). Each attribute is also relevant because it contributes to the information content of the entire set of attributes. As proof of this, the absence of any single relevant attribute diminishes or destroys the information content of the set. The addition of irrelevant or illogical attributes would not enhance the information content of the set.

RECORD. A record is a complete set of attributes for a single occurrence within an entity class. For example, a particular customer's name, address, and account balance is one occurrence (or record) within the AR class. To find a particular record within the database, we must be able to identify it uniquely.

Therefore, every record in the database must be unique in at least one attribute.¹ This unique identifier attribute is called the primary key. Because no natural attribute (such as customer name) can guarantee uniqueness, we typically assign artificial keys to records. The key for the AR records in [Figure 1-5](#) is the customer account number. This is the only unique identifier in this record class. The other attributes possess values that may also exist in other records. For instance, multiple customers may have the same name, sales amounts, credit limits, and balances. Using any one of these as a key to find a specific record would not work efficiently. These nonunique attributes are, however, often used as secondary keys for categorizing data. For example, the account balance attribute can be used to prepare a list of customers with balances greater than \$10,000.

FILE. A file (or table) is a complete set of records of an identical class. For example, all the AR records of the organization constitute the AR file. Similarly, files are constructed for other classes of records such as inventory, accounts payable, and payroll. The organization's database is the entire collection of such files.

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

Information Generation

[Information generation](#) is the process of compiling, arranging, formatting, and presenting information to

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

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

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

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

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

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

Feedback

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

Organizational Structure and AIS

In later chapters we see how the design and/or audit of accounting information systems require an understanding of the functional segments and activities that constitute an organization's structure. Physical accounting information systems comprise technologies of various types and configurations, as well as people and tasks from across the organization. Indeed, the so-called "accounting" information system actually involves diverse accounting and nonaccounting activities and personnel. For example, the sales processing system, which is a subsystem of the revenue cycle (refer to [Figure 1-2](#)), includes the following organization functions: sales, credit, inventory control, warehousing, shipping, billing, accounts receivable, general ledger, and data processing. [Figure 1-6](#) depicts these and other typical business functions for a hypothetical manufacturing firm. The shaded functions in [Figure 1-6](#) (those associated with processing sales orders) emphasize the entitywide impact of AIS.

FUNCTIONAL SEGMENTATION

Segmentation by business function is a common method of organizing a business entity. Functional [segments](#) derive from the flow of resources through the firm. For example, assume a manufacturing firm that employs the following resources: materials, labor, financial capital, and information. [Table 1-2](#) shows the relationship between these resources and the functional segments that manage them.

The segments and the functions within them will vary among organizations, depending on their size and lines of business. A public water company, for example, does not need to market its product and probably will have little in the way of advertising or market research functions. Also, a service organization with no inventories to manage will not need an inventory control function. The remainder of this section presents the key features of the functional areas for the hypothetical firm represented in [Figure 1-6](#).

Materials Management

The objective of materials management is to plan and control the materials inventory of the company. A manufacturing firm must have sufficient inventories on hand to meet its production needs and yet avoid excessive inventory levels. Every dollar invested in inventory is a dollar that is not earning a return. Furthermore, idle inventory can become obsolete, lost, or stolen. Ideally, a firm would coordinate inventory arrivals from suppliers such that they move directly into the production process. As a practical matter, however, most organizations maintain safety stocks to carry them through the lead time between placing the order for inventory and its arrival. We see from [Figure 1-6](#) that materials management has three sub-functions:

1. *Purchasing* is responsible for ordering inventory from vendors when inventory levels fall to their reorder points. The nature of this task varies among organizations. In some cases, purchasing requires no more than sending a purchase order to a designated vendor. In other cases, this task involves soliciting bids from a number of competing vendors. The nature of the business and the type of inventory determine the extent of the purchasing function.
2. *Receiving* is the task of accepting the inventory previously ordered by purchasing. Receiving activities include counting and checking the physical condition of these items. This is an organization's first, and perhaps only, opportunity to detect incomplete deliveries and damaged merchandise before they move into the production process.
3. *Stores* takes physical custody of the inventory received and releases these resources into the production process as needed.

FIGURE 1-6 FUNCTIONAL AREAS OF A FIRM

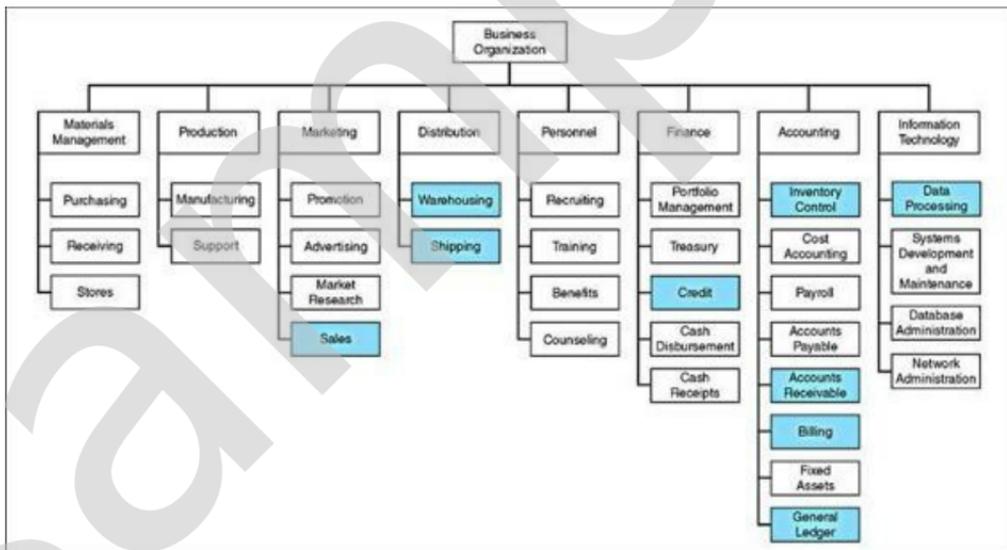


TABLE 1-2 FUNCTIONS FROM RESOURCES

| Resource | Functional Segment |
|-------------------|---|
| Materials | Materials Management Production Marketing Distribution |
| Labor | Personnel |
| Financial Capital | Finance |
| Information | Accounting Information technology |

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Production

Production activities occur in the conversion cycle in which raw materials, labor, and plant assets are used to create finished products. The specific activities are determined by the nature of the products being manufactured. In general they fall into two broad classes: (1) primary manufacturing activities and (2) production support activities. Primary manufacturing activities shape and assemble raw materials into finished products. Production support activities ensure that primary manufacturing activities operate

efficiently and effectively. These include, but are not limited to, the following types of activities:

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

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

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

Marketing

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

Distribution

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

Personnel

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

Finance

The finance function manages the financial resources of the firm through banking and treasury activities, portfolio management, credit evaluation, cash disbursements, and cash receipts. Because of the cyclical nature of business, many firms swing between positions of excess funds and cash deficits. In response to these cash flow patterns, financial planners seek lucrative investments in stocks and other assets, and low-cost lines of credit from banks. The finance function also administers the daily flow of cash in and out of the firm.

THE ACCOUNTING FUNCTION

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

obligations. Second, accounting distributes transaction information to operations personnel to coordinate many of their key tasks. The following accounting functions contribute directly to business operations: inventory control, cost accounting, payroll, accounts payable, accounts receivable, billing, fixed asset accounting, and the general ledger. We deal with each of these specifically in later chapters. For the moment, however, we need to maintain a broad view of accounting to understand its functional role in the organization.

The Value of Information

The value of information to a user is determined by its **reliability**. We saw earlier that the purpose of information is to lead the user to a desired action. For this to happen, information must possess certain attributes—relevance, accuracy, completeness, summarization, and timeliness. When these attributes are consistently present, information has reliability and provides value to the user. Unreliable information has no value. At best, it is a waste of resources; at worst, it can lead to dysfunctional decisions. Consider the following example:

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

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

Accounting Independence

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

INFORMATION TECHNOLOGY

Figure 1-6 depicts four information technology (IT) functions: (1) data processing, (2) systems development and maintenance, (3) database administration, and (4) network administration. Although an organization may have many additional IT functions, these four are included in this discussion because they hold specific internal control concerns for management and auditors that we will investigate in detail in later chapters. Below, we outline the key features of each of them.

