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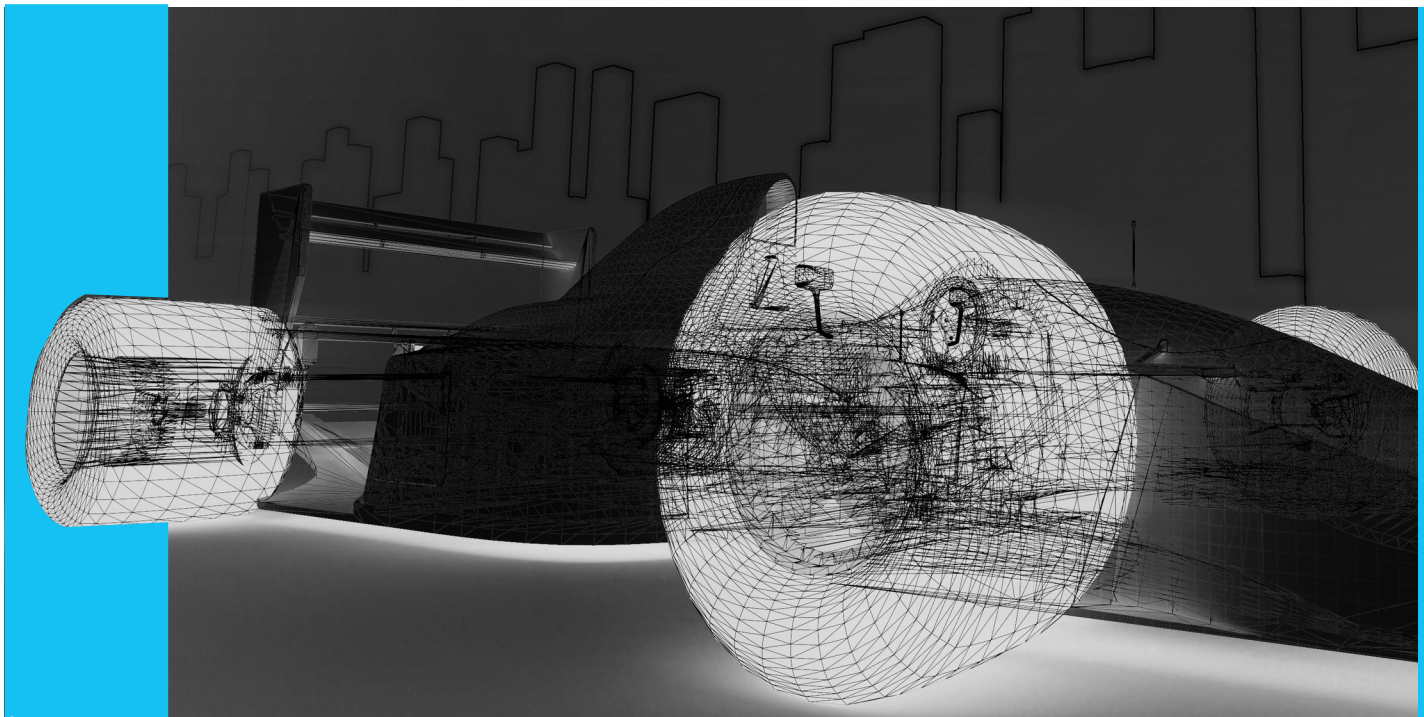

Understanding Information Systems

Part One

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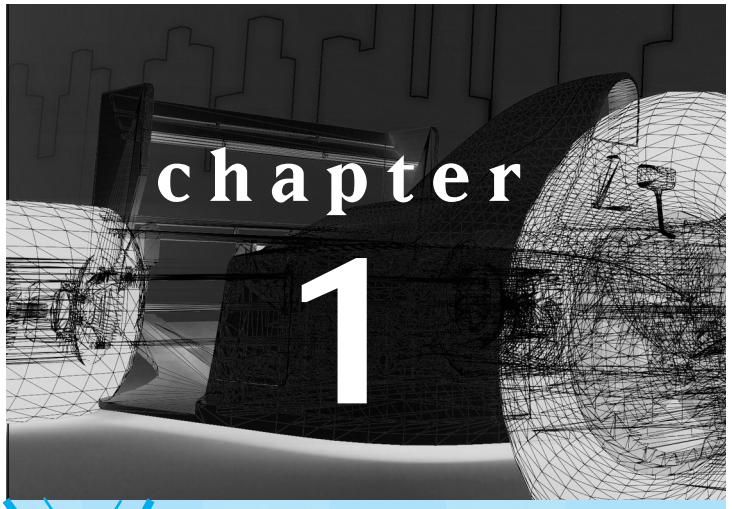

Introduction to Accounting Information Systems

We start each chapter in this text with a real-life story, a vignette, describing a situation that introduces and emphasizes the importance and relevance of the material in the chapter. In this chapter, however, we take a slightly different approach. We describe in our own words three recent developments that will affect your role as accountants in a rapidly changing business world. First, the Sarbanes-Oxley Act of 2002 (SOA) has changed the daily work of financial accountants, auditors, and others. Second, the blackout in the northeastern part of the United States and portions of Canada in August 2003 has once again demonstrated the vulnerability of our information technology resources. Third, the new format and content of the Uniform CPA Examination reflects a radically changed work environment for practicing accountants. Let's expand, briefly, on these three developments.

Section 404 of the Sarbanes-Oxley Act means changes for both auditors and the companies that they audit. To comply with SOA management must identify, document, and evaluate significant internal controls. Auditors must then audit and report on managements' assertions about the organizations' systems of internal control. Section 409 of the SOA requires disclosure to the public on a "rapid and current basis" of material changes in an organization's financial condition.

In August 2003 a massive power failure left major portions of the eastern United States and Canada without electricity. Power was not restored in some areas for days. Many businesses were unable to operate during the blackout because their backup facilities were located within the blackout area. What happens to a business if it has no operating backup facilities? Entire supply chains may be interrupted. A business may not be able to enter customer orders, make purchases, manufacture products, ship goods, bill customers, and receive payments.

As noted in the Preface, the Uniform CPA Examination changed in April 2004 and became a computer-based test with new sections and content. The content changes require that CPA candidates be able to answer questions in such areas as internal control in manual and computerized environments and the technology-based environments in which business processes and accounting systems operate.

Learning Objectives

- To appreciate the complex, dynamic environment in which accounting is practiced.
- To know the AIS and its relationship to the organization's business processes.
- To know the attributes of information.
- To understand decision making.
- To recognize how information is used for different types of decisions and at various levels in the organization.
- To recognize how the information system supports the management function.
- To appreciate the influence of strategic planning to the ongoing success of the organization.
- To understand the importance of the information system's strategic plan and to recognize the relationship of that plan to the organization's strategic plan.
- To recognize the accountant's role in relation to the current environment for the AIS.
- To understand how to use this textbook effectively to learn AIS.

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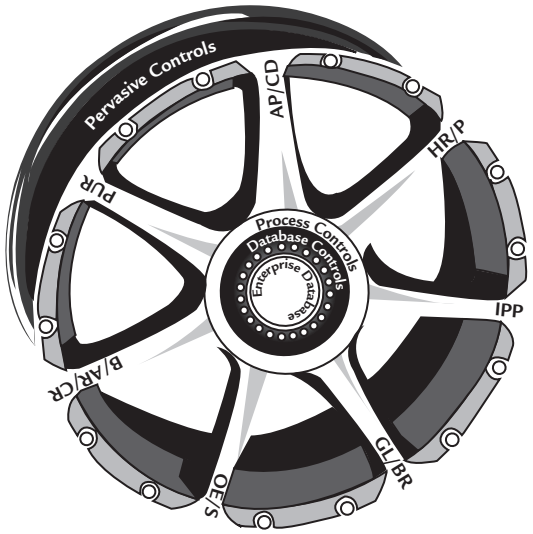

At this point in each chapter of this text we present the AIS wheel introduced in the Preface and describe the part(s) of the wheel addressed by that chapter. In this chapter we introduce you to the study of accounting information systems. The topics are broad and provide a foundation for the remainder of the text and for all parts of the wheel.

Read on to learn how these developments will affect your career and how this text will help prepare you for a success in that career.

SYNOPSIS

In this chapter, we introduce you to the subject of accounting information systems (AIS), describe the importance of AIS to your future success, and lay out some important terms and concepts that we will use throughout the text. We begin by presenting a view of the practice of accounting. We will see that accountants today are shifting their focus from being business accountants and auditors to being information management and business measurement professionals, providing value-added services to their organizations and clients. This view, rooted in changes in information technology and changes in a volatile business environment, reflects the practice of accounting for those on the leading edge of their profession. Next, we define and explain AIS and its relationship to the organization. Then, we describe the qualities that information must possess to drive the organization and enable the performance of key management functions. We also discuss organization-wide and information systems-specific strategic plans and how these must be coordinated to ensure that the organizations' and the information systems' objectives are in sync. Finally, we summarize the role of the accountant in today's business environment.

Throughout the text we will present three themes to connect our discussions to topics that are currently of great interest to accountants. These themes are enterprise systems and enterprise resource planning (ERP) systems—such as those sold by SAP,

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Oracle, and PeopleSoft; e-Business—including retail e-Business such as Amazon.com and B2B marketplaces such as Covisint.com (operated by the Big Three and other auto manufacturers); and internal control—those business practices that keep an organization out of trouble and heading toward achievement of its objectives. We introduced these in the Preface and discuss them further later in this chapter.

INTRODUCTION

At the start of this chapter three developments were introduced that will affect your role as an accountant. Here, each development will be discussed in turn. First, the requirements of Section 404 of the Sarbanes-Oxley Act (SOA) represent significant expansions of the internal control-related roles of management and auditors. These responsibilities are increasing at the same time that computer-based systems are becoming more sophisticated, thus adding to the complexity of the systems of internal control. Compliance with Section 409 of the SOA will require the application of legal, financial, and technical expertise to ensure that the organization's accounting information systems are able to produce financial data in a timely and accurate manner. Who else but the accountant, armed with the latest knowledge of accounting and information technology, can ensure compliance with these provisions of the SOA?

Second, the blackout of August 2003—and many other natural disasters in the past—has motivated organizations to develop plans to respond to these events and to be able to continue operations once they have occurred. At one point in our past, organizations could use information technology to create a competitive advantage. In many industries this is no longer true. Organizations now create an advantage by installing information technology that has functionality equal to or better than their competitors, and is more secure and reliable. For example, it is no longer an advantage to interact with business partners via the Internet. Everyone does that. Rather, it is the successful organization that ensures that their Internet connections are reliable and secure, even when faced with a disaster. An accountant's knowledge of the business, information technology, and the costs and benefits of internal controls, makes them uniquely qualified to design contingency plans to mitigate the results of such disasters.

Third, the revised content of the Uniform CPA exam reflects the knowledge required for the accountant's role as an information management and business measurement professional. To address these issues, this textbook takes you on a journey through a set of elements broader than that introduced in a typical accounting course. Becoming reasonably comfortable in dealing with these elements will probably require a substantial effort that can bring handsome rewards in terms of your professional success and the competitive edge you can gain in the marketplace. We begin by presenting a view of accountants at work. You will see that the accountants' success is closely linked to their conceptual knowledge of and ability to effectively utilize the available information technology (IT). We ask you to consider the opportunities—and, yes, the challenges—of the future accountant's environment.

We continue our introduction to AIS with some background material and definitions. First, we define and describe AIS, depict it as a major part of business processes and an organization, and describe the critical functions that an AIS performs in an organization. Then we describe the qualities that information must possess to support management and drive the organization. We also discuss the organization and information systems strategic plans that ensure that the information system effectively supports organization objectives. Finally, we indicate the accountant's critically important AIS roles.

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Some of the terms in this chapter may not be familiar to you. Don't let that worry you at this point. We will define and illustrate these terms later in the book.

THE TEXTBOOK'S THREE THEMES

ENTERPRISE SYSTEMS

Before we embark on our journey, we want to describe for you the importance of our three themes and how they will be included in our discussions throughout this text. The three themes were introduced and defined in the Preface. *Enterprise systems* integrate the business process functionality and information from all of an organization's functional areas, such as marketing and sales, cash receipts, purchasing, cash disbursements, human resources, production and logistics, and business reporting (including financial reporting). *Enterprise resource planning (ERP) systems* are software packages that can be used for the core systems necessary to support enterprise systems. It is critical that accountants understand these systems because they will be members of the teams that will install and operate them in their organizations. To install an enterprise system, the business processes of an organization must be understood and documented. If necessary, the business processes must be changed and then mapped to the enterprise system. A major part of the installation project is the configuration of the enterprise system to tailor it to the business processes. As consultants, business process owners, system users, or auditors, we must understand these systems and be able to install, use, and audit them. Enterprise systems are described more fully in Chapter 2 and are discussed throughout the remainder of the book.

E-BUSINESS

E-Business is the application of electronic networks (including the Internet) to undertake business processes between individuals and organizations. These processes include interaction between back-office (i.e., internal) processes, such as distribution, manufacturing, and accounting, and front-office (i.e., external) processes, such as those that connect an organization to its customers and suppliers. The electronic networks include the Internet and electronic data interchange (EDI), both described in Chapter 3. E-Business has created entirely new ways of working within and across organizations. For example, organizations are buying and selling goods and services at virtual marketplaces. This changes how organizations identify customers and select vendors. It should change how they determine what it costs to acquire goods from a vendor and what price(s) they should charge their customers for their products. Obviously, accountants should be aware of the opportunities and risks associated with this new way of doing business. E-Business is explained more fully in Chapter 3 and discussed throughout the remainder of the book.