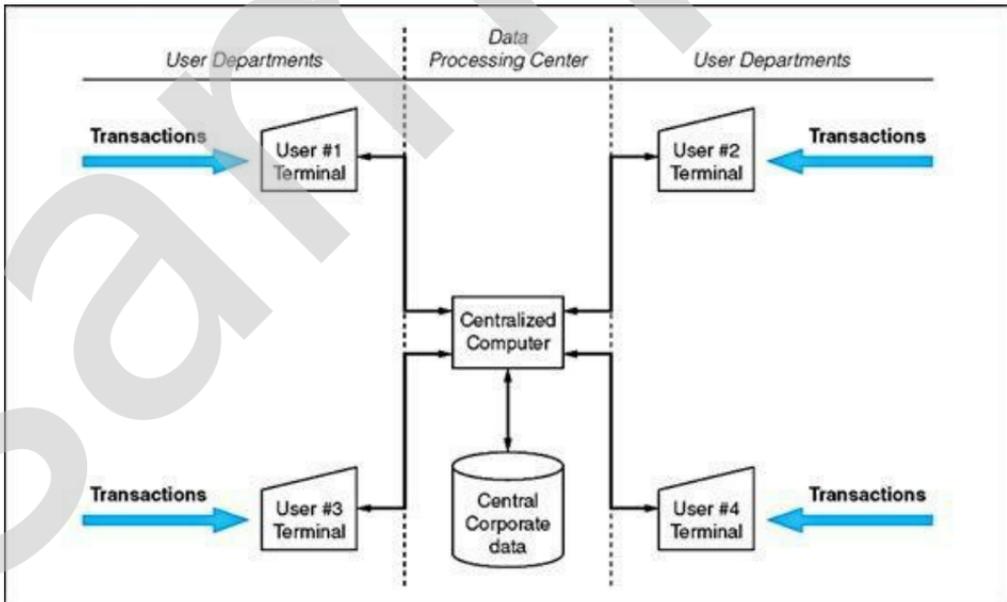
Data Processing

The data processing function brings to bear IT personnel, computer hardware, application programs (software), and corporate data to support user information needs through transaction processing and information reporting. Data processing configurations vary among different types of business entities. At one end of a continuum of options is the centralized data processing model, and at the other end is the distributed data processing model. Many organizations employ a combination of centralized and distributed processing.

CENTRALIZED DATA PROCESSING. Under the **centralized data processing** model, all data processing is performed by one or more large computers housed in a common data center that serves users

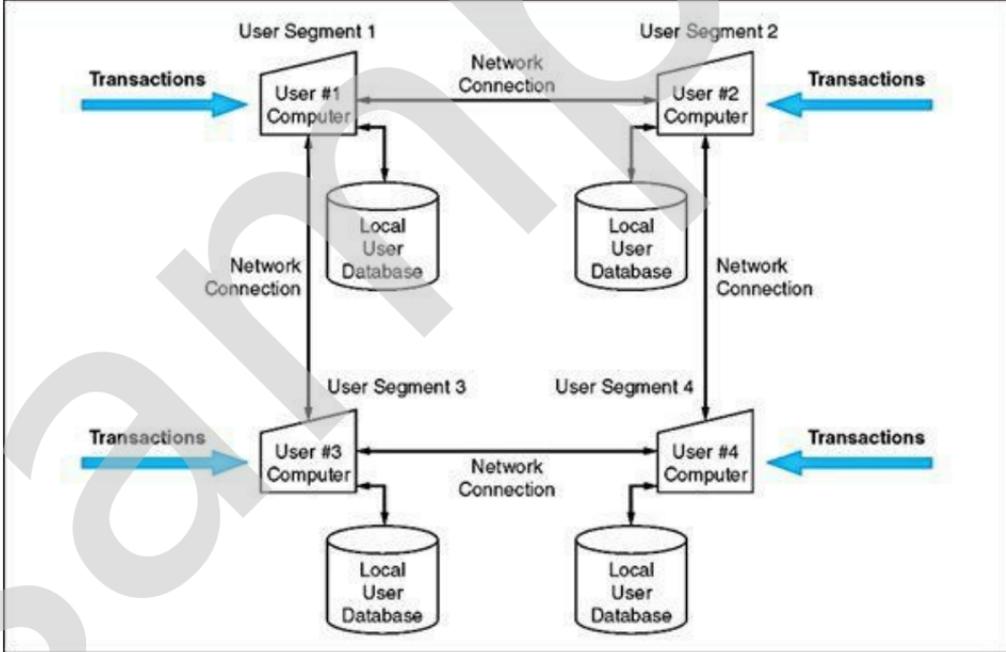
throughout the organization. [Figure 1-7](#) illustrates the centralized approach. End users process transactions from terminals in their respective departments, which are connected to the central computer and database. Because the computing resources (personnel, hardware, software, and data) are centrally located and accessible by all authorized users, the centralized data processing configuration lends itself to intraorganization communication and data sharing between user departments.

FIGURE 1-7 CENTRALIZED DATA PROCESSING MODEL



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FIGURE 1-8 DISTRIBUTED DATA PROCESSING MODEL



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DISTRIBUTED DATA PROCESSING. Figure 1-8 depicts the **distributed data processing (DDP)** model, in which users process their transactions locally. Under this configuration each user segment possesses the IT personnel, facilities, hardware, software, and data they need to support their operations. Unlike in the centralized approach, users in a DDP environment function independently and tend not to share data and information. Any necessary sharing, however, is accomplished through network connections between the users.

Both the centralized and distributed data processing models have their respective benefits, risks, and internal control implications. We will examine these issues in detail in subsequent chapters.

Systems Development and Maintenance

The information systems needs of organizations are met by two related functions: systems development and systems maintenance. The systems development function is the process by which organizations acquire information systems. The systems maintenance function is responsible for keeping the existing system current with user needs. We examine each of these functions separately below.

SYSTEMS DEVELOPMENT. Organizations acquire information systems in two ways: they purchase commercial software and/or they build custom systems inhouse from scratch. **Commercial software** is available for both general accounting use and for industry specific applications, such as medical billing. Commercial software packages are sometimes called **turnkey systems** because they can often be implemented by the user with little or no modification.

The business community has recognized the many advantages of buying commercial software applications. Software vendors such as Microsoft, Oracle, and SAP design their products to appeal to a large community of users, which keeps down the unit cost to the customer. Also, by purchasing commercial packages, client companies can acquire effective business solutions that are thoroughly tested, free from errors, and are current with professional standards and technological innovations designed by domain experts. Both small and large firms that have standardized information needs are potential customers for commercial software. Larger organizations with unique information needs often develop [custom software](#) through a formal process called the [systems development life cycle](#). Creating custom software requires the organization to have an inhouse team of qualified and experienced IT professionals consisting of systems analysts, programmers, and database designers. The IT team works with corporate users to assess their information needs, design computer solutions, and physically implement them.

Custom systems are more expensive than commercial packages because the organization must absorb all the development costs, which commercial vendors are able to spread across the entire user population. For example, companies in competitive, fast-moving industries such as telecommunications, pharmaceuticals, and financial services invest hundreds of millions of dollars in custom software. However, when information needs are unique, and no commercial package adequately meets them, custom software is often the only option.

To fill this void some commercial software vendors design their systems in modules that allow flexibility through numerous processing options. Large scale [enterprise resource planning \(ERP\)](#) systems are an example of this approach. The base ERP system is comprised of thousands of small program modules. From this vast array of options the IT team selects those modules that support the organization's specific information and data processing needs. Configuring the system in this way often takes many months, but the result is a customized system with the advantages of a commercial system. ERP key features, benefits, risks, and control issues are discussed in [Chapter 11](#).

SYSTEMS MAINTENANCE. Over the course of the system's life (often several years), a system may be modified many times as user needs change and evolve. Maintenance changes may be trivial, such as modifying the system to produce an additional report, or significant, such as modifying it to execute new accounting rules that impact many different system modules. Between 80 and 90 percent of a system's total cost may be incurred because of maintenance activities.

Systems development and maintenance activities constitute material financial investments in hardware, software, and personnel for many organizations. These activities also represent significant risks that need to be controlled and, consequently, are of concern to management and accountants. We deal with these issues in detail in [Chapter 13](#), [14](#), and [17](#).

Database Administration

Centrally organized companies maintain their data resources in a central location that is shared by all authorized end users (refer to [Figure 1-7](#)). In this shared-data arrangement, a special independent group—database administration—headed by the database administrator is responsible for the security and integrity of the database. We explore the database concept and the role of the database administrator in [Chapter 9](#).

Network Administration

A [network](#) is a collection of interconnected computers and communications devices that allows users to communicate, access data and applications, and share information and resources. [Network administration](#) is responsible for the effective functioning of the software and hardware that constitute the organization's network. This involves configuring, implementing, and maintaining network equipment. In addition, network administration is responsible for monitoring network activity to ensure that the network is being used in accordance with company policies and that it is secure from attack by hackers from outside

the organization as well as unauthorized individuals within the organization. Network technologies, security issues, and control techniques are the topics of [Chapter 12](#) and [16](#).

Outsourcing the IT Function

From this brief discussion we see that the IT segment of an organization comprises highly technical, dynamically changing, and expensive activities. Corporate management has long complained about the administrative burden and high cost associated with managing and maintaining IT functions. In an effort to bring costs under control and to escape their IT headaches, many corporate executives look to [IT outsourcing](#). Under this practice the organization sells its IT resources (hardware, software, and facilities) to a third-party outsourcing vendor such as HP Enterprise Services (formally EDS). The outsourcing organization then leases back IT services from the vendor for a contract period of typically between five and ten years. The company's IT employees are often transferred in such deals and become employees of the outsourcing vendor. Of course, when the vendor takes the IT function off shore, employee transfers are not possible.