CONTROLS

Internal control is a system of integrated elements—people, structure, processes, and procedures—in concert to provide reasonable assurance that an organization achieves its *business process* goals. These goals include efficiency and effectiveness of operations, reliable financial reporting to stakeholders, compliance with applicable laws and regulations, and the safeguarding of valuable organizational resources. For example, controls ensure that an organization's products (its inventory) are not stolen and that the organization does not have too much inventory (perhaps a waste of resources), or too little inventory (leading, perhaps, to a lost opportunity to sell the product). Compliance with laws and regulations includes the SOA that, as noted earlier, requires that management identify, document, and evaluate significant internal controls and that auditors report on managements' assertions about the system of internal control. While management has the responsibility for an organization's system of internal control, it is the accountant and other business process owners who are given the responsibility to effect the system

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of control. Therefore, it is incumbent on all managers and accountants to know how to use controls to ensure achievement of the organization's goals. In Chapter 7 we introduce internal control and then apply it throughout the remainder of the book.

BEYOND DEBITS AND CREDITS

CONTROLS

Have your accounting studies to date convinced you that the most serious problem you may face in your career is that your trial balance doesn't balance? If so, here are a couple of examples that might persuade you otherwise. It wasn't too long ago that the procedures used to process credit card sales were completely manual. A sales clerk would prepare the credit card slip by hand, run it through a machine to imprint your name and account number, and—to reduce the possibility of credit card fraud—look up your credit card number in a book that listed stolen credit cards. But, this printed book was printed only periodically and could never be up-to-date. Soon a procedure was developed whereby clerks would call the credit card companies for approval for a purchase. While this took longer, the selling merchants were able to assure themselves that the credit card had not been reported stolen and that sufficient credit was available on the customer's account. Finally, we evolved to the system that we have today: approvals are obtained automatically by connecting directly (i.e., online) to the credit card company. Why do we do this? The merchant and the credit card company want to make sure that they will get paid for the sale. As you will learn in Chapter 10, an accountant can't book a sale unless it is likely that they will get paid for the sale.

E-BUSINESS

Many of you are familiar with a different control problem that exists today—the purchase of items using credit cards on the Internet. You can read the statistics about individuals who do not want to buy on the Internet because they fear that their private information, especially their credit card number, is not secure. Controls have been put in place to protect the consumer, merchant, and credit card company (we'll read about them in Chapters 3, 8, and 9). Still, fraudulent transactions occur and millions of dollars are lost. Again, we see controls protecting the assets of the organization and assuring effectiveness of operations. After all, if customers aren't confident in the security of a merchant's Web site they will go elsewhere with their purchases.

ENTERPRISE SYSTEMS

Another example is demonstrated with a large multinational company in the health care industry. It acquired a new, large division after having just installed an ERP system in all of its worldwide operations. After installing the ERP system in the new division, the data related to the previous year's purchases and sales for the entire company, including the new division, were exported from the ERP system into a separate database (i.e., a data warehouse, as will be explained in Chapter 5). The cost accountants were then asked to analyze the costs and selling prices for a line of products and to suggest a new pricing structure that would make sense in light of the incorporation of the products from the new division. To accomplish this task, the cost accountants needed to know how the data was defined and stored in the ERP systems, how it had been exported, and finally how to get it out of the data warehouse in a form that they could use. What seemed like a simple analysis, one that would be performed all the time by a staff accountant, became something quite different!

As much as we think we know how to effectively utilize computers, these examples demonstrate that we do not know—or do not or cannot apply—everything that we have learned. These examples indicate challenges for you, while offering opportunities to

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those who learn in this course to be effective information management and business measurement professionals.

Challenges and Opportunities for the Accountant

Are you preparing yourself to be effective in the future? Will you be able to adapt to advances in technology, and will you look ahead and prepare yourself to take advantage of technology improvements? Could you perform the analysis of the cost and price data described in the previous section? Could you help assess the risks and benefits related to an organization's e-Business and develop the controls necessary to ensure a secure and reliable Web presence? Could you help consult with management to comply with SOA Section 404 or audit managements' internal control assertions? We intend to help you prepare yourself to utilize the available technology and to participate in planning for and growing with the technology.

The business consulting units of the Big Four public accounting firms have accounted for a significant percentage of the firms' business and were growing faster than are the accounting, auditing, and tax portions of their businesses. The consulting units of three of these firms have been split off from the "accounting" portions of the firms (Ernst & Young Consulting became Cap Gemini Ernst & Young, KPMG Consulting became BearingPoint, and the consulting division of PricewaterhouseCoopers was sold to IBM). Still, the growth portion of the remaining "accounting" firms will remain in their value-added, business advising lines. For example, a major line of business for these firms has been to assist their clients in complying with SOA Section 404.[1] Also, the new consulting firms will be recruiting personnel with accounting and technology skills. If you aspire to a career in public accounting, your success in the consulting segment of public practice will depend on your knowledge and experience in relatively technical areas that, at first glance, are far afield from the practice of accounting.

The story is the same in other accounting positions. Management accountants and internal auditors find themselves buying, using, and evaluating complex computer-based information systems. Financial accountants must be sure that their accounting information systems can produce financial statements to comply with the SOA Section 409. The management accountant must be sure that a new information system has the necessary features, such as controls and the ability to access data and to trace data from input to output. Also, these information systems must be protected from fraud and other abuses. How effectively you use technology to perform these functions will determine how well you can do your job. That may decide the very survival of your company in a competitive, international marketplace.

A survey sponsored by the Institute of Management Accountants asked some 800 CPAs and other finance professionals about the nature of the work they perform today and what they anticipate they will be doing in the future. Asked to rank in order of importance the professional activities that will be most valued by employers in two or three years, respondents named the following as their top five (the chapter numbers in parentheses indicate where aspects of these topics are discussed in this text):

1. Customer and product profitability (Chapters 10 and 15).
2. Process improvement (*Acquiring, Developing, and Implementing Accounting Information Systems*, the supplement that accompanies this text).

[1] The type of service performed depends on whether the work is performed for an audit client.

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3. Performance evaluation (Chapters 7–8 and the text supplement *Acquiring, Developing, and Implementing Accounting Information Systems*).
4. Long-term strategic planning (Chapters 1 and 8, and the text supplement *Acquiring, Developing, and Implementing Accounting Information Systems*).
5. Computer systems and operations (Chapters 2–3, 5-6, and 8–16).[2]

Independent auditors are faced with deciding on the "reasonableness" of financial statements produced from data contained in the information system. As an auditor, you will be asked to execute your audit tasks and to provide additional "value-added" service to the client. You will, for example, provide your client with advice on improving operations and will alert your firm to potential consulting engagements. Successful public accounting firms will be those that provide cost-effective audits along with broader, high-quality service to the client.

These conclusions were confirmed by the report of a project sponsored by the American Accounting Association, the American Institute of Certified Public Accountants, the Institute of Management Accountants, and the Big Five (there were five at the time) public accounting firms. Practitioners surveyed reported that accounting graduates would need to be able to provide services in the areas of financial analysis, financial planning, financial reporting, strategic consulting, and systems consulting.[3]

Historically, the accountant has performed an *attest function* to determine the reliability of financial information presented in printed financial statements. This role is expanding to include the following:

- Non-financial information. For example, accountants might help sports teams determine whether their stadiums are located in the best places to generate income and whether they operate efficiently.[4]
- Use of information technology to create or summarize information from databases.
- An *assurance service* whereby the accountant will interpret information to determine the quality and relevance of information to be used for decision making.[5]

A special committee of the American Institute of Certified Public Accountants (AICPA) has identified six assurance services[6] that will be offered by accountants. These services are:

- Risk assessment (CPA Risk Advisory Services).
- Business performance measurement (CPA Performance View).
- Information systems reliability (SysTrust, see Chapter 3).
- Electronic commerce (WebTrust, see Chapter 8).
- Health care performance measurement.
- ElderCare Services (now called PrimePlus Services).

[2] Gary Siegel, C. S. Kulesza, and James E. Sorensen, "Are You Ready for the New Accounting?" *Journal of Accountancy* (August 1997): 42–46.

[3] W. Steve Albrecht and Robert J. Sack, *Accounting Education: Charting the Course Through a Perilous Future* (Sarasota, FL: American Accounting Association, 2000): 15.

[4] Lee Burton, "Accountants Expand Scope of Audit Work," *The Wall Street Journal* (June 17, 1996).

[5] See Robert K. Elliott, "Assurance Services and the Audit Heritage," *Auditing: A Journal of Practice and Theory* (Supplement 1998): 1–7.

[6] See http://www.aicpa.org/assurance/index.htm for a description of the assurance services and other services being defined by the AICPA. See http://www.cica.ca/ for those services being defined by the Canadian Institute of Chartered Accountants (CICA).

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Development of these services has been a joint effort between the AICPA and the Canadian Institute of Chartered Accountants (CICA). In addition to the development of these assurance services, the AICPA has, in cooperation with CPAs across the United States and other professional organizations, proposed a vision of the profession's future. Called the "CPA Vision project,"[7] it proposes five core services. Three of those five address or apply information technology. They are "assurance and information integrity," "management consulting and performance measurement," and "technology services." Among the core competencies that will be required of those performing these services are "interpretation of converging information" (able to interpret and provide a broader context using financial and non-financial information) and "technology adept" (able to utilize and leverage technology in ways that add value to clients, customers, and employers).

Finally, the AICPA has created a new credential, the certified information technology professional (CITP), to recognize CPAs who can provide skilled advice on using IT to implement business strategy.[8] Skills necessary to obtain this accreditation include (chapter coverage in this text is shown in parentheses) the following:

- An understanding of project management (the text supplement *Acquiring, Developing, and Implementing Accounting Information Systems*).
- Familiarity with IT and business processes (IT throughout the text, business processes in Chapters 10–16).
- Competence in technology (throughout the text).[9]

Components of the Study of AIS

Figure 1.1 (page 10) depicts the elements central to our study of AIS. Many should be familiar to you, and many have been introduced earlier in this chapter. Let's briefly discuss each element, with special emphasis on how the accountant is affected. Before beginning, let us tell you two things. First, the *study* of AIS is our *broad view*, while the accounting information system itself is our *narrow view*. Second, you shouldn't assign any meaning to the placement of the elements in Figure 1.1. The figure just tells you that there are 10 elements.

Technology. Our ability to plan and manage business operations depends partly on our knowledge of the technology available. For instance, can we manage production without knowledge of robotics? It goes without saying that technological developments have a profound effect on information systems; enterprise systems, ERP systems, e-Business, databases, and intelligent systems are but a few examples. Technology provides the foundation on which AIS and business operations rest, and knowledge of technology is critically important to our complete understanding of the AIS discipline. Exhibit 1.1 (page 11) describes the 10 most important technological challenges and opportunities facing CPAs in 2003. These technologies were selected by a group of CPAs and other professionals recognized as technology leaders. The AICPA's Top Technologies Task Force sponsored this group and published the results. The exhibit indicates where these technologies are discussed in this text.

Databases. Your other accounting courses have emphasized accounting as a reporting function. The full accounting cycle, however, includes data collection and

[7] See http://www.aicpa.org/vision/index.htm for a description of the CPA Vision project.
[8] See http://citp.aicpa.org/ for a description of the CITP designation.
[9] "IT Credential to Help CPAs Make Business Sense Out of Technology," *Journal of Accountancy* (July 2000): 95–96.

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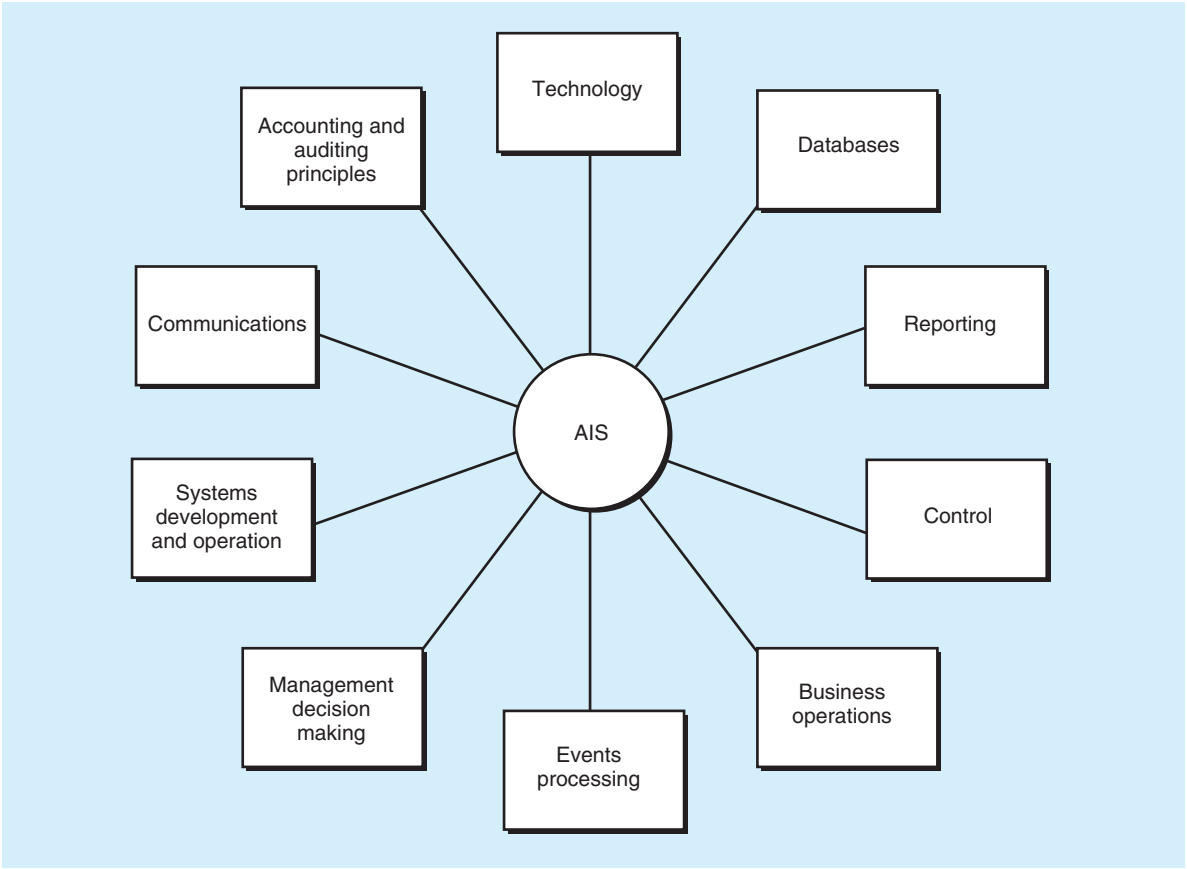
Figure 1.1 Elements in the Study of Accounting Information Systems



storage, and these aspects must become part of your knowledge base. In addition, important to a complete understanding of AIS are the variety of databases, both private and public; the quantity and type of data available in these databases; and methods of retrieving those data. To perform analysis, to prepare information for management decision making, and to audit a firm's financial records, an accountant must be able to access and use data from public and private databases. Chapters 5 and 6 explore the design and use of an organization's own databases. Chapter 3 examines the use of public databases.