A variant of IT outsourcing, called [cloud computing](#), is location-independent computing whereby shared data centers deliver hosted IT services over the Internet. These services fall into three categories: [software as a service \(SaaS\)](#), [infrastructure as a service \(IaaS\)](#), and [platform as a service \(PaaS\)](#). The concept can be equated to the way in which electricity is delivered to a private home. The homeowner enters into a contract with the local public utility company to deliver electricity as needed. The public utility company may generate some of this electricity, but during high demand periods it will go to the national electric grid to tap into the production of other electricity generators across the country. Similarly, an organization pursuing cloud computing signs a contract with an IT service provider to provide computing resources. When demand exceeds the provider's IT capacity, it acquires additional capacity from data centers in the "cloud" that are connected via the Internet. A potential risk to the client firm is that it does not necessarily know where its data are actually being processed, just as the homeowner does not know where his or her electricity is being generated. The advantage to the client organization is access to whatever computing power it needs, while it pays only for what it uses. Also, cloud computing contracts are flexible and relatively short term. In contrast, traditional outsourcing contracts tend to be fixed price, inflexible, and much longer term.

IT outsourcing is a rapidly growing phenomenon. The departure from tradition that it represents carries both advantages and risks that management and auditors need to recognize. In [Chapter 15](#) we explore these issues in detail.

Accountants' Unique Role in AIS

The final section of this chapter outlines two key areas in which accountants are uniquely involved with the accounting information system—as system designers and system auditors.

ACCOUNTANTS AS SYSTEM DESIGNERS

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

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

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

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

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

The design of the conceptual system involves specifying the criteria for identifying delinquent customers and the information that needs to be reported. As the domain expert, the accountant determines the nature of the information required, its sources, its destination, and the accounting rules that need to be applied. The physical system includes the data storage medium to be used and the method for capturing and presenting the information. IT professionals determine the most economical and effective technologies for accomplishing the task. Hence, systems design must be a collaborative effort. Because of the specificity of accounting rules, the susceptibility of material error, and the potential for fraud, the accountant's involvement in systems design needs to be pervasive.

ACCOUNTANTS AS SYSTEM AUDITORS

Business organizations undergo audits of different types for different purposes. The most common of these are external (financial) audits, internal audits, and fraud audits. Each type of audit requires that the auditor have a thorough understanding of AIS functions and internal controls.

External (Financial) Audits

An external audit is an independent attestation performed by an expert—the auditor—who expresses an opinion regarding the presentation of financial statements. This task, known as the **attest function**, is performed by Certified Public Accountants (CPA) who work for public accounting firms that are independent of the client organization being audited. The audit objective is always associated with assuring the fair presentation of financial statements. These audits are, therefore, often referred to as *financial audits*. The Securities and Exchange Commission (SEC) requires all publicly traded companies to undergo a financial audit annually. CPAs conducting such audits represent the interests of outsiders: stockholders, creditors, government agencies, and the general public.

The CPA's role is similar in concept to that of a judge who collects and evaluates evidence and renders an opinion. A key concept in this process is *independence*. The judge must remain independent in his or her deliberations. The judge cannot be an advocate of either party in the trial but must apply the law impartially based on the evidence presented. Likewise, the independent auditor collects and evaluates evidence and renders an opinion based on the evidence. Throughout the audit process, the auditor must maintain independence from the client organization. Public confidence in the reliability of the company's internally produced financial statements rests directly on an evaluation of them by an independent auditor.

The evidence auditors gather comes from two types of tests that they perform: (1) tests of controls and (2) substantive tests. As the name implies, **tests of controls** are focused on the system itself and the controls built into it that reduce the risk of material errors and/or fraud. Performing tests of controls requires a thorough understanding of system processes. **Substantive tests** focus on data rather than process. These tests include techniques for verifying the accuracy of the account balances. Obviously these tests are related; a system with malfunctioning controls runs the risk of processing data incorrectly, which will result in inaccurate account balances.

The external auditor must observe strict rules in conducting financial audits. These authoritative rules have been defined by the SEC, the Financial Accounting Standards Board (FASB), the AICPA, and by federal law (Sarbanes-Oxley Act (SOX) of 2002). With the passage of SOX, Congress established the Public Company Accounting Oversight Board (PCAOB), which has to a great extent replaced the function served by the FASB, and some of the functions the AICPA (e. g., setting standards and issuing reprimands and penalties for CPAs who are convicted of certain crimes or guilty of certain infractions). Regardless, under federal law the SEC has final authority for financial auditing.

Attest Service versus Advisory Services

An important distinction needs to be made regarding the external auditor's traditional attestation function and the rapidly growing field of advisory services, which many public accounting firms offer. Advisory services are professional services offered by public accounting firms to improve their client organizations' operational efficiency and effectiveness. The domain of advisory services is intentionally unbounded so that it does not inhibit the growth of future services that are currently unforeseen. As examples, advisory services include actuarial advice, business advice, fraud investigation services, information system design and implementation, and internal control assessments for compliance with SOX.

Prior to the passage of SOX, accounting firms could provide advisory services concurrently to audit (attest function) clients. SOX legislation, however, greatly restricts the types of nonaudit services that auditors may render audit clients. It is now unlawful for a registered public accounting firm that is currently providing attest services for a client to provide the following services:

- bookkeeping or other services related to the accounting records or financial statements of the audit client
- financial information systems design and implementation
- appraisal or valuation services, fairness opinions, or contribution-in-kind reports
- actuarial services

- internal audit outsourcing services
- management functions or human resources
- broker or dealer, investment adviser, or investment banking services
- legal services and expert services unrelated to the audit
- any other service that the Board determines, by regulation, is impermissible.

The IT advisory services units of public accounting firms have different names in different firms, but they all engage in tasks known collectively as risk management. These groups often play a dual role within their respective firms; they provide nonaudit clients with IT advisory services and also work with their firm's financial audit staff to perform IT-related tests of controls (often called **IT auditing**) as part of the attestation function. Keep in mind that in many cases the purpose of the task, rather than the task itself, defines the service being rendered. For example, a risk management professional may perform a test of IT controls as an advisory service for a nonaudit client who is preparing for a financial audit by a different public accounting firm. The same professional may perform the same test for an audit client as part of the attest function.

Internal Audits

The Institute of Internal Auditors (IIA) defines **internal auditing** as an independent appraisal function established within an organization to examine and evaluate its activities as a service to the organization.² Internal auditors perform a wide range of activities on behalf of the organization, including conducting financial audits, performing IT audits examining an operation's compliance with organizational policies and legal obligations, evaluating operational efficiency, and detecting and pursuing fraud within the firm.

An internal audit is typically conducted by auditors who work for the organization, but this task may be outsourced to other organizations. Internal auditors are often certified as a Certified Internal Auditor (CIA) or a Certified Information Systems Auditor (CISA). While internal auditors self-impose independence to perform their duties effectively, they represent the interests of the organization. These auditors generally answer to executive management of the organization or the audit committee of the board of directors. The standards, guidance, and certification of internal audits are governed mainly by the Institute of Internal Auditors (IIA) and, to a lesser degree, by the Information Systems Audit and Control Association (ISACA).

External versus Internal Auditors

The characteristic that conceptually distinguishes external auditors from internal auditors is their respective constituencies: while external auditors represent outsiders, internal auditors represent the interests of the organization. Nevertheless, in this capacity, internal auditors often cooperate with and assist external auditors in performing aspects of financial audits. This cooperation is done to achieve audit efficiency and reduce audit fees. For example, a team of internal auditors can perform tests of computer controls under the supervision of a single external auditor.

The independence and competence of the internal audit staff determine the extent to which external auditors may cooperate with and rely on work performed by internal auditors. Some internal audit departments report directly to the controller. Under this arrangement, the internal auditor's independence is compromised, and the external auditor is prohibited by professional standards from relying on evidence provided by the internal auditors. In contrast, external auditors can rely in part on evidence gathered by internal audit departments that are organizationally independent and report to the board of directors' audit committee (discussed later). A truly independent internal audit staff adds value to the audit process. For example, internal auditors can gather audit evidence throughout a fiscal period, which external auditors may then use at year end to conduct more efficient, less disruptive, and less costly audits of the

organization's financial statements.

Fraud Audits

In recent years fraud audits have, unfortunately, increased in popularity as a corporate governance tool. They have been thrust into prominence by a corporate environment in which both employee theft of assets and major financial frauds by management (e. g., Enron, WorldCom, etc.) have become rampant. The objective of a fraud audit is to investigate anomalies and gather evidence of fraud that may lead to criminal conviction. Sometimes fraud audits are initiated when corporate management suspects employee fraud. Alternatively, boards of directors may hire fraud auditors to investigate their own executives if theft of assets or financial fraud is suspected. Organizations victimized by fraud usually contract with specialized fraud units of public accounting firms or with companies that specialize in forensic accounting. Typically, fraud auditors have earned the Certified Fraud Examiner (CFE) certification, which is governed by the Association of Certified Fraud Examiners (ACFE).

The Role of the Audit Committee

The boards of directors of publicly traded companies form a subcommittee known as the audit committee that has special responsibilities regarding audits. This committee is usually composed of three people who should be outsiders (not associated with the families of executive management nor former officers, etc.). With the advent of the Sarbanes-Oxley Act, at least one member of the audit committee must be a "financial expert." The audit committee serves as an independent "check and balance" for the internal audit function and liaison with external auditors. One of the most significant changes imposed by SOX has been to the relationship between management and the external auditors. Prior to SOX, external auditors were hired and fired by management. Many believe, with some justification, that this relationship erodes auditor independence when disputes over audit practices arise. SOX mandates that external auditors now report to the audit committee, which hires and fires auditors and resolves disputes.

To be effective, the audit committee must be willing to challenge the internal auditors (or the entity performing that function) as well as management when necessary. Part of the role of committee members is to look for ways to identify risk. For instance, they might serve as a sounding board for employees who observe suspicious behavior or spot fraudulent activities. In general, they become an independent guardian of the entity's assets by whatever means is appropriate. Corporate frauds often have some relationship to audit committee failures. These include lack of independence of audit committee members, lack of experienced members on the audit committee, inactive audit committees, and the total absence of an audit committee.

Designer/Auditor Duality

The accountant's dual roles of designer and auditor draw upon a common skill set. An accountant cannot effectively conduct an audit if he or she does not understand the principles of systems design. The functions involved in a system, the tasks performed by it, and the internal controls that are, or should be, in place are design issues about which auditors routinely gather evidence. Likewise, an accountant cannot properly design a system without a thorough understanding of audit issues and concerns. For example, the designer must understand the nature of a particular audit risk before he or she can plan the design of internal control techniques needed to mitigate the risk. Also, the designer must understand audit objectives regarding evidence gathering so he or she may create a system that facilitates the subsequent extraction of audit evidence.

The accountant's dual responsibility for systems design and auditing has greatly influenced the organization and approach taken in this book. Although primarily an AIS design text, chapter topics are

presented from the auditor's perspective. Human activities, manual procedures, and information technologies such as networks, databases, and computer applications that constitute the AIS are presented and discussed within the context of the audit risks they pose and how those risks can be mitigated through internal controls. This approach is followed throughout the remaining chapters of the book.

Summary

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

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

The final section of this chapter examined the dual roles of accountants as (1) designers of AIS and (2) auditors of AIS. The IT function is responsible for designing the physical system, and the accounting function is responsible for specifying the conceptual system. Auditing is an independent attestation performed by the auditor, who expresses an opinion about the fairness of a company's financial statements. A distinction was drawn between attestation and financial services. Both external and internal auditors conduct IT audits.

Key Terms

[accounting information systems \(AIS\)](#)
[attest function](#)
[auditing](#)
[auditor](#)
[centralized data processing](#)
[cloud computing](#)
[commercial software](#)
[conceptual system](#)
[custom software](#)
[data](#)
[data collection](#)
[data processing](#)
[data sources](#)
[data storage](#)
[database](#)
[database management](#)
[discretionary reporting](#)
[distributed data processing\(DDP\)](#)
[end users](#)
[enterprise resource planning \(ERP\)](#)
[feedback](#)
[financial transaction](#)
[general ledger/financial reporting system \(GL/FRS\)](#)
[general model for AIS](#)
[independence](#)
[information](#)
[information flows](#)
[information generation](#)
[information system](#)
[infrastructure as a service \(IaaS\)](#)
[internal auditing](#)
[IT auditing](#)
[IT outsourcing](#)
[management information system \(MIS\)](#)
[management reporting system \(MRS\)](#)
[network](#)
[network administration](#)
[nondiscretionary reporting](#)
[nonfinancial transactions](#)
[physical system](#)
[platform as a service \(PaaS\)](#)
[reliability](#)
[segments](#)
[software as a service \(SaaS\)](#)
[stakeholders](#)
[substantive tests](#)
[systems development life cycle](#)

[tests of controls](#)
[trading partners](#)
[transaction](#)
[transaction processing system \(TPS\)](#)
[turnkey systems](#)

Review Questions

1. What are the four levels of activity in the pyramid representing the business organization? Distinguish between horizontal and vertical flows of information.
 2. What is the relationship among data, information, and an information system?
 3. Distinguish between AIS and MIS.
 4. What are the three cycles of transaction processing systems?
 5. What is discretionary reporting?
 6. What are the characteristics of good or useful information?
 7. What rules govern data collection?
 8. What are the levels of data hierarchy?
 9. What are the three fundamental tasks of database management?
 10. What is feedback, and how is it useful in an information system?
 11. What are the fundamental objectives of all information systems?
 12. What does stewardship mean, and what is its role in an information system?
 13. List five functional areas and their sub-functions.
 14. Distinguish the roles of internal and external auditors.
 15. What is the role of a database administrator?
 16. What is the role of the accounting function in an organization?
 17. Distinguish between the centralized and distributed approaches to organizing the IT function.
 18. What is distributed data processing?
 19. What is an ERP system?
 20. What two roles are played by accountants with respect to the information system?
 21. Define the term *attest function*.
 22. Define the term *financial services*.
 23. What is IT auditing?
 24. Distinguish between conceptual and physical systems.
 25. What is the role of the audit committee of the board of directors?
 26. Who initiates a fraud audit within the organization?
 27. When can external auditors rely on the work performed by internal auditors?
 28. Name the tests that auditors perform to gather evidence.
 29. What characteristic conceptually distinguishes internal and external auditing?
 30. What is the role of network administration?
 31. What is cloud computing?
 32. Name the two ways in which organizations acquire information systems.
 33. Why are custom systems more expensive than commercial systems?
 34. What types of companies are potential customers for commercial software?
 35. Briefly explain accounting independence.
 36. Why do systems designers need to know anything about auditing?
-

Discussion Questions

1. Discuss the differences between internal and external users of information and their needs and demands on an information system. Historically, which type of user has the firm catered to most?
2. Comment on the level of detail necessary for operations management, middle management, and stockholders.
3. Distinguish between financial and nonfinancial transactions. Give three examples of each.
4. An information system must meet three fundamental objectives. Discuss why these objectives cannot effectively be met by a common set of information.
5. Do you think transaction processing systems differ significantly between service and manufacturing industries? Are they equally important to both sectors?
6. Discuss the difference between the financial reporting system and general ledger system.
7. Examine [Figure 1-4](#) and discuss where and how problems can arise that can cause the resulting information to be bad or ineffective.
8. Discuss how the elements of efficiency, effectiveness, and flexibility are crucial to the design of an information system.
9. Discuss what is meant by the statement, “The accounting system is a conceptual flow of information that represents physical personnel, machinery, and flows of raw materials and cash through the organization.”
10. Discuss the importance of accounting independence in accounting information systems. Give an example of where this concept is important (use an example other than inventory control).
11. Discuss why it is crucial that internal auditors report solely to the audit committee of the board of directors and answer to no other group.
12. Contrast centralized data processing with distributed data processing. How do the roles of end users differ between the two approaches?
13. Discuss how conceptual and physical systems differ and which functions are responsible for each of these systems.
14. Why is an active board of directors audit committee important to an organization?
15. Do you agree with the statement, “The term *IT auditor* should be considered obsolete because it implies a distinction between regular auditors and auditors who examine computerized AIS”? Why or why not?
16. Describe cloud computing and explain how it is similar to obtaining a commodity product.
17. Why is it important to organizationally separate the accounting function from other functions of the organization?
18. What is the most likely system acquisition method—commercial software, custom software, or ERP—for each of the following situations?
 - A plumbing supply company with 12 employees that sells standard products to wholesale customers in a local community needs a system to manage its affairs.
 - A major oil company with diverse holdings, complex oil leases, and esoteric accounting practices needs a system that can coordinate its many enterprises.
 - A municipal government needs a system that complies with standard government accounting practices but can be integrated with other existing systems.
19. What is an external financial audit, and what are the sources of audit evidence?
20. Why do firms outsource their IT functions? Explain the options of traditional IT outsourcing and cloud computing, and how they differ.