Reporting. To design reports generated by an information system, the accountant must know what outputs are required or are desirable. Often, the user will prepare a report on an ad hoc basis using powerful report-generating tools or a database query language (discussed in Chapters 5 and 6). These reports often support management decisions as well as fulfill certain reporting obligations. GAAP-based financial statements are but one example of reporting that will be considered in our study of AIS.

Control. Traditionally, accountants have been experts on controlling business processes. As a practicing accountant, you will probably spend much of your time providing such expertise. Consider how much more difficult it will be to control modern, complex business processes. You must develop an understanding of con-

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Exhibit 1.1 American Association of Certified Public Accountants (AICPA) Top Ten Technology List for 2003

1. *Information security:* The hardware, software, processes, and procedures in place to protect an organization's information systems from internal and external threats. They include firewalls, antivirus, password management, patches, locked facilities, Internet protocol strategy, and perimeter control. Discussed throughout the text but especially in Chapters 7–16.
2. *Business information management:* The process of capturing, indexing, storing, retrieving, searching, and managing documents electronically, including knowledge and database management (XML, PDF, and other formats). Business information management brings to fruition the promise of the "paperless office." Discussed throughout the text but especially in Chapters 2–6.
3. *Application integration:* The ability of different operating systems, applications, and databases to "talk" to each other and for information to flow freely regardless of application, language, or platform. Discussed throughout the text but especially in Chapter 2.
4. *Web services:* Applications that use the Internet as their infrastructure and access tool, including both Web-enabled and Web-based applications. Examples include Java applications, Microsoft's .Net initiative, and today's application service providers (ASP) and business portals. Discussed in Chapter 10.
5. *Disaster recovery planning:* The development, monitoring, and updating of the process by which organizations plan for continuity of their business in the event of a loss of business information resources due to impairments such as theft, virus infestation, weather damage, accidents, or other malicious destruction. Discussed in Chapter 8.
6. *Wireless technologies:* The transfer of voice or data from one machine to another via the airwaves without physical connectivity. Examples include cellular, satellite, infrared, Bluetooth, wireless (WiFi), 3G, and 2-way paging. Discussed in Chapter 3.
7. *Intrusion detection:* Software or hardware solutions that list and track successful and unsuccessful login attempts on a network such as Tripwire. Intrusion detection capabilities are being built into many of today's firewall applications. Discussed in Chapter 8.
8. *Remote connectivity:* Technology that allows a user to connect to a computer from a distant location outside of the office. Examples would include RAS (Remote Access Services), WTS (Windows Terminal Server), Citrix, MangoMind, and PCAnywhere. Discussed in Chapter 3.
9. *Customer relationship management:* Managing all customer touch points, including call center technologies, e-commerce, data warehousing, and all other technologies used to facilitate communications with customers and prospects. Discussed in Chapters 2 and 10.
10. *Privacy:* Today, more and more personal information is being collected and converted to digital formats. This information must be protected from unauthorized use by those with access to the data. Privacy is a business issue, as well as a technology issue, because of state, federal, and international regulations. Discussed in Chapters 3 and 7–9.

Source: See http://www.toptentechs.com/ for the list of top ten technology issues, technologies, technology applications, and emerging technologies. This list was obtained from the Web site in October 2003.

trol that is specific to the situation at hand, yet is adaptable for the future. Control—the means by which we make sure the intended actually happens—will be introduced in Chapter 7 and explored in detail in Chapters 8 and 9 and in the business process chapters, Chapters 10 through 16.

The next three elements—business operations, events processing, and management decision making—comprise a major focus of this text, *business processes.* The logical components of business processes are described later in this chapter. Knowledge of these processes is essential for success as an accountant, consultant, business process owner, or IT specialist.

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Business operations. Organizations engage in activities or operations, such as hiring employees, purchasing inventory, and collecting cash from customers. An AIS operates in concert with these business operations. Many AIS inputs are prepared by operating departments—the *action* or *work* centers of the organization—and many AIS outputs are used to manage these operations. Therefore, we must analyze and manage an AIS in light of the work being performed by the organization. For example, to advise management and to prepare reports for management decision making, a management accountant must understand the organization's business.

Events processing. As organizations undertake their business operations, events, such as sales and purchases, occur. Data about these events must be captured and recorded to mirror and monitor the business operations. The events have operational and AIS aspects. To design and use the AIS, an accountant must know what event data are processed and how they are processed.

Management decision making. The information used for a decision must be tailored to the type of decision under consideration. Furthermore, the information is more useful if it recognizes the personal management styles and preferences of the decision maker. For instance, the manager of department A prefers to receive a monthly cash flow statement that groups receipts and payments into broad categories. The manager of department B, on the other hand, wants to see more detailed information in the form of an analysis of payments by vendors. Beyond the information available to managers, many decision makers now use *intelligent systems* to help them make decisions. Later in this chapter we introduce management decision making and then discuss management's use of the data collected by each business process (Chapters 10–16). In Chapter 5 we examine intelligent systems.

Systems development and operation. The information systems that process business events and provide information for management decision making must be designed, implemented, and effectively operated. An accountant often participates in systems development projects. He or she may be a user or business process owner contributing requests for certain functions or an auditor advancing controls for the new system. Choosing the data for a report and designing that report or configuring an enterprise system are examples of systems development tasks that can be accomplished by an accountant. In the text supplement *Acquiring, Developing, and Implementing Accounting Information Systems,* we examine systems development and operation and the accountant's role in those processes.

Communications. To present the results of their endeavors effectively, accountants must possess strong oral and written communication skills. Have your professors been drumming this message into you? If not, you'll become acutely aware of its importance when you enter the job market. Unlike in other accounting courses, there are few right or wrong answers in the study of AIS. Throughout this course, you will be required to evaluate alternatives, to choose a solution, and to defend your choice. Technical knowledge won't be enough for the last task.

Accounting and auditing principles. To design and operate the accounting system, an accountant must know the proper accounting procedures and must understand the audits to which the accounting information will be subjected. As an illustration, suppose you were designing an AIS for the billing function at XYZ, Inc. Would you invoice a customer at the time the customer's purchase order was received, or would you wait until XYZ's shipping department notified you that the goods had been shipped? We're confident that you chose the second alternative.

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WHAT IS AN ACCOUNTING INFORMATION SYSTEM?

In this section, we suggest a definition for AIS (this is our *narrow view* of AIS) and discuss related terms to help you understand the subject matter of this textbook. Because these definitions establish a background for later study, you should read this section carefully. We begin with a definition of a system and then define and discuss an accounting information system. We conclude this section by discussing how the accountant interacts with the AIS and with the current business environment.

Systems and Subsystems

A **system** is a set of interdependent elements that together accomplish specific objectives. A system must have organization, interrelationships, integration, and central objectives. Using Figure 1.2 (page 14), we can discuss this definition. Figure 1.2(a) depicts a system consisting of four *interrelated* parts that have come together, or *integrated*, as a single system, which we have named System 1.0. Each part of a system—in this case, parts 1.1, 1.2, 1.3, and 1.4—is known as a **subsystem**. Within limits, any subsystem can be further divided into its component parts or subsystems. Figure 1.2(b) depicts subsystem 1.2 as a system consisting of three subsystems. Notice that we use the term *system* (versus *subsystem*) to describe our area of current interest. For example, in a typical university, the College of Business and the College of Engineering are subsystems of the university system, whereas the School/Department of Accountancy and the Marketing Department are subsystems of the College of Business system.

In Figure 1.2, parts (a) and (b) depict the *interrelationships* (A through H) in a system; part (c) depicts the hierarchical *organization* structure inherent in any system. Again, picture system 1.0 as a university and system 1.2 as the College of Business. Interrelationship F might be a finance student being sent by the Finance Department (1.2.1) to the School/Department of Accountancy (1.2.2) for a minor in accounting.

A system's *basic objectives* depend on its type—natural, biological, or man-made—and on the particular system. For example, the human circulatory system is a biological system (a subsystem of the human body) whose purpose is to carry blood containing oxygen and carbon dioxide to and from the organs and extremities of the body.

Determination of the purpose of man-made systems—such as governments, schools, and business organizations—is a matter we must discuss and understand. Disagreement over the basic functions of the government of the United States has always led to spirited debate among political parties. For example, is the U. S. government the "employer of last resort" and therefore responsible for providing jobs for every citizen? Even when we agree on what the objectives should be, we may disagree on how they should be attained. For example, we might all agree that the objective of a municipal school system is to "educate the young citizens of the city." However, if you attend a meeting of a local school board, you probably won't discover consensus over how to meet that objective.

Business organizations usually have more straightforward purposes that are normally related to the "bottom line." However, many businesses establish goals other than financial return to the owners. For example, a business might strive to improve the quality of life of its employees, or to use its natural resources responsibly. Here is our own bottom line: We must know a business organization's objectives to understand that business as a system and to understand the actions and interactions of that business components or subsystems. This is a central theme of our study of AIS.

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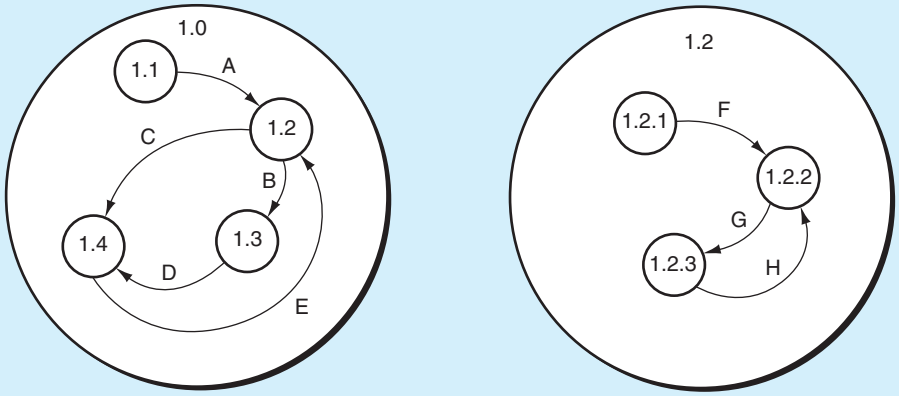
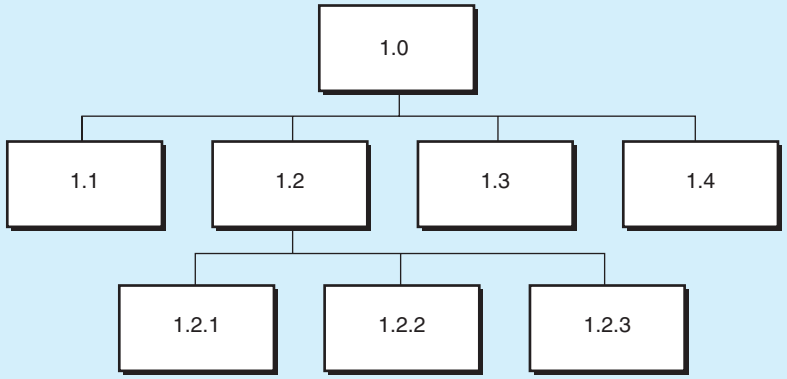
Figure 1.2 Systems and Subsystems



(a) System: 1.0
Subsystems: 1.1, 1.2, 1.3, 1.4
Interrelationships: A, B, C, D, E

(b) System: 1.2
Subsystems: 1.2.1, 1.2.2, 1.2.3
Interrelationships: F, G, H



(c) System 1.0 organization

The Information System

An **information system (IS)** (or **management information system [MIS]**) is a man-made system that generally consists of an integrated set of computer-based and manual components established to collect, store, and manage data and to provide output information to users. Figure 1.3 depicts the functional components of an information system. Imagine a simple information system used to maintain inventory balances for a shoe store. The inputs for such a system might be receipts of new shoes or sales of shoes; the processing might be to update (in storage) the inventory records for the particular shoe; and the output might be a listing of all the kinds and sizes of shoes and their respective recorded balances. That is, a simple information system is directed at the processing of business events.