Multiple-Choice Questions

- Which of the following is NOT a financial transaction?
 - purchase of products
 - cash receipts
 - update valid vendor file
 - sale of inventory
- The following are subsystems of the accounting information system, EXCEPT the
 - transaction processing system.
 - human resources system.
 - general ledger/financial reporting system.
 - management reporting system.
- Which of the following is NOT a purpose of the transaction processing system?
 - managing and reporting on the status of financial investments
 - converting economic events into financial transactions
 - distributing essential information to operations personnel to support their daily operations
 - recording financial transactions in the accounting records
- The objectives of the data collection activity of the general model for accounting information systems are to collect data that are
 - relevant and redundant.
 - efficient and objective.
 - efficient and redundant.
 - efficient and relevant.
- Which of the following is NOT a characteristic of effective information?
 - relevance
 - accuracy
 - summarization
 - precision
- Which of the following is NOT a database management task?
 - retrieval
 - storage
 - summarization
 - deletion
- When viewed from the highest to most elemental level, the data hierarchy is
 - attribute, record, file.
 - record, attribute, key.
 - file, record, attribute.
 - file, record, key.
 - key, record, file.
- Which is NOT a source of evidence for an external auditor?
 - work performed by internal auditors who organizationally report to the controller
 - tests of controls
 - substantive tests
 - work performed by internal auditors who report to the audit committee of the BOD
- Which of the following is NOT an objective of all information systems?
 - support for the stewardship function of management
 - support for management decision making
 - support for the day-to-day operations of the firm
 - all of the above are objectives

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

- a. purchasing, receiving, and inventory control
- b. receiving, sales, distribution, and purchasing
- c. receiving, storage, purchasing, and accounts payable
- d. purchasing, receiving, and storage
- e. purchasing, storage, and distribution

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

- a. maintenance, inventory control, and production planning
- b. production planning, quality control, manufacturing, and cost accounting
- c. quality control, production planning, manufacturing, and payroll
- d. maintenance, production planning, storage, and quality control
- e. manufacturing, quality control, and maintenance

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

- a. inventory control, accounts payable, fixed assets, and payroll
- b. fixed assets, accounts payable, cash disbursements, and cost accounting
- c. purchasing, cash receipts, accounts payable, cash disbursements, and payroll
- d. inventory control, cash receipts, accounts payable, cash disbursements, and payroll
- e. inventory control, cost accounting, accounts payable, cash disbursements, and payroll

13. Which statement about cloud computing is most true?

- a. Cloud computing involves longterm contracts.
- b. Cloud computing is location-independent computing.
- c. Cloud computing involves an organization selling its IT resources to a vendor and leasing back IT services from the vendor.
- d. Cloud computing involves fixed price contracts.
- e. Cloud computing involves signing entering into multiple contracts with each IP service provider to create a cloud of resources.

14. Which of the following statements is most accurate?

- a. ERP systems are commercial software packages that are sometimes called turnkey systems because they can be implemented by the user with little or no modification.
 - b. Substantive tests provide evidence focused on the system controls.
 - c. Public accounting firms that provide attest services are not allowed under SOX to offer IT advisory services.
 - d. Both small and large firms that have standardized information needs are potential customers for commercial software.
 - e. External auditors may rely on the work of internal auditors only if they report to the controller or the CEO of the client company.
-

Problems

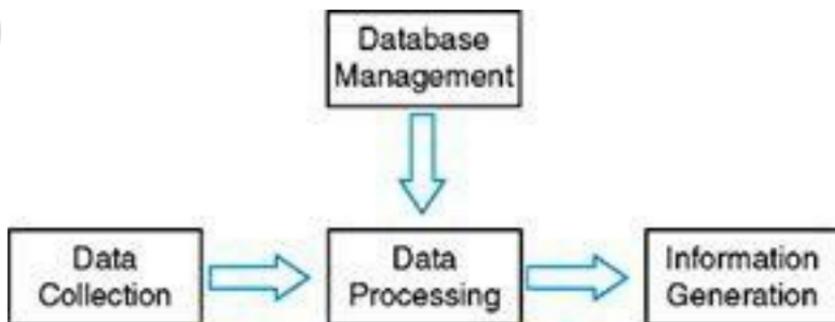
1. USERS OF INFORMATION

Classify the following users of information as either:

- I—internal user
- T—external user: trading partner
- S—external user: stakeholder
- a. Internal Revenue Service
- b. Inventory control manager
- c. Board of directors
- d. Customers
- e. Lending institutions
- f. Securities and Exchange Commission
- g. Stockholders
- h. Chief executive officer
- i. Suppliers
- j. Bondholders

2. ACCOUNTING INFORMATION SYSTEM MODEL

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



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3. ACCOUNTING INFORMATION SYSTEM & MANAGEMENT INFORMATION SYSTEM FEATURES

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

4. INFORMATION SYSTEM CATEGORIZATION

Classify the following items as either:

- TPS—transaction processing system
FRS—financial reporting system
MRS—management reporting system
- Variance reports
 - Sales order capture
 - Balance sheet
 - Budgets
 - Purchase order preparation
 - Tax returns
 - Sales summary by product line
 - Cash disbursements preparation
 - Annual report preparation
 - Invoice preparation
 - Cost-volume-profit analysis

5. ORGANIZATION FUNCTIONS

Based on [Figure 1-6](#) in the text, draw a diagram of functional segments for an oil company that has the following operations:

- A head office in New York City responsible for international and national marketing, acquisition of leases and contracts, and corporate reporting.
- Two autonomous regional facilities in Tulsa, Oklahoma, and New Orleans, Louisiana. These facilities are responsible for oil exploration, drilling, refining, storage, and the distribution of petroleum products to corporate service stations throughout the country and abroad.

6. ORGANIZATION FUNCTIONS

Based on [Figure 1-6](#) in the text, draw a diagram of functional segments for a manufacturer of diversified products. The general characteristics of the firm are as follows:

- The organization produces three unrelated products: lawn and garden furniture for sale in home improvement centers and department stores, plastic packaging products for the electronics and medical supply industries, and paper products (for example, plates, cups, and napkins) for the fast food industry.
- Although the manufacturing facilities are located within a single complex, none of the three products shares the same suppliers, customers, or physical production lines.
- The organization's functional activities include design, production, distribution, marketing, finance, human resources, and accounting.

7. FUNCTIONAL SEGMENTATION

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

Required

- What operational problems (for example, inefficiency, errors, or fraud) do you think Blue Sky could experience because of this structure?
- Draw a new diagram reflecting an improved structure that solves the problems you identified. If necessary, you may add up to two new positions.



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8. COMMUNICATIONS

Before the mid-1970s, systems programmers and businesspeople (including accountants) did not communicate well with one another. The programmers were criticized for using too much jargon, and the businesspeople were criticized for not adequately expressing their needs. Efforts have been made to overcome this communication gap, but room for improvement still exists. What problems do you think resulted from this communication gap? What do you think you can do to help close the gap even more when you enter the workforce?

9. CHARACTERISTICS OF USEFUL INFORMATION

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

| Record Type | Primary Key |
|---------------------|-----------------|
| Accounts Receivable | Customer Number |
| Accounts Payable | |
| Inventory | |

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

10. DATA ATTRIBUTES

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

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

11. DISTRIBUTED DATA PROCESSING

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

- 1 When we get into more advanced topics, we will see how a combination of nonunique attributes can be used as a unique identifier.
- 2 Institute of Internal Auditors, *Standards of Professional Practice of Internal Auditing* (Orlando, FL.: Institute of Internal Auditors, 1978).

Introduction to Transaction Processing



Learning Objectives

After studying this chapter, you should:

- 1 Understand the broad objectives of transaction cycles.
 - 2 Recognize the types of transactions processed by each of the three transaction cycles.
 - 3 Know the basic accounting records used in transaction processing systems.
 - 4 Understand the relationship between traditional accounting records and their digital equivalents in computerbased systems.
 - 5 Be familiar with the documentation techniques used for representing manual procedures and the computer components of systems.
 - 6 Understand the differences between batch and realtime processing and the impact of these technologies on transaction processing.
 - 7 Be familiar with data coding schemes used in accounting information systems.
-

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

The purpose of this chapter is to present some preliminary topics that are common to all three transaction processing cycles. In subsequent chapters, we will draw heavily from this material as we examine the individual subsystems of each cycle in detail. This chapter is organized into six major sections. The first is an overview of transaction processing. This section defines the broad objective of the three transaction cycles and specifies the roles of their individual subsystems. The second section describes the

relationship among accounting records, both traditional and digital, in forming an audit trail. The third section describes the key features of flat file and database structures used to store accounting data. The fourth section examines several documentation techniques used to represent systems including manual procedures and the computer components of system. The fifth section addresses alternative transaction processing approaches. It reviews the fundamental features of batch and realtime technologies and their implication for transaction processing. The final section examines data coding schemes and their role in transaction processing.

An Overview of Transaction Processing

TPS applications process financial transactions. A financial transaction was defined in [Chapter 1](#) as

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

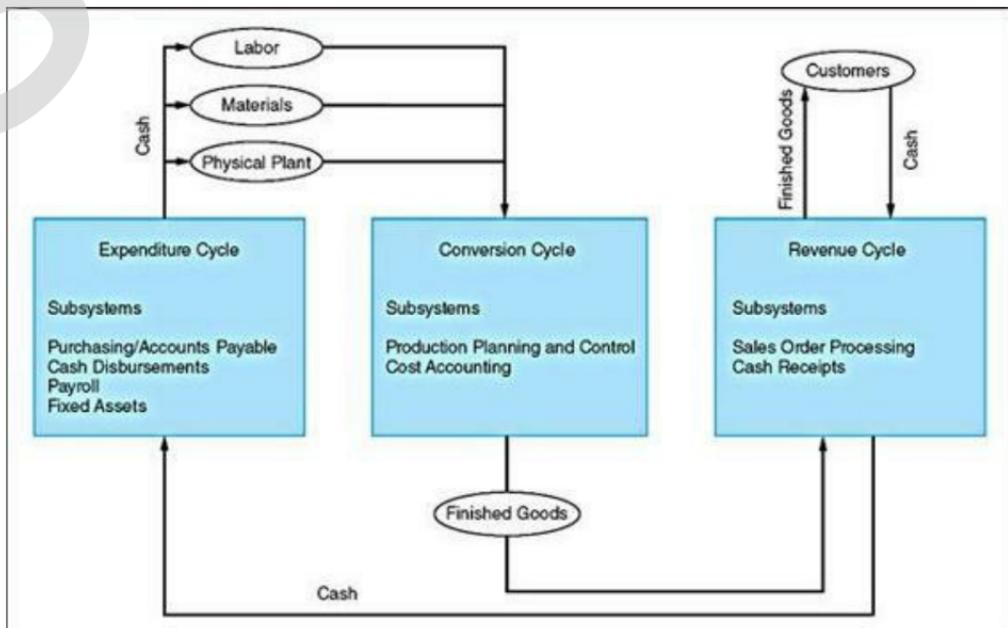
The most common financial transactions are economic exchanges with external parties. These include the sale of goods or services, the purchase of inventory, the discharge of financial obligations, and the receipt of cash on account from customers. Financial transactions also include certain internal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

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

TRANSACTION CYCLES

Three transaction cycles process most of the firm's economic activity: the expenditure cycle, the conversion cycle, and the revenue cycle. These cycles exist in all types of businesses—both profitseeking and not-for-profit types. For instance, every business (1) incurs expenditures in exchange for resources (expenditure cycle), (2) provides value added through its products or services (conversion cycle), and (3) receives revenue from outside sources (revenue cycle). [Figure 2-1](#) shows the relationship of these cycles and the resource flows between them.

FIGURE 2-1 RELATIONSHIP BETWEEN TRANSACTION CYCLES



The Expenditure Cycle

Business activities begin with the acquisition of materials, property, and labor in exchange for cash—the **expenditure cycle**. [Figure 2-1](#) shows the flow of cash from the organization to the various providers of these resources. Most business-to-business (B2B) expenditure transactions are based on a credit relationship between the trading parties. The actual disbursement of cash takes place at some point after the receipt of the goods or services. Days or even weeks may pass between these two events. Thus, from a systems perspective, this transaction has two parts: a physical component (the acquisition of the goods or services) and a financial component (the cash disbursement to the supplier). A separate subsystem of the cycle processes each component. The primary expenditure cycle subsystems are outlined next. Because of the extent of this body of material, two chapters are devoted to a detailed examination. Purchases/accounts payable and cash disbursements systems are the topics of [Chapter 5](#). Payroll and fixed asset systems are examined in [Chapter 6](#).

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

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

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

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

The Conversion Cycle

The **conversion cycle** is composed of two major subsystems: the production system and the cost accounting system. The production system involves the planning, scheduling, and control of the physical product through the manufacturing process. This includes determining raw material requirements, authorizing the work to be performed and the release of raw materials into production, and directing the movement of the work-in-process through its various stages of manufacturing. The cost accounting system monitors the flow of cost information related to production. Information this system produces is used for inventory valuation, budgeting, cost control, performance reporting, and management decisions, such as make-or-buy decisions. We examine the basic features of these systems in [Chapter 7](#).

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

The Revenue Cycle

Firms sell their finished goods to customers through the revenue cycle, which involves processing cash sales, credit sales, and the receipt of cash following a credit sale. Revenue cycle transactions also have a physical and a financial component, which are processed separately. The primary subsystems of the revenue cycle, which are the topics of Chapter 4, are briefly outlined below.

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

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

Accounting Records

MANUAL SYSTEMS

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

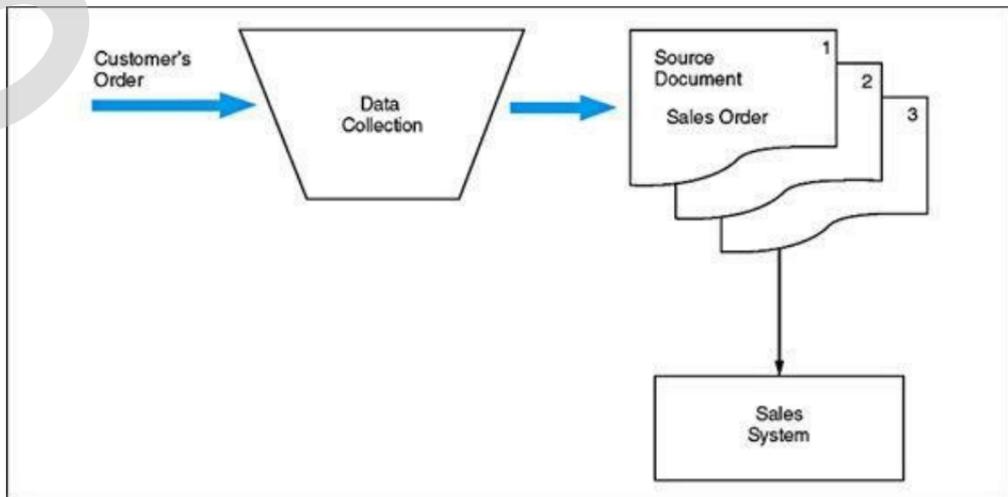
Documents

Documents serve several purposes in transaction processing. Documents may initiate transaction processing or be the output of a process. They also provide auditors with evidence of economic events. In this section we examine three types of documents: source documents, product documents, and turnaround documents.

SOURCE DOCUMENTS. Economic events result in the creation of some documents at the beginning (the source) of the transaction. These are called source documents are used to capture and formalize transaction data that the transaction cycle uses for processing. [Figure 2-2](#) shows the creation of a source document.

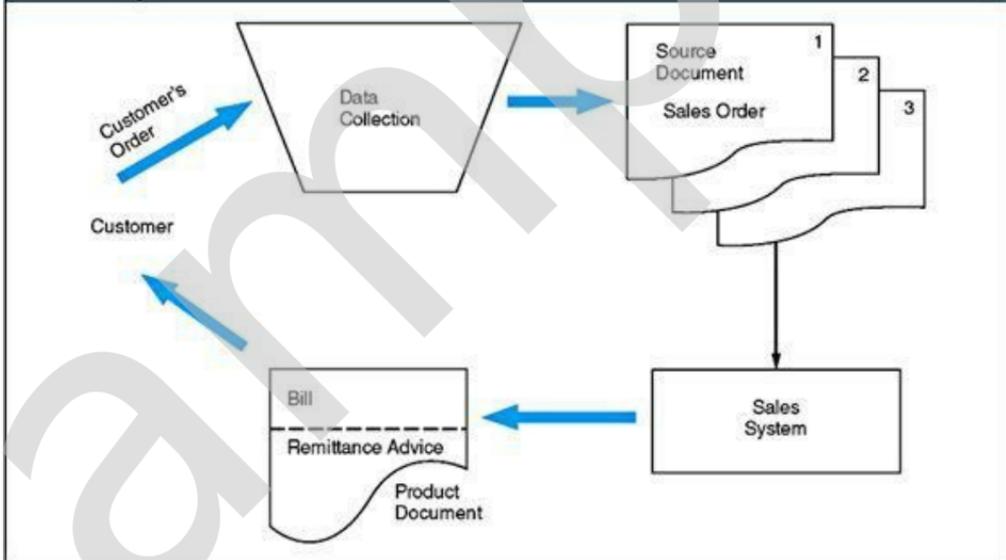
The economic event (in this case the sale) causes the sales clerk to prepare a multipart sales order, which is formal evidence that a sale occurred. Copies of this source document enter the sales system and are used to convey information to various functions, such as billing, shipping, and accounts receivable.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

FIGURE 2-2 CREATION OF A SOURCE DOCUMENT



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FIGURE 2-3 A PRODUCT DOCUMENT



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PRODUCT DOCUMENTS. Product documents are the result of transaction processing rather than the triggering mechanism for the process. For example, a payroll check to an employee is a product document of the payroll system. [Figure 2-3](#) extends the example in [Figure 2-2](#) to illustrate that the customer's bill is a product document of the sales system. We will study many other examples of product documents in later chapters.