The IS facilitates these operational functions and supports management decision making by providing information that managers can use to plan and control the activi-

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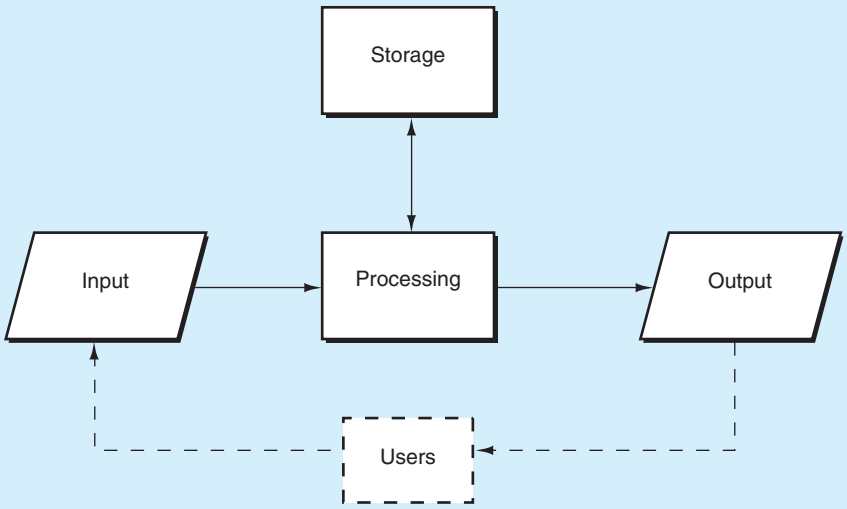
Figure 1.3 Functional Model of an Information System



NOTE:
System outputs result in user actions. Some actions (i.e., feedback) in turn become subsequent system inputs.

ties of the firm. The IS may have advanced elements, such as a database for storage, and use decision models to present output information for decision making. For example, assume that, while entering data about shoe sales, we also enter data about who purchased the shoes, how they paid for the shoes, and why they decided to buy their shoes at our store. We might store those data and periodically print reports useful in making decisions about advertising effectiveness. Or we might decide, on the basis of analysis of the sales data, to engage in joint advertising campaigns with a credit card company whose cards are often used in the store.

The Accounting Information System

ENTERPRISE SYSTEMS

The IS used in our shoe store might have components designed specifically for the organizational function being supported. For example, the IS in our shoe store supports inventory control (a logistics function) by maintaining records for each shoe stocked in the store. The shoe store IS also supports a sales and marketing function by analyzing sales in a variety of ways. Other typical IS components include personnel, production, finance, and accounting. However, integrated IS processing, such as that in an *enterprise system*, has allowed the distinctions among these separate systems to become blurred.[10]

So it is that historically an IS incorporated a separate **accounting information system (AIS)**, a specialized subsystem of the IS. The purpose of this separate AIS was to collect, process, and report information related to the financial aspects of business events. For example, the input to our AIS might be a sale, such as the shoe sale in our earlier example. We process our sale by recording the sales data in the sales journal, classifying the

[10] These separate IS components and their related business processes are often referred to as "stovepipes" to emphasize that they are separated and may not communicate with each other.

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data using our chart of accounts, and posting the data to the general ledger. Periodically, the AIS will output trial balances and financial statements. However, given the integrated nature of information systems today, we seldom can distinguish an AIS that is separate from the IS.

This textbook studies the discipline of AIS and takes the view that the AIS often cannot be distinguished from the IS. This view is consistent with our assertion that contemporary accountants are information management and business measurement professionals. Our coverage of AIS is based on the 10 elements of Figure 1.1 (page 10). We cover these elements because, as an accountant, your skills must transcend the processing of financial data. You must understand the technology and the operating goals of the organizational functions for which the financial data are processed. For example, supermarket checkout scanners simultaneously collect accounting and operational sales data. Therefore, we must understand sales and marketing goals and the technology used in operations if we are to effectively operate, analyze, or audit a supermarket's AIS. These skills become even more critical as organizations evolve toward highly integrated information systems, such as *enterprise systems.* In summary, a complete study of the AIS should consider all 10 elements of Figure 1.1.

Finally, just as an IS can be divided into its functional components, the AIS may be divided into components based on the operational functions supported. In the sales example, the sales data might originate in the billing/accounts receivable/cash receipts subsystem. We call these AIS components the *AIS processes* or *AIS subsystems.* In this text we subdivide the AIS into these processes to facilitate our discussions and your understanding of the elements of the AIS. These processes are described in Chapters 10–16.

Comparison of Manual and Automated Accounting Information Systems

Table 1.1 (page 18) compares portions of a manual AIS with an automated AIS. The business events described in the table are for Waltham Company for the month of June 20X1, the first month of operations. The left column of the table describes portions of a manual accounting cycle, while the middle column describes the equivalent steps that would be performed in a computerized accounting system. Figure 1.4 (page 19) depicts the journal, ledgers, and trial balance described in Table 1.1. You should be familiar with the terms and concepts in column 1 and the terms *input*, *process(ing)*, *storage*, *output*, and *update* that we introduced with Figure 1.3 (page 15). In this section we define and discuss the other terms in the middle column of Table 1.1.

First, we look at terms related to the input stage. **Input data** are data received by the information system from the external environment or from another area within the information system. Data input includes *capturing* data (for example, completing a source document such as a sales order or preparing batch totals) and, if necessary, *conversion* of the data to *machine-readable form.*[11] Input data, such as the sales event data in Table 1.1 (page 18), are normally recorded in business event data. **Business event data** represent the "books of original entry" used for recording most business events.[12] These business

[11] When inputs are keyed into a computer directly without the use of a source document, the capture and conversion steps are combined. For instance, order entry clerks might key in a customer order without first transcribing it onto an order form. This might be done with catalog sales. When inputs are received electronically, such as when an order is sent from a customer via the Internet, the capture and conversion steps do not involve any keying within the capturing organization.

[12] As we will discuss later in this chapter, business event data and master data represent the relevant portions (or *views*) of the *enterprise database* being used for a particular application.

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events comprise the activities of the organization, such as purchasing goods from vendors and collecting cash from customers. The general and special journals used in manual accounting systems are examples of business event data. Business event data reflect the business events for a certain time period, such as one day.

Next, we examine the terms related to the two process stages in Table 1.1. Business event data are used often as a key source of data to *update* various master data. A **master data update** can be defined as an information processing activity whose function is to incorporate new master data into existing master data. Updating includes adding, deleting, and replacing master data and/or records. For example, in Table 1.1, the sales event data are used to update the accounts receivable master data by adding new accounts receivable records.

Master data updates are recorded on master data. **Master data** are repositories of relatively permanent data maintained over an extended period of time.[13] Master data contain data related to *entities*—persons (e.g., employees, customers), places (e.g., buildings), and things (e.g., accounts receivable, inventory). Master data include such data as the accounts receivable master data (that is, the accounts receivable subsidiary ledger), the customer master data, and the general ledger master data (that is, the general ledger).

Two types of updates can be made to master data: information processing and data maintenance. **Information processing** includes data processing functions related to economic events such as accounting events, internal operations such as manufacturing, and financial statement preparation such as adjusting entries. The updates in Table 1.1 are information processing updates related to a sales event. **Data maintenance**, on the other hand, includes activities related to adding, deleting, or replacing the *standing data* portions of master data. Master data **standing data** include relatively permanent portions of master data, such as the credit limit on customer master data and the selling price and warehouse location on inventory master data. In this textbook, we emphasize information processing, and our analysis of the internal controls related to master data updates is restricted to master data updates from information processing. However, at appropriate points in the text, we refer to controls related to data maintenance.

Let's summarize. A computerized accounting information system automates the manual accounting cycle with which you are already quite familiar. When we computerize an AIS, we merely change *how* the data are processed; we do not change *what* tasks are performed. As you undertake your study of AIS, keep that thought in mind; it should facilitate your study.

Logical Components of a Business Process

Figure 1.5 (page 20) depicts the three logical components of a business process; the information process is that portion of the overall IS (introduced earlier and depicted in Figure 1.3 on page 15) related to a particular business process.[14] In this section, we define the other two processes, describe how the three processes work together, and emphasize the critical role that the management information process plays.

[13] See footnote 10.

[14] Many would use the terms information *process* and information *system* interchangeably. But, we ask you to think of an information process as the portion of the information system that is related to a particular business process.

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Table 1.1 Comparison of Manual and Automated Accounting Cycles

Manual Accounting Cycle[a]	Automated Accounting Cycle	Impact Analysis[b]
Journalize—Record sales data in a sales journal.	**Input**—Record the sales data (*input data*) in the sales event data (input to storage).	Two entries are made in the book of original entry, one for the Smith sale and one for the Jones sale.
Post—Post each entry from the sales journal to the customer subsidiary ledger.	**Process**—Record each sale in the accounts receivable (AR) master data (**update** *storage*).	Smith's AR balance is increased by $75 and Jones' AR balance is increased by $50.
Post—Total the sales journal and post to the general ledger (GL).	**Process**—Total the sales event data and record in the GL master data (**update** *storage*).	The sales account and the AR control account are each increased by $125.
Summarize[c]—Prepare a trial balance.	**Output**—Retrieve (a *process*) the general ledger master data (from *storage*) and print the trial balance.	The debit and credit balances in each general ledger account are listed (Sales = CR $125, AR = DR $125).

[a] Some types of financial events may be journalized in the general journal (i.e., no special journal) and posted only to the general ledger (i.e., no subsidiary ledgers).
[b] Assume two sales, one to Stan Smith for $75 on June 5, 20X1 (Invoice 601) and one to Julie Jones for $50 on June 16, 20X1 (Invoice 602). Assume further that these are the first and only sales to these customers and the only sales for this period (June) to any customers.
[c] The accounting cycle continues after the preparation of the general ledger trial balance. Additional steps usually include adjusting entries, preparation of financial statements and closing entries,and reconciling subsidiaryledger balances to general ledger control account balances.

The **operations process** is a man-made system consisting of the people, equipment, organization, policies, and procedures whose objective is to accomplish the work of the organization. Operations processes typically include production, personnel, marketing and sales, accounting, finance, warehousing, and distribution.

The **management process** is a man-made system consisting of the people, authority, organization, policies, and procedures whose objective is to plan and control the operations of the organization. The three most prominent management activities are planning, controlling, and decision making. These are discussed in the next section of this chapter.

If we follow the flows connecting the three processes of Figure 1.5, we can gain an understanding of how these processes work together to accomplish the business process'—and therefore the organization's—objectives. To focus our discussion, we chose a customer order/sales event to illustrate Figure 1.5. Stay with us as we discuss each of the numbered flows in the figure.

- *Flow 1.* Management hires personnel and establishes the means for accomplishing the work of the organization. For example, management would design the procedures used to warehouse inventory and then to ship those goods to the customers.
- *Flow 2.* Management establishes broad marketing objectives and assigns specific sales quotas by which progress toward the long-run objectives can be measured. In addition, management designs the information system's procedures for facilitating operations, such as the procedures used to pick and ship goods to the customer.

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Figure 1.4 Journalizing, Posting, and Summarizing in a Manual Accounting System