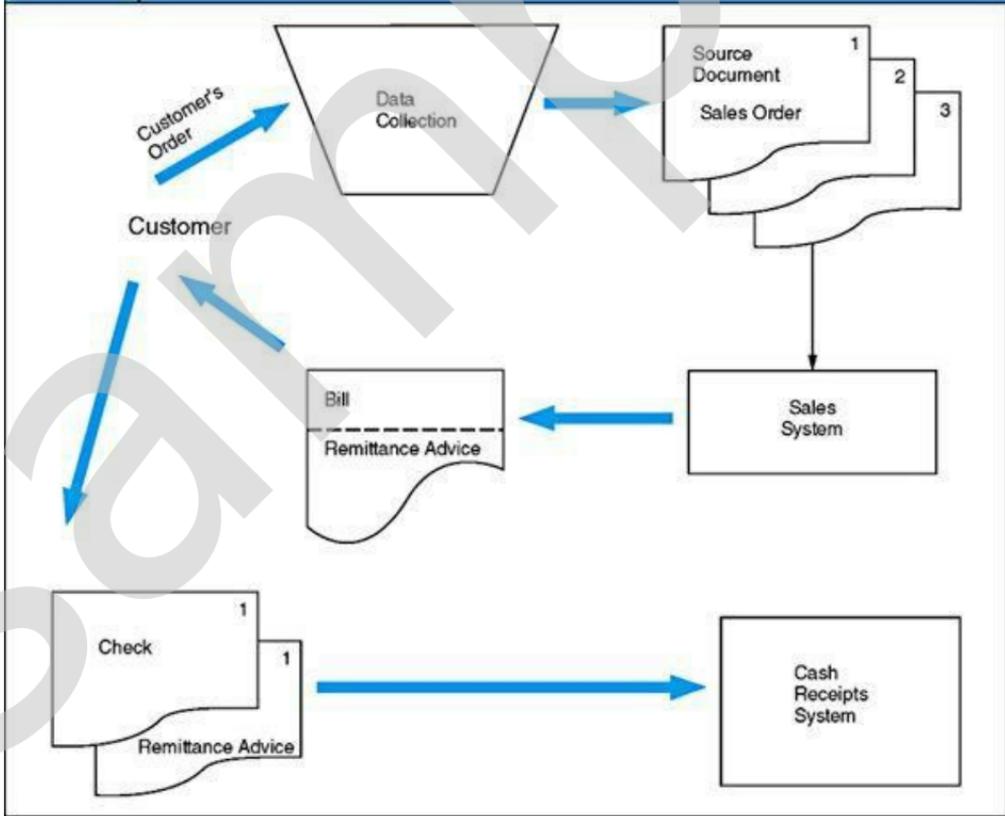
TURNAROUND DOCUMENTS. Turnaround documents are product documents of one system that become source documents for another system. This is illustrated in [Figure 2-4](#). The customer receives a perforated two-part bill or statement. One portion is the actual bill, and the other portion is the remittance advice. Customers remove the remittance advice and return it to the company along with their payment (typically a check). The remittance advice is a turnaround document that contains important information about a customer's account to help the cash receipts system process the payment. One of the problems designers of cash receipts systems face is matching customer payments to the correct customer accounts. Providing this needed information as a product of the sales system ensures accuracy when the cash receipts system processes it.

Journals

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

journals: special journals and general journals.
FIGURE 2-4 A TURNAROUND DOCUMENT

sample



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

As you can see, the sales journal provides a specialized format for recording only sales transactions. At the end of the processing period (month, week, or day), a clerk posts the amounts in the columns to the ledger accounts indicated (see the discussion of ledgers in this chapter). For example, the total sales will be posted to account number 401. Most organizations use several other special journals, including the cash receipts journal, cash disbursements journal, purchases journal, and the payroll journal.

FIGURE 2-5 SALES ORDER RECORDED IN SALES JOURNAL



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FIGURE 2-6 SALES JOURNAL

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

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REGISTER. The term **register** is often used to denote certain types of special journals. For example, the payroll journal is often called the payroll register. We also use the term *register*, however, to denote a log. For example, a receiving register is a log of all receipts of raw materials or merchandise ordered from vendors. Similarly, a shipping register is a log that records all shipments to customers.

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

As a practical matter, most organizations have replaced their general journal with a journal voucher system. A journal voucher is actually a special source document that contains a single journal entry

specifying the general ledger accounts that are affected. Journal vouchers are used to record summaries of routine transactions, nonroutine transactions, adjusting entries, and closing entries. The total of journal vouchers processed is equivalent to the general journal. Subsequent chapters discuss the use of this technique in transaction processing.

Ledgers

A **ledger** is a book of accounts that reflects the financial effects of the firm's transactions after they are posted from the various journals. Whereas journals show the chronological effect of business activity, ledgers show activity by account type. A ledger indicates the increases, decreases, and current balance of each account. Organizations use this information to prepare financial statements, support daily operations, and prepare internal reports. [Figure 2-8](#) shows the flow of financial information from the source documents to the journal and into the ledgers.

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

FIGURE 2-7 GENERAL JOURNAL

| GENERAL JOURNAL | | | | | | PAGE |
|-----------------|---------------|--------------------------|------------|-----------|-----------|------|
| | DATE | DESCRIPTION | POST. REF. | DEBIT | CREDIT | |
| 1 | Sept. 1, 2009 | Depreciation Expense | 520 | 5 0 0 0 | | 1 |
| 2 | | Accumulated Depreciation | 210 | | 5 0 0 0 | 2 |
| 3 | | | | | | 3 |
| 4 | Sept. 2, 2009 | Insurance Expense | 525 | 1 2 0 0 | | 4 |
| 5 | | Prepaid Insurance | 180 | | 1 2 0 0 | 5 |
| 6 | | | | | | 6 |
| 7 | Sept. 3, 2009 | Cash | 101 | 1 1 0 0 0 | | 7 |
| 8 | | Capital Stock | 310 | | 1 1 0 0 0 | 8 |
| 9 | | | | | | 9 |
| 10 | | | | | | 10 |
| 11 | | | | | | 11 |
| 12 | | | | | | 12 |

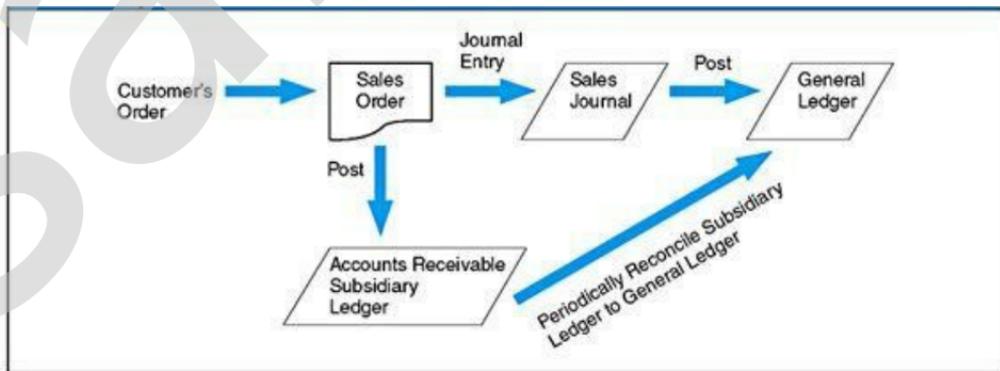
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GENERAL LEDGERS. The general ledger (GL) summarizes the activity for each of the organization's

accounts. The general ledger function updates these records from journal vouchers prepared from special journals and other sources located throughout the organization. The general ledger presented in [Figure 2-9](#) shows the beginning balances, the changes, and the ending balances as of a particular date for several different accounts.

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

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



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FIGURE 2-9 GENERAL LEDGER

Cash

ACCOUNT NO. 101

| DATE | ITEM | POST. REF. | DEBIT | CREDIT | BALANCE | |
|----------|------|------------|---------|---------|---------|-----------|
| | | | | | DEBIT | CREDIT |
| Sept. 10 | | SI | 3 3 0 0 | | | 3 3 0 0 |
| 15 | | SI | 6 8 2 5 | | | 1 0 1 2 5 |
| Oct. 3 | | SI | 4 0 0 0 | | | 1 4 1 2 5 |
| 10 | | CDI | | 2 8 0 0 | | 1 1 3 2 5 |

Accounts Receivable

ACCOUNT NO. 102

| DATE | ITEM | POST. REF. | DEBIT | CREDIT | BALANCE | |
|---------|------|------------|---------|---------|---------|---------|
| | | | | | DEBIT | CREDIT |
| Sept. 1 | | SI | 1 4 0 0 | | | 1 4 0 0 |
| 8 | | SI | 2 6 0 5 | | | 4 0 0 5 |
| 15 | | CDI | | 1 6 5 0 | | 2 3 5 5 |

Accounts Payable

ACCOUNT NO. 201

| DATE | ITEM | POST. REF. | DEBIT | CREDIT | BALANCE | |
|---------|------|------------|---------|-----------|---------|-----------|
| | | | | | DEBIT | CREDIT |
| Sept. 1 | | PI | | 2 0 5 0 0 | | 2 0 5 0 0 |
| 10 | | CDI | 2 8 0 0 | | | 1 7 7 0 0 |

| Purchases | | ACCOUNT NO. 502 | | | | | | | | | | | | | |
|-----------|------|-----------------|-------|--------|---------|--------|--|--|--|--|--|--|--|--|--|
| DATE | ITEM | POST. REF. | DEBIT | CREDIT | BALANCE | | | | | | | | | | |
| | | | | | DEBIT | CREDIT | | | | | | | | | |
| Sept. 1 | | P1 | 20500 | | | 20500 | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
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SUBSIDIARY LEDGERS. Various accounting departments of the firm, including inventory, accounts payable, payroll, and accounts receivable. This separation provides better control and support of operations. [Figure 2-10](#) illustrates that the total of account balances in a subsidiary ledger should equal the balance in the corresponding general ledger control account. Thus, in addition to providing financial statement information, the general ledger is a mechanism for verifying the overall accuracy of accounting data that separate accounting departments have processed. Any event incorrectly recorded in a journal or subsidiary ledger will cause an out-of-balance condition that should be detected during the general ledger update. By periodically reconciling summary balances from subsidiary accounts, journals, and control accounts, the completeness and accuracy of transaction processing can be formally assessed.