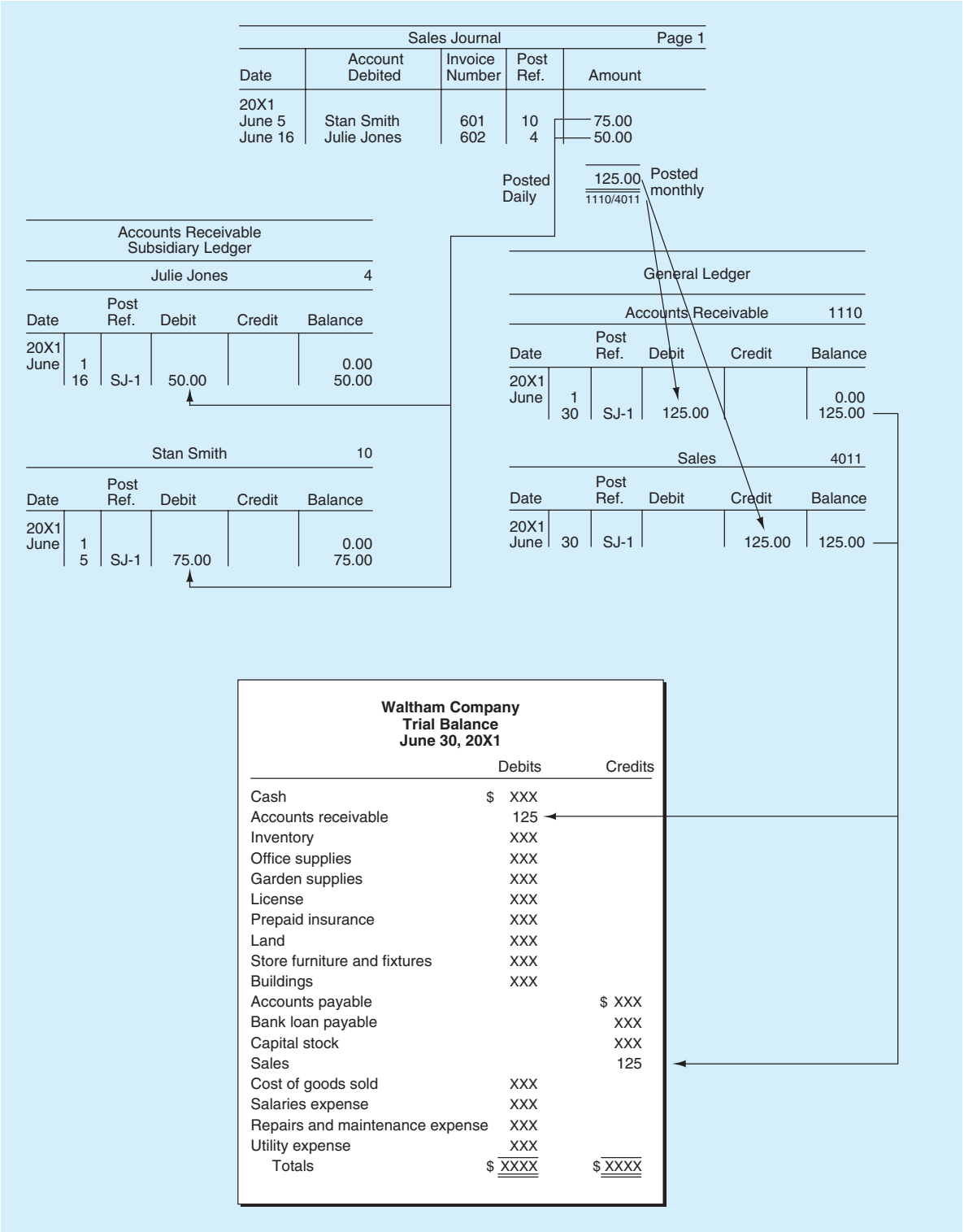

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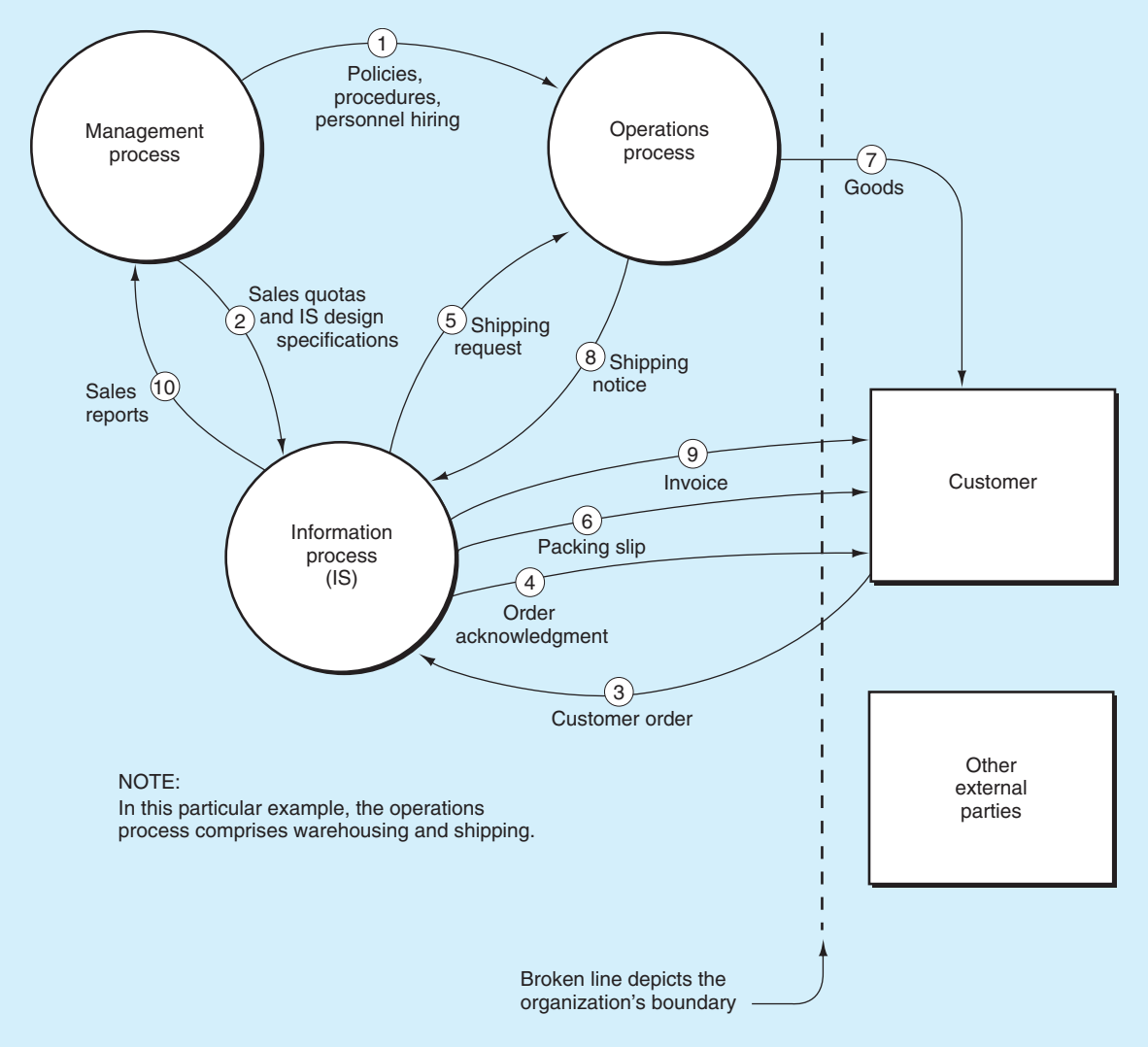
Figure 1.5 A Logical Model of a Business Process



- *Flow 3.* Normal operations begin with the IS receiving a customer's order to purchase goods.
- *Flow 4.* The IS acknowledges the customer's purchase order.
- *Flow 5.* The IS sends to the warehouse a request to ship goods to the customer. This request identifies the goods and their location in the warehouse.
- *Flow 6.* A document (i.e., a packing slip) identifying the customer and the goods is attached to the goods.
- *Flow 7.* The goods are shipped to the customer.[15]

[15] Note that flow 6 is shown as coming from the IS, whereas flow 7 emanates from the operations process. Physically, the two flows are really inseparable; logically, however, they are separate. In later chapters, we will have more to say about the difference between logical and physical system features.

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- *Flow 8.* The shipping department reports to the IS that the goods have been shipped.
- *Flow 9.* The IS prepares an invoice and sends it to the customer.
- *Flow 10.* The IS sends management a report comparing actual sales to previously established sales quotas.

These 10 flows highlight several important concepts that we need to discuss.

- The information process facilitates operations by maintaining inventory and customer data and by providing electronic signals (such as those used in automated warehouses) and paper documents with which to execute business events, such as shipments to customers.
- The information process provides the means by which management monitors the operations process. For example, management "learns" sales results only from the sales report.
- Operations-related and accounting-related processes are integrated. For example, the shipping notice triggers the accounting process of updating the sales and accounts receivable data in conjunction with preparing the invoice, an operational activity.
- Management designs the operations and information processes and establishes these processes by providing people, equipment, other physical components, and policies.
- Information process users include operations personnel, management, and people outside the organization, such as the customer.

Our discussion of Figure 1.5 should make it clear that the IS can be crucial to an organization's success by facilitating the day-to-day operations processes and by providing useful information for the organization's management. Let's examine the attributes that make information useful to a decision maker and how management can make use of that information to drive the organization toward achievement of its strategic objectives.

MANAGEMENT USES OF INFORMATION

An information system serves two important functions within an organization. First, the information system mirrors and monitors actions in the operations system by processing, recording, and reporting business events. For example, the information system processes customer orders; records sales to customers by updating sales, accounts receivable, and inventory data; and produces invoices and sales event summaries.

The second major function of the information system is to support managerial activities, including management decision making. How do managers use this information? First, they monitor current operations to keep their "ship" on course. For example, managers need to know if enough inventory is being produced each day to meet expected demand. Managers' second use of information is to help them achieve satisfactory results for all their stakeholders (e.g., customers, stockholders). For example, information can measure attainment of goals regarding product quality, timely deliveries, cash flow, and operating income. Finally, managers use the information system to recognize and adapt in a timely manner to trends in the organization's environment. For example, managers need answers to questions such as: "How does the time it takes us to introduce a new product compare to our competitors?" "Does our unit cost to manufacture compare to

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our competitors?"[16] Because information systems provide critical support to such management activities, we must understand these activities, including decision making, to understand the required design features of good information systems. In this section we discuss, in general terms, management uses of information.

Data Versus Information

Our definitions of *data* and *information* are a bit circular. **Information** is data presented in a form that is useful in a decision-making activity. The information has value to the decision maker because it reduces uncertainty and increases knowledge about a particular area of concern. **Data** are facts or figures in raw form. Data represent the measurements or observations of objects and events. To become useful to a decision maker, data must be transformed into information. Figure 1.6 illustrates the transformation process. Notice that part (a) repeats the functional model of an *information system* that we saw in Figure 1.3 (page 15), whereas part (b) uses the same symbols with different labels. Might you conclude, then, that the function of the information system is to transform data into information? Absolutely.

We said, however, that *information* must be *useful* in decision making. What attributes give information its utility value? Let's answer this question next.

Qualities of Information

To provide output useful for assisting managers and other users of information, an information system must collect data and convert them into information that possesses important qualities. In this section, we examine some of the elements of information quality that allow us to design and control the collection and processing of data. Exhibit 1.2 (page 24) describes qualities of information that, if attained, will help an organization achieve its business objectives. Figure 1.7 (page 25) presents an overview of information qualities depicted as a hierarchy. In the following paragraphs we discuss and expand upon these various information qualities.

You can see from the exhibit that the *effectiveness* quality overlaps with other qualities as it includes such measures as "timely" (i.e., availability) and "correct" (i.e., integrity). The effectiveness of information must be evaluated in relation to the purpose to be served—decision making. Effective information is information that is useful for the decision to be made. Effectiveness, then, is a function of the decisions to be made, the method of decision making to be used, the information already possessed by the decision maker, and the decision maker's capacity to process information. The superior factors in Figure 1.7, such as "users of information" and "overall quality (decision usefulness)," provide additional emphasis for these points. Our examples should make these points clear.[17]

Understandability enables users to perceive the information's significance. Valued from the user's point of view, understandable information is presented in a form that permits its application by the user in the decision-making situation at hand. For example, information must be in a language understood by the decision maker. By language,

[16] To read more about measures of performance, see Robert S. Kaplan and David P. Norton, "The Balanced Scorecard Measures That Drive Performance," *Harvard Business Review* (January–February 1992): 71–79, as well as subsequent articles that have appeared in the *Harvard Business Review*.

[17] The descriptions of many of these terms are adapted from *Statement of Financial Accounting Concepts No. 2: Qualitative Characteristics of Accounting Information*, Financial Accounting Standards Board (FASB), May 1980.

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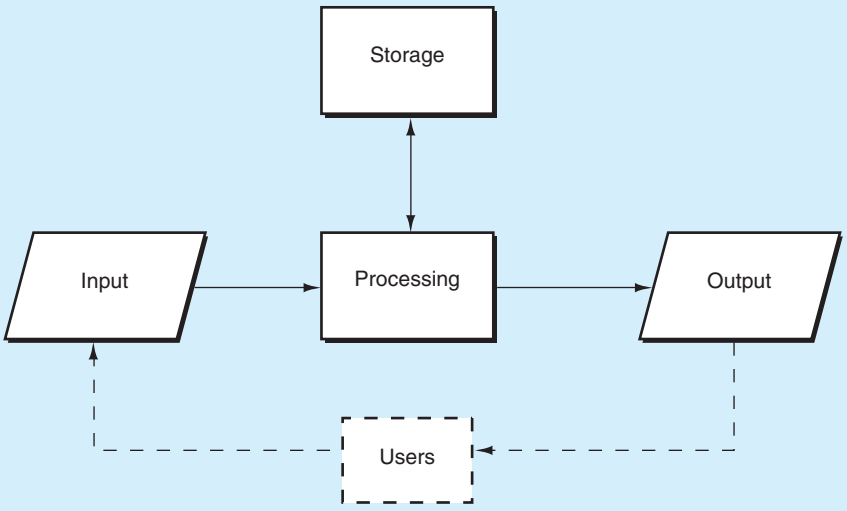
Figure 1.6 Transforming Data into Information



(a) Functional model of an information system

(b) The same information system model with new labels

we mean native language, such as English or French, as well as technical language, such as those used in physics or computer science. Also, information that makes excessive use of codes and acronyms may not be understandable to some decision makers.

Information capable of making a difference in a decision-making situation by reducing uncertainty or increasing knowledge for that particular decision has **relevance**. For example, a credit manager making a decision about whether to grant credit to a customer might use the customer's financial statements and credit history because that information could be relevant to the credit-granting decision. The customer's organization chart

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Exhibit 1.2 Qualities of Information

Effectiveness: deals with information being relevant and pertinent to the business process as well as being delivered in a timely, correct, consistent, usable, and complete manner.

Efficiency: concerns the provision of information through the optimal (most productive and economical) usage of resources.

Confidentiality: concerns the protection of sensitive information from unauthorized disclosure.

Integrity: relates to the accuracy and completeness of information as well as its validity in accordance with a business's set of values and expectations.

Availability: relates to information being available when required by the business process, and hence also concerns the safeguarding of resources.

Compliance: deals with complying with those laws, regulations, and contractual obligations to which the business process is subject, that is, externally imposed business criteria.

Reliability of information: relates to systems providing management with appropriate information for both to use in operating the entity, in providing financial reporting to users of the financial information, and in providing information to regulatory bodies with regard to compliance with laws and regulations.

Source: Reprinted with permission from *COBIT: Control Objectives for Information and Related Technology—Framework*, 3rd ed. (Rolling Meadows, IL: The Information Systems Audit and Control Foundation, 2000): 14.

would not be relevant. The description of *reliability of information* in Exhibit 1.2 uses the term "appropriate." Relevance is a primary component of appropriateness.

Information that is available to a decision maker before it loses its capacity to influence a decision has **timeliness**. Lack of timeliness can make information irrelevant. For example, the credit manager must receive the customer's credit history before making the credit-granting decision. If the decision must be made without the information, the credit history becomes irrelevant. Exhibit 1.2 describes *availability* as "being available when required." Thus, availability can increase timeliness.

Predictive value and **feedback value** improve a decision maker's capacity to predict, confirm, or correct earlier expectations. Information can have both types of value, since knowledge of the outcomes of actions already taken will generally improve a decision maker's abilities to predict the results of similar future actions. A buyer for a retail store might use a sales forecast—a prediction—to establish inventory levels. As the buyer continues to use these sales forecasts and to review past inventory shortages and overages—feedback—he or she can refine decision making concerning inventory.

If there is a high degree of consensus about the information among independent measurers using the same measurement methods, the information has **verifiability**. In accounting, we record assets at their historical cost. Why? Because evidence of the assets' cost will permit several people to arrive at a similar estimate of the book value of the asset.

Neutrality or **freedom from bias** means that the information is not biased. Bias is the tendency of information to fall more often on one side than on the other of the object or event that it represents. For example, an accounts receivable balance that is usually higher than what can be collected is biased. Notice that verifiability addresses the reliability of the measurement method (e.g., historical cost, market value), and neutrality addresses the reliability of the person doing the measuring.

Comparability is the information quality that enables users to identify similarities and differences in two pieces of information. If we can compare information about two similar objects or events, the information is comparable. For example, in either your financial or managerial accounting course you probably studied ratio analysis of financial statements. You also learned that one of the "yardsticks" against which you might evaluate

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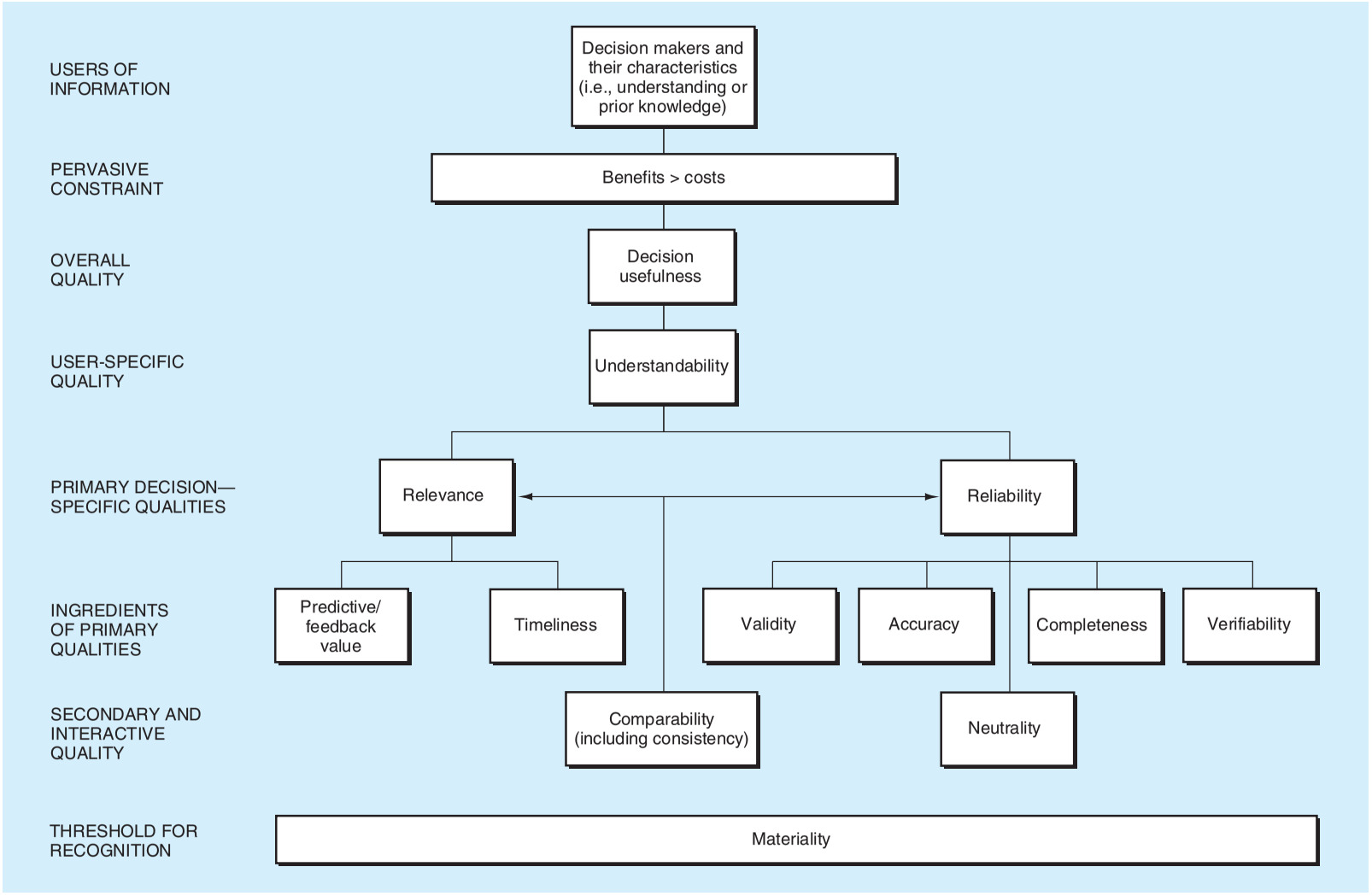
Figure 1.7 A Hierarchy of Information Qualities



Source: Adapted from *Statement of Financial Accounting Concepts No. 2: Qualitative Characteristics of Accounting Information*, Financial Accounting Standards Board (FASB), May 1980, p. 15. Copyright by Financial Accounting Standards Board, 401 Merritt 7, P.O. Box 5116, Norwalk, CT 06856-5116. Reprinted with permission. Copies of complete documentation are available from the FASB.

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the ratios of company A would be similar ratios for competitor company B or for the industry as a whole. But how good is your comparison of two companies if one uses FIFO (first in, first out) inventory costing, and the other uses LIFO (last in, first out) costing? Generally accepted accounting principles strive to make accounting information as comparable as possible across firms by establishing common practices for accounting for inventory, fixed assets, leases, and so on.

If, on the other hand, we can compare information about the same object or event collected at two points in time, the information is **consistent**. Again, in doing ratio analysis, you probably performed horizontal or trend analysis for two or more years for one company.

As noted in Exhibit 1.2 (page 24), *integrity* is an information quality that can be expanded into three very important qualities: validity, accuracy, and completeness. In Figure 1.7 (page 25) these are components of reliability. Information about actual events and actual objects has **validity**. For example, suppose that the IS records a sale and an account receivable for a shipment that didn't occur. The *recorded* information describes a fictitious event; therefore, the information lacks validity.

Accuracy is the correspondence or agreement between the information and the actual events or objects that the information represents. For example, we would have inaccurate information if the quantity on hand in an inventory report was reported as 51 units, when the actual physical quantity on hand was 15 units (note the transposition). Inaccurate information also would result if, for instance, 15 units were actually on hand, yet the inventory report indicated only 10 units.

Completeness is the degree to which information includes data about every relevant object or event necessary to make a decision. We use *relevant* in the sense of all objects or events that we *intended* to include. For example, in Chapter 7 we will learn that an accountant must ensure that an accounting system captures and records all *valid* accounting event data, otherwise the accounting database is not complete. For instance, suppose the shipping department prepared 50 shipping notices for 50 actual shipments made for the day. Two of the notices were accidentally blown to the floor and were discarded with the trash. As a result, the billing department prepared customer invoices for only 48 shipments, not 50.

In summary, the *effectiveness* of information can be measured in many ways. Those previously discussed and included in Exhibit 1.2 and Figure 1.7 (pages 24 and 25) include *understandability*, *relevance* (or *reliability*), *timeliness* (or *availability*), *predictive value*, *feedback value*, *verifiability*, *neutrality* (or *freedom from bias*), and *comparability*, *consistency*, and *integrity* (or *validity*, *accuracy*, and *completeness*). We will see these qualities again, in addition to those not discussed here (*efficiency*, *confidentiality*, and *compliance*) in subsequent chapters.

Conflicts Among the Information Qualities

It is virtually impossible to simultaneously achieve a *maximum* level for all the qualities of information. In fact, for some of the qualities, an increased level of one requires a reduced level of another. In one instance, obtaining *complete* information for a decision may require delaying use of the information until all events related to the decision have taken place. That delay may sacrifice the *timeliness* of the information. For example, to determine all the merchandise shipments made in November, an organization may have to wait until several days into December to make sure that all shipments get posted.

CONTROLS

Let's look at another example. To obtain *accurate* information, we may carefully and methodically prepare the information, thus sacrificing the *timeliness* of the information.

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For example, to ensure the accuracy of a customer invoice, billing clerks might check the invoice for accuracy several times and then get their supervisor to initial the invoice, indicating that he or she also has checked the invoice for accuracy. These procedures certainly delay the mailing of the invoice.

Management Decision Making

We have asserted that the purpose of an IS is to facilitate an organization's business processes and to support management *decision making* by providing information that managers can use to plan and control the activities of the firm. Let's pursue the meaning and importance of decision making. Very simply, **decision making** is the process of making choices. It is the central activity of all management. Managers make decisions or choices, such as what products to sell, in which markets to sell those products, what organizational structure to use, and how to direct and motivate employees. Herbert A. Simon, a Nobel-prize-winning economist, describes decision making as a three-step process:

1. *Intelligence*: Searching the environment for conditions calling for a decision.
2. *Design*: Inventing, developing, and analyzing possible courses of action.
3. *Choice*: Selecting a course of action.[18]

Figure 1.8 (page 28) depicts these three steps. Analyze the figure to see what information is required for each step. Information from and about the environment and the organization is needed to recognize situations or problems requiring decisions. For example, information about economic trends, marketing intelligence, and likely competitor actions should help management to recognize opportunities for new markets and products. Information about inefficient or overworked processes in the organization should focus management's attention on problems in the organization. Managers use information from inside and outside the organization to design courses of action. For example, information about personnel resources, production capacity, and available distribution channels should help management to develop alternative methods for producing and distributing a new product. Finally, a manager requires information about the possible outcomes from alternative courses of action. For example, to choose from among alternative production options, a manager needs information about the costs and benefits of the alternatives or about the probability of success of each option.

The pyramid on the left side of Figure 1.9 (page 28) represents data flows related to the processing of business events. It emphasizes that operations and information flows are both horizontal and vertical, and that there are several levels of management.[19] At the level of operations and business events processing, the flows are horizontal as the information moves through operational units such as sales, the warehouse, and accounting. In the sales example of Figure 1.5 (page 20), the operational documents and records are the outputs of these horizontal flows.

For example, horizontal flows relate to specific business events, such as one shipment, or to individual inventory items. This information is narrow in scope, detailed, accurate, and comes largely from within the organization. The data captured at the operations and business event processing level constitute the foundation for the vertical information flows that service a multilevel management function.

[18] Herbert A. Simon, *The New Science of Management Decision* (New York: Harper & Row, 1960): 2.

[19] Because Figure 1.9 depicts data from business events, the vertical information flows upward. Other data, such as budgets, would flow downward.

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Figure 1.8 Steps in Decision Making