THE AUDIT TRAIL

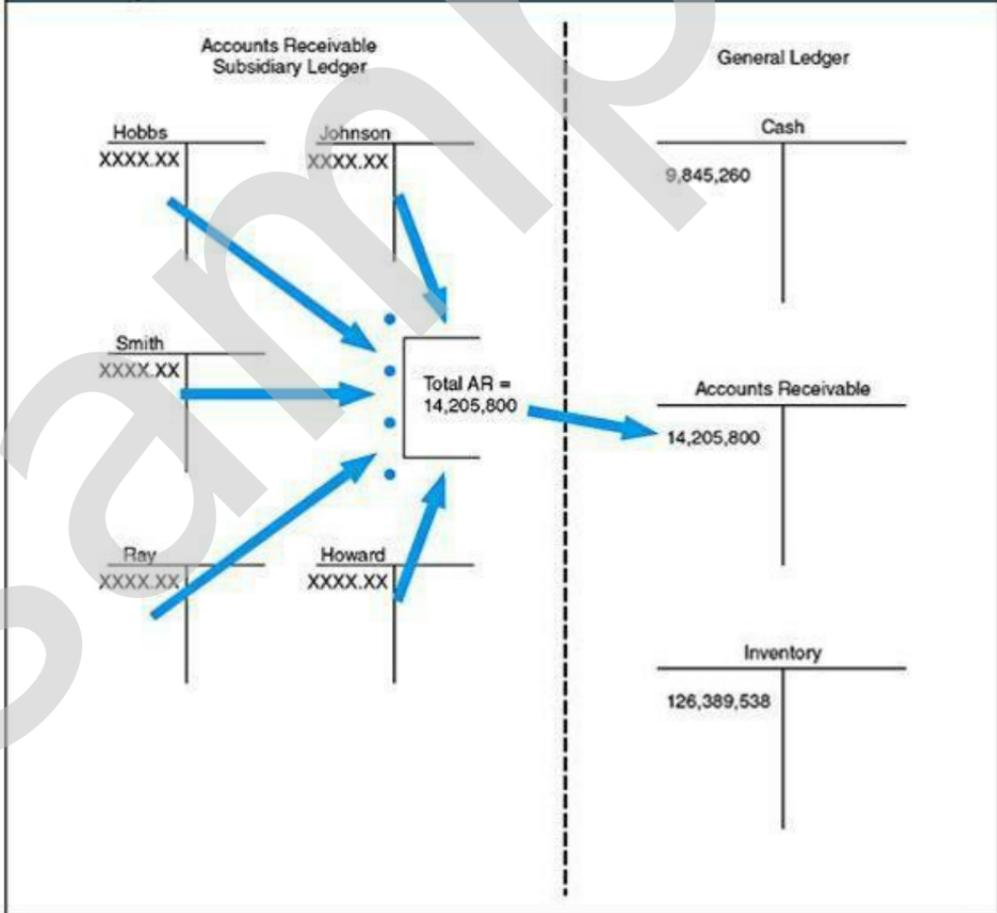
The accounting records described previously provide an **audit trail** for tracing account balances contained in the financial statements back to source documents and the economic events that created them. An audit trail is of utmost importance in the conduct of a financial audit.

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

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

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

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



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DIGITAL ACCOUNTING RECORDS

Modern accounting systems store data in four types of digital computer files: master files, transaction files, reference files, and archive files. [Figure 2-11](#) illustrates the relationship between these files in forming an audit trail.

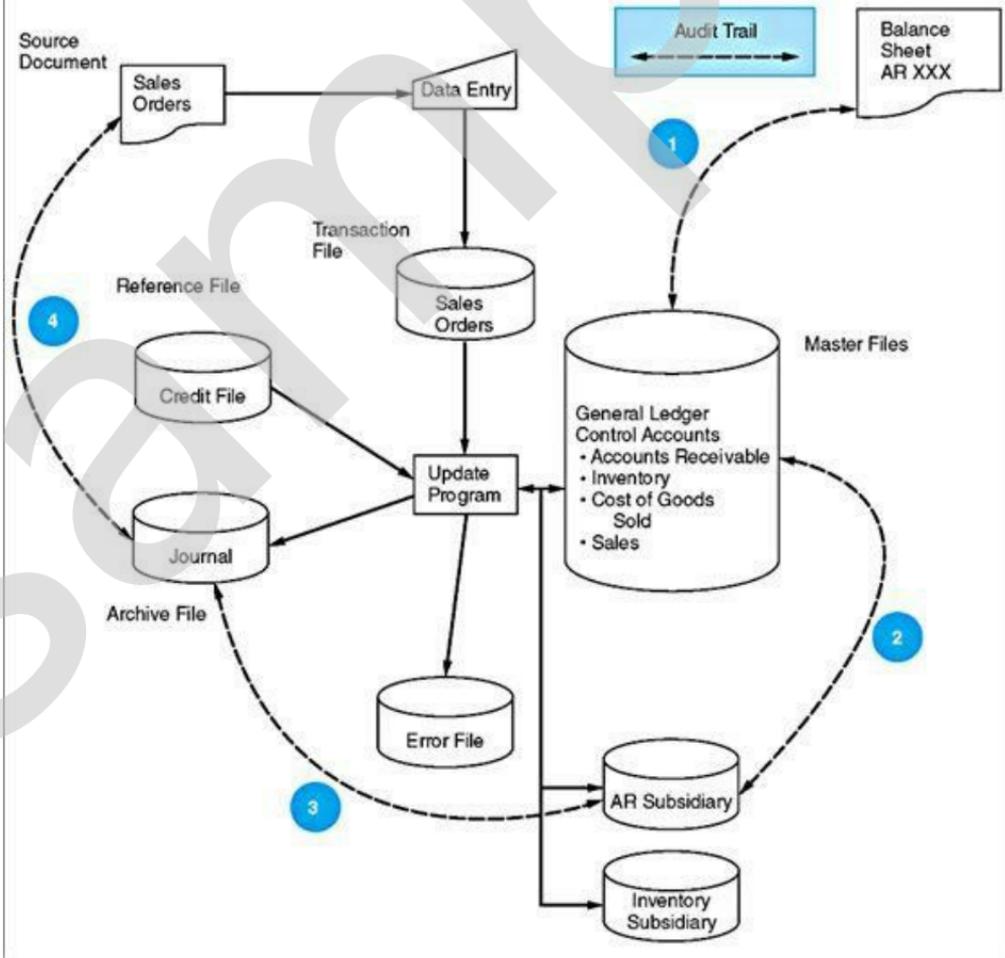
MASTER FILE. A [master file](#) contains account data. The general ledger and subsidiary ledgers are examples of master files. Data values in master files are updated (changed) by transactions.

TRANSACTION FILE. A [transaction file](#) is a temporary file of transaction records used to update data in a master file. Sales orders, inventory receipts, and cash receipts are examples of transaction files. The actual file update process is explained later in the chapter.

REFERENCE FILE. A [reference file](#) stores data that are used as standards for processing transactions.

For example, the payroll program may refer to a tax table to calculate the proper amount of withholding taxes for payroll transactions. Other reference files include price lists used for preparing customer invoices, lists of authorized suppliers, employee rosters, and customer credit files for approving credit sales. The reference file in [Figure 2-11](#) is a credit history file.

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



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ARCHIVE FILE. An [archive file](#) contains records of past transactions that are retained for future reference and form an important part of the audit trail. Archive files include journals, prior-period payroll information, lists of former employees, records of accounts written off, and prior-period ledgers.

The Digital Audit Trail

Audit trails among digital records are less observable than those between hardcopy documents, but they still exist. Let's walk through the system represented in [Figure 2-11](#) to illustrate how digital files provide an

audit trail. We begin with the capture of the economic event. In this example, sales are recorded manually on source documents. The next step in this process is to convert the source documents to digital form. This is done in the data-entry stage, where the transactions are edited for correctness and a transaction file of sales orders is produced. Some computer systems do not use physical source documents. Instead, transactions are captured directly on digital media.

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

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

1. Compare the accounts receivable balance in the balance sheet with the master file AR control account balance.
2. Reconcile the AR control Figure with the AR subsidiary account total.
3. Select a sample of update entries made to accounts in the AR subsidiary ledger and trace these to transactions in the sales journal (archive file).
4. From these journal entries, identify specific source documents that can be pulled from their files and verified. If necessary, the auditor can confirm the accuracy and propriety of these source documents by contacting the customers in question.