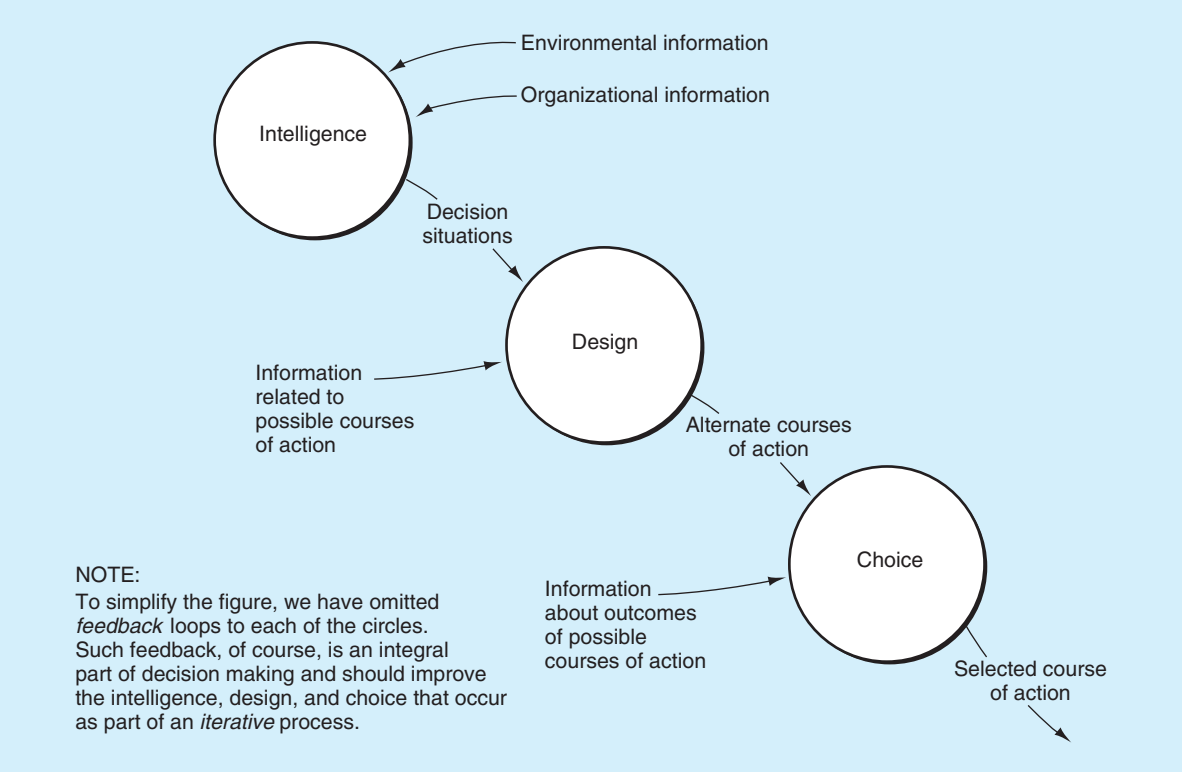
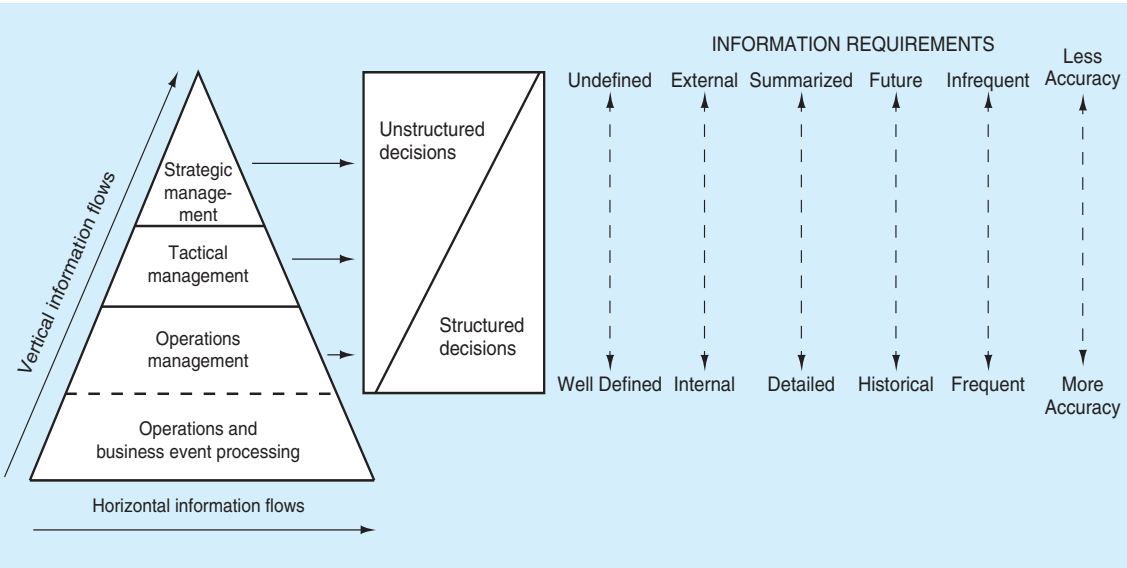


Figure 1.9 Management Problem Structure and Information Requirements



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On the other hand, information useful to operations management personnel is often an aggregate of data related to several business events. For example, a report summarizing shipments made each day might be useful to the shipping manager. At the operations management level, supervisors use this type information to monitor the daily functioning of their operating units. The vertical information useful to operations management is a summarized and tailored version of the information that flows horizontally.

Tactical management requires information that focuses on relevant operational units and is more summarized, broader in scope, and need not be as accurate as the information used by operations management. Some external information may be required. For example, a warehousing and distribution manager might want information about the timeliness of shipments each month.

Finally, strategic management requires information to assess the environment and to project future events and conditions. Information is even more summarized, broader in scope, and comes from outside the organization more than does the information used by tactical management. To be useful to division managers, chief financial officers (CFOs), and chief executive officers (CEOs), information must relate to longer time periods, be sufficiently broad in scope, and be summarized to provide a means for judging the long-term effectiveness of management policies. External financial statements, annual sales reports, and division income statements are but a few examples of strategic-level information. We should note, however, that current computer technology facilitates access to detailed data at all management levels.

CONTROLS

The decision's structure, or lack thereof, also heavily influences the kind of information required to make a decision. *Structure* is the degree of repetition and routine in the decision. Structure implies that we have seen this very decision before and have developed procedures for making the decision. We can use the degree of structure inherent in each decision-making step to categorize the decisions as structured or unstructured. We define **structured decisions** as those for which all three decision phases (intelligence, design, and choice) are relatively routine or repetitive. In fact, some decisions are so routine that a computer can be programmed to make them. For example, many organizations have automated the decision of when and how much credit to grant a customer when an order is received. At the time the customer's order is entered, the computer compares the amount of the order to the customer's credit limit, credit history, and outstanding balances. Using this information the computer may grant credit, deny credit, or suggest a review by the credit department. These procedures are described in more detail in Chapter 10.

Consider, on the other hand, managers' decision-making process when choosing what research and development projects to undertake in the next year. This is only one example of what we classify as an **unstructured decision**, one for which none of the decision phases (intelligence, design, or choice) are routine or repetitive.

Look again at Figure 1.9 and see that it summarizes several concepts introduced in this section and also helps us to understand the nature of the characteristics associated with information used by the three levels of management for decision making. Further, this figure indicates the proportion of structured and unstructured decisions handled by the three management levels.

Information Qualities and Decision-Making Level

The level of the decision maker and the type of decision to be made will determine the preeminence of certain information qualities. For example, strategic management may

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require information high in predictive value. Information used for strategic planning should help managers "see" the future and thereby assist them in formulating long-term plans. The strategic manager may not be as concerned with timeliness or accuracy and would therefore prefer a quarterly sales report to a daily report. Operations management must make frequent decisions, with shorter lead times, and may therefore require a daily sales report to be able to react in a timely manner to changes in sales patterns. Operations management may require timely and accurate information and may not be concerned about the predictive value of the information.

Conclusions About Management Decision Making

From Figures 1.8 and 1.9 (page 28) and their related discussions, we can reach the following conclusions. Information needed for decision making can differ in degree of aggregation and detail, in source, and in fundamental character. We have also seen that the required qualities of information will differ by decision type and level of management.

Within the organization, managers can secure inputs to their decisions directly, from the environment or from direct observation of business processes. Managers can also receive information indirectly through the IS, which retrieves and presents operational and environmental information. As we understand more about the decisions to be made and can better anticipate the data needed to make those decisions, the information system can be designed to provide more of the required information. For example, in ever-increasing numbers, organizations' information systems are obtaining information about economic trends and indicators that is available in public databases.

Because data requirements for structured decisions are well defined, we strive to improve our understanding of decisions so that we can make more decisions structured, anticipate the data needed for those decisions, and regularly provide those data through the information system.

ENTERPRISE SYSTEMS

Let's conclude this section by asking: How does the IS support the multiple information uses suggested by the preceding discussions? For example, how does the IS support such users as the organization's operations units, the organization's management, and people outside the organization? How does the IS supply the information needed by three levels of management? One key component enabling the IS to meet the needs of this diverse constituency is the enterprise database. As noted in the Preface, the **enterprise database** is the central repository for all the data related to the enterprise's business activities and resources. IS processes, such as order entry, billing, and inventory, update the database. Output can be obtained by other IS processes and by other users, such as management. When processes or other users access the enterprise database, they are given a *view* of the database appropriate for their needs. For example, when entering the customer order in Figure 1.5 (page 20), the IS was given access to that *portion* of the database that was required, such as the applicable customer and inventory data.

Strategic Planning and Information Systems

Strategic planning is the process of selecting the organization's long-term objectives and of setting the strategies for achieving those objectives. This planning process is the responsibility of strategic management and is concerned with the overriding issues facing the organization, such as product lines and profitability. Given the international, competitive, and dynamic environment confronted by an organization, strategic planning is crucial to the survival of that organization. Figure 1.10 depicts the strategic planning process.

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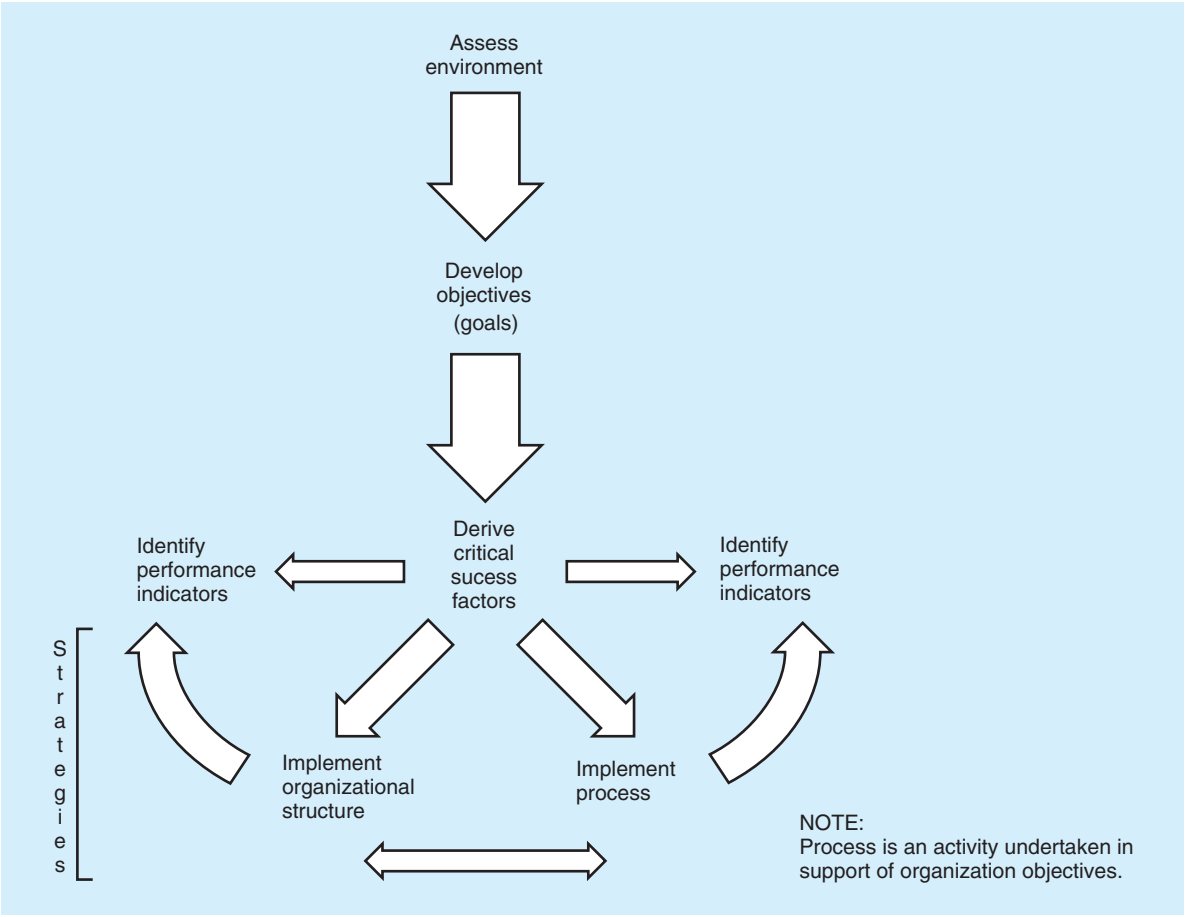
Figure 1.10 Organizational Strategic Planning Process



The strategic planning process addresses such questions as:

1. What business are we in and who are our customers?
2. What knowledge advantage do we have in our business?
3. How should our products be perceived?
4. What rate of return on assets, earnings, or cash flow are we trying to achieve?
5. What are our social responsibilities?

The strategic plan includes answers to these questions. In this section, we summarize organizational strategic planning and suggest the critical importance of that planning process and the information system to the long-term success of an organization.

Organizational Strategic Planning

As shown in Figure 1.10, the strategic planning process includes the following steps:

1. Assess the environment for factors suggesting opportunities and threats. Figure 1.10 depicts the importance of the environment in selecting the organization's objectives. That is, the environment is the only independent variable.

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2. Assess the organization's strengths and weaknesses and develop objectives that match the organization's strengths and weaknesses with the opportunities and threats in the environment. An **objective** is an intention; it is a desired state or condition being sought. For example, an organization may want to be the biggest, the most profitable, the most respected, or the firm with the broadest product line in its industry. We also refer to an objective as a **goal**.
3. Derive the factors that are central to the accomplishment of the objectives and to the survival of the organization—the critical success factors. **Critical success factors (CSFs)** are events, circumstances, conditions, and activities that are essential to the survival of the organization. Examples include cost control, product pricing, product styling, and close ties with high-quality franchisees.
4. Develop corporate strategy (also referred to as a **plan**). A **strategy** is the means (organizational structure and processes) by which an organization has chosen to achieve its objectives and critical success factors. For example, a strategy for achieving prominence in an industry might be to increase research and development to achieve a higher level of new-product development. Or as an alternative to research and development, an organization might choose to copy competitors' products. Strategies apply to a variety of functions within the organization, including the information systems function.
5. Identify the *performance indicators* that will demonstrate achievement of the organization's strategies and critical success factors.

Recall from our earlier discussions of management decision making that strategic planning decisions are largely unstructured and that the source of much of the information needed for the strategic planning process comes from outside the organization. Also, lower-level management must convert the strategic plan to plans directed at each organizational level and unit. During this process, management must ensure that goals are not in conflict between organizational levels or between functions at the same level. That is, the planning process must ensure that individuals or functions work toward a common objective. An organization strives to establish *goal congruence* for individuals and functions so as to attain optimal output for the organization. Without goal congruence, individuals will strive to maximize their own output.

Information Systems for Aiding the Strategic Planner

The information system can play an important role in the *development of the strategic plan* and in monitoring ongoing operations to *measure attainment of the plan*. In this section we discuss the upfront and ongoing assistance that the strategic planner obtains from the information system.

ENTERPRISE SYSTEMS

During the strategic planning process, data from the *enterprise database* can be compared to data about the competition to determine an organization's relative strengths and weaknesses. For example, these data might include sales trends, gross margin on sales, age of capital assets, skills of existing personnel, debt/equity ratio, and so on. These data can be presented in reports from the existing information systems applications, such as sales/marketing, human resources management, fixed assets, finance and inventory, or via decision models incorporated in the IS. Strategic planners can combine the environmental data with those obtained internally to assess the organization's competitive position. The demand for such information has been a major driver in the move to *enterprise systems*, which bring all of the organization's information together into a single *enterprise database* and generally provide the associated tools for strategic analysis and decision support.

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In addition to assisting in the planning phase, the IS can be used to follow up by reporting certain *performance indicators* that illustrate the status of processes and critical success factors. For example, the number of franchises along with the level of sales and number of customer complaints for each should indicate the status of an organization's franchise network. Other performance indicators might be the number of new products, the cost to manufacture the products, and their selling price. If the *enterprise database* is developed in light of the strategic plan, many of the data for the performance indicators should be readily available.

Strategic Uses of Information Technology

CONTROLS

E-BUSINESS

In addition to an organizational strategic planning process, there must be a strategic planning process for the information systems function (discussed in Chapter 8). That process must be coordinated with the organization's strategic planning process to ensure that the *organization's* strategic plan is supported and that information technology is used to the best advantage of the organization. For example, during the strategic planning process, organizations should seek to achieve strategic advantage over their competitors by utilizing available information technology. This is particularly observable as companies ponder how to deal with the rapidly evolving world of e-Business. If the organization regards its information system as useful only for supporting operations-level processes, however, it will soon find itself at a competitive disadvantage.

As you study AIS, reflect on the implications that the strategic use of information technology will have on the organization structure and process of the AIS. Also, consider the impact that the strategic application of information technology will have on your career as a user and developer of information technology.

Strategic Planning and the Financial Specialist

Let's review what we have learned in the last three sections. Superior strategic planning efforts can enhance the long-term success of an organization. Successful strategic use of information technology is another determinant of an organization's success.

Before concluding our coverage of strategic planning, let's discuss the important relationship that exists between the financial manager and the strategic planning process of the organization and the information system. First, the financial manager should participate in the planning process. One function of the financial manager in this process is to analyze the financial structure of the organization and its competitors to determine relative strengths and weaknesses. For example, information about the mix of fixed and variable costs and the proportion of short- and long-term debt to total equity may indicate relative advantages of one firm over another. Also, the financial specialist could assist in the design of the reporting system established to monitor achievement of planning goals. For example, the financial specialist could establish some of the financial *performance indicators.*

Second, the financial manager should approve the output of the planning process—the organizational strategic plan and the information systems strategic plan. A financial manager is in a unique position to sign off on the plans' feasibility and financial viability (discussed in greater detail in Chapter 8).

Finally, the planning process will have a significant impact on the information system. Recall the elements of the study of AIS introduced in Figure 1.1 (page 10) and note that the information systems strategic planning process must address many of those elements. For example, the organizational planning process should explore plans for new business operations, and the information systems strategic planning process should address the

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technology requirements for those new operations. Any changes in operations or technology mean changes in events processing, control, and so on. To illustrate, suppose that a department store chain is planning to install new point-of-sale (POS) equipment in its retail outlets. The information systems strategic plans must include strategies for the interface of the new POS technology with the existing information systems structure.

Be prepared to participate in the strategic planning process. A financial specialist conversant in the organizational and information systems strategic planning will have an advantage in management and operation of the AIS. A financial specialist knowledgeable in the elements of the AIS will be better able to participate in strategic planning efforts in the organization.

THE ACCOUNTANT'S ROLE IN THE CURRENT BUSINESS ENVIRONMENT

Let's return to a discussion of the accountant as an information management and business measurement specialist that we began in the Preface and examine the accountant's role in and for the modern business and the AIS. Regarding the AIS, the accountant can assume three roles: designer, user, and auditor.

As a *designer* of an AIS, the accountant brings a knowledge of accounting principles, auditing principles, information systems techniques, and systems development methods. In designing the AIS, the accountant might answer such questions as:

- What will be recorded (i.e., what is a recordable business event)?
- How will the event be recorded (i.e., what data elements will be captured and where will they be stored? For example, what ledger accounts will be used)?
- When will the event be recorded (i.e., before or after occurrence)?
- What controls will be necessary to provide valid, accurate, and complete records; to protect assets; and to ensure that the AIS can be audited?
- What reports will be produced, and when will they be produced?
- How much detail will the reports include?

In short, the accountant often participates in designing and implementing the AIS. Bookkeepers, clerks, and computers operate the AIS.

Accountants perform a number of functions within organizations, including those of controller, treasurer, tax specialist, financial analyst, cost accountant, general accountant, and information systems and budgeting specialist. In all cases, the accountant *uses* the AIS to perform his or her functions. The accountant's effectiveness depends on how well he or she knows the AIS and the technology used to implement it. For instance, to be able to analyze financial information (e.g., to function as a financial analyst or managerial accountant), an accountant must know what data are stored in the AIS, how to access those data, what analysis tools exist and how to use them, and how to present the information using available report-writing facilities.

As a *user*, the accountant may also be called on to participate in the AIS design process. In fact, an information system user should insist on being involved to make sure that a new system contains required features. To be effective in the design process, the user must know how systems are developed, the techniques used to develop a system, and the technology that will be used in a new system.

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As internal and external auditors, accountants *audit* the AIS or provide the assurance *services* mentioned earlier in this chapter. Auditors are interested in the reliability of the accounting data and of the reports produced by the system. They may test the system's controls, assess the system's efficiency and effectiveness, and participate in the system design process. To be effective, the auditor must possess knowledge of systems development techniques, of controls, of the technology used in the information systems, and of the design and operation of the AIS.

SUMMARY

In February 2003, the International Federation of Accountants (IFAC) published a revised version of Education Guideline 11, Information Technology for Professional Accountants,[20] "to assist member bodies to prepare professional accountants to work in the information technology environment" (page 1). In 1996, one of those member bodies of IFAC, the American Institute of Certified Public Accountants (AICPA), published its own report in response to a previous version of Guideline 11, *Information Technology Competencies in the Accounting Profession: AICPA Implementation Strategies for IFAC International Education Guideline No. 11*,[21] to encourage implementation of the guideline in the United States. Several passages in the AICPA report serve to emphasize the importance of the AIS course in your studies, as well as validate the approach that we take in presenting the AIS material to you.

Regarding the importance of information technology to an accounting career, the AICPA concludes, ". . . professional accounting has merged and developed with IT to such an extent that one can hardly conceive of accounting independent from IT" (page 5). The AICPA goes on to describe three important challenges currently facing the accounting profession. Information technologies are (1) affecting the way in which organizations operate, (2) changing the nature and economies of accounting activity, and (3) changing the competitive environment in which accountants operate (page 6).

In discussing the teaching of technology concepts, the AICPA report reads ". . . it is important to emphasize the need for strategic, conceptual understanding of information technology as a resource to enable achievement of business objectives. A *strategic, conceptual understanding* of information technology focuses on the functions of each information component, the objectives of technology achievements for each information technology component, the potential business impact of new technology. . . . understanding the concepts behind the technology helps students to learn to use, evaluate, and control technology more effectively. . . . encourages students and professionals to concentrate on applying and using technology to achieve business purposes" (page 7).

It is our hope that when you have completed your journey through AIS with us that you will confirm that we have followed that philosophy in this text. Further, it is our firm belief that years from now you will conclude that the knowledge and skills developed in the AIS course will have been central to your career success.

[20] International Education Guideline 11: Information Technologies for Professional Accountants, International Federation of Accountants (IFAC), February 2003. See http://www.ifac.org.

[21] The material in the remainder of this section is taken from *Information Technology Competencies in the Accounting Profession: AICPA Implementation Strategies for IFAC International Education Guideline No. 11* (New York: AICPA, 1996). Page numbers in parentheses in this section refer to that report.

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REVIEW QUESTIONS

RQ 1-1 Describe this textbook's three themes.

RQ 1-2 What 10 elements are included in the study of AIS?

RQ 1-3 A system must have organization, interrelationships, integration, and central objectives. Why must each of these four components be present in a system?

RQ 1-4 Are the terms *system* and *subsystem* synonymous? Explain your answer.

RQ 1-5 What is the relationship between an AIS and an IS?

RQ 1-6 Compare the elements of a manual accounting cycle and an automated accounting cycle.

RQ 1-7 What are three logical components of a business process? Define the functions of each. How do the components interact with one another?

RQ 1-8 Why is the information system important to the organization?

RQ 1-9 What are the two major functions of an information system?

RQ 1-10 What factors distinguish *data* from *information*?

RQ 1-11 What are the qualities of information presented in this chapter? Explain each quality in your own words and give an example of each.

RQ 1-12 What are the three steps in decision making?

RQ 1-13 Refer to Figure 1.9 (page 28). Characterize the horizontal information flows and the vertical information flows.

RQ 1-14 What factors distinguish the types of information required by strategic managers, by tactical managers, and by operational managers?

RQ 1-15 In your own words, explain *structure* as it relates to decisions.

RQ 1-16 Why do we coordinate the organizational and the information systems strategic plans?

RQ 1-17 What three roles can an accountant fill in relation to the AIS? Describe them.

DISCUSSION QUESTIONS

DQ 1-1 "I don't want to learn about technology; I just want to be a good accountant." Comment.

DQ 1-2 Examine Figure 1.1 (page 10). Based on your college education to date, with which elements are you most comfortable? With which are you least comfortable? Discuss your answers.

DQ 1-3 Examine Figure 1.1 (page 10). Based on any practical experience that you have had, with which elements are you most comfortable? With which are you least comfortable? Discuss your answers.

DQ 1-4 Why might we have more trouble assessing the success of a federal government entitlement program than we would have judging the success of a business organization?

DQ 1-5 Why must we have knowledge of a system's objectives to study that system?

DQ 1-6 Do you think your accounting education is preparing you effectively to practice accounting? Why or why not? Discuss, from both a short-term (i.e.,

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immediately on graduation) and a long-term (i.e., 5 to 10 years after beginning your career) standpoint.

DQ 1-7 Examine Figure 1.9 (page 28). Discuss the relative importance of horizontal information flows and vertical information flows to the accountant.

DQ 1-8 "When we computerize an AIS, we merely change how the data are processed; we don't change what tasks are performed." Do you agree? Give examples to support your position.

DQ 1-9 Give several examples not mentioned in the chapter of potential conflicts between pairs of information qualities.

DQ 1-10 Regarding financial reporting, which quality of information do you think should be superior to all other qualities? Discuss your answer.

DQ 1-11 What information quality is most important—relevance or reliability? Discuss your answer.

DQ 1-12 Describe a few structured decisions and a few unstructured decisions. Discuss the relative amount of structure in each decision.

DQ 1-13 "To be of any value, a modern information system must assist all levels of management." Discuss.

DQ 1-14 "We don't need an information system strategic planning process. We can just respond to user requests for information system applications." Discuss.

DQ 1-15 Describe some factors critical to your success in college (i.e., your college *critical success factors*).

PROBLEMS

P 1-1 In his first address as Chairman of the Board of the American Institute of Certified Public Accountants (AICPA), Robert K. Elliott said:

> "Knowledge leveraging will shape a wide range of CPA services. CPAs will be able to identify relevant information and its sources, perform modeling, devise and apply performance measures of all kinds, design systems to obtain needed information, advise on controls and security and otherwise ensure relevance and reliability. CPAs will identify and deploy knowledge needed for strategic planning and investments, for marketing decisions, for monitoring internal and external conditions, for conducting daily operations, for maximizing the productivity of employee behavior and for measuring the effectiveness of operations, personnel and processes. All this and more."[22]

Write a paper (your professor will tell you how long the paper should be) to discuss ways in which this chapter agrees with this quote. Discuss any disagreements. Do you think that the CPA should be performing these services? Why or why not?

P 1-2 Conduct research on the expansion of the role of the accountant into areas such as non-financial information, assurance services, and similar functions. Write a paper (your professor will tell you how long the paper should be) to discuss the pluses and minuses of this expansion.

[22] Robert K. Elliott, "Who Are We As a Profession—and What Must We Become?" *Journal of Accountancy* (February 2000): 84.

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P 1-3 Conduct research on the implementation of Section 404 of the Sarbanes-Oxley Act of 2002. Write a paper (your professor will tell you how long the paper should be) to discuss how accountants within an organization are involved in helping their organizations comply with this section. Describe also how accountants in public accounting and consulting are affected by this section of the SOA.

P 1-4 Assume that a manager can obtain information from the organization's database in three ways: by direct inquiry using a computer, by a daily printout, and by a monthly report. Using the qualities of information discussed in this chapter (*understandability*, *relevance*, *timeliness*, *predictive value/feedback value*, *neutrality/freedom from bias*, *comparability*, *consistency*, *validity*, *accuracy*, and *completeness*), compare and contrast these three sources of information.

KEY TERMS

system
subsystem
information system (IS)
management information system (MIS)
accounting information system (AIS)
input data
business event data
master data update
master data
information processing
data maintenance
standing data
operations process
management process
information
data
understandability
relevance
timeliness
predictive value
feedback value
verifiability
neutrality
freedom from bias
comparability
consistent
validity
accuracy
completeness
decision making
structured decisions
unstructured decision
enterprise database
strategic planning
objective
goal
critical success factors (CSFs)
plan
strategy
effectiveness
efficiency
confidentiality
integrity
availability
compliance
reliability of information