Accounting Information Systems

2ⁿᵈ Edition

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Accounting Information Systems

Second Edition

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His research interests include use of financial and nonfinancial measures to assess organizational performance; accounting information systems, enterprise systems, business processes, and business value; design science; and systems dynamics and business process simulation.

Preface

Whether accountants work in public accounting or in industry, they use a variety of technology tools. The International Federation of Accountants (IFAC) describes four roles for accountants with respect to information technology: **(1) *users* of technology and information systems, (2) *managers* of users of technology and related information systems, (3) *designers* of information systems, and (4) *evaluators* of information systems.** As users, managers, designers, and evaluators of technology and technology-driven business processes, accountants must understand the organization and how organizational processes generate information important to management. To ensure that processes and systems are documented—and to participate in improvements to processes and systems—accountants must be business analysts.

This textbook aims to provide students with a variety of technology and business analysis concepts and skills. It is intended for use in the first Accounting Information Systems course at both the undergraduate and graduate levels. Ongoing changes in business technology—such as the move to Internet-based systems, Big Data and data analytics, software as a service, and mobile access to enterprise information, as well as increased security and control requirements—make technological skills more important than ever for accounting graduates. This textbook also aims to show how current changes in accounting and technology affect each of these roles. For example, the Sarbanes-Oxley Act affects financial reporting system controls, and XBRL changes system requirements and affects how companies develop and report financial information. We also consider the role of Big Data and data analytics and how they are used in financial accounting, managerial accounting, and auditing. Additionally, we consider both the COBIT and COSO frameworks to describe how organizations deal with risk management. In their roles as managers, designers, and evaluators, accountants must know how those frameworks affect their accounting and related information systems.

The core competencies of the American Institute of Certified Public Accountants (AICPA) emphasize accounting skills over content. This textbook emphasizes examples, problems, and projects through which students can develop the technological skills they need for their accounting careers. It uses real-world companies such as Starbucks, Walmart, Google, and Amazon that students can relate to. It takes a broad view of accounting information systems that emphasizes the accountants' roles in the use, management, design, and evaluation of the systems and the management information that they produce. To assist accounting students in experiencing the benefit of learning information technology/information services (IT/IS) concepts and using IT/IS skills in accounting, we focus on business processes, business requirements, how information technology supports those requirements, and how accountants contribute. In particular, this textbook helps students learn to:

- **Design business processes and represent them with standard documentation tools.** The role of the accounting function has evolved from stewardship and reporting to full partnership, supporting management decisions throughout the organization. As business analysts, accountants must be able to document business processes, identify potential improvements, and design and implement new business processes. Thus, this textbook helps develop business process modeling skills.
- **Design and implement well-structured databases to enable business processes.** Accountants must also understand how business processes generate data and how such data are structured, interrelated, and stored in a database system. To ensure that business processes and the database systems are documented and to participate

in improvements to processes and systems, accountants must understand and be able to model such systems. Thus, this textbook helps develop data modeling and database implementation skills.

- **Query databases to provide insights about the performance of business operations.** Most organizational information resides in databases. To support management decisions throughout the organization, accountants must understand how those data are structured and how to retrieve information to support business management decisions. Thus, this textbook develops skills on the use of Microsoft Access and databases in general. This textbook also develops data analytics tools through the use of Microsoft Excel and Tableau.
- **Evaluate internal control systems and apply business rules to implement controls and mitigate information systems risks.** Recent federal legislation—for example, the Sarbanes-Oxley Act of 2002 and COSO and COBIT guidance—emphasizes the importance of risk mitigation in modern organizations. Internal control systems must constantly evolve to meet a changing risk environment. Accountants are often the internal control experts and must, therefore, understand how internal controls should be implemented in business processes as part of the organization's overall risk mitigation and governance framework. Thus, this textbook presents specific material on internal control and accounting information systems, as well as general information about computer fraud and security. It also describes how to monitor and audit accounting information systems.

AIS 2e Content Updates

General Updates for the 2nd Edition
- Added additional End-of-Chapter Multiple Choice Questions and Problems throughout the text.
- Significantly revised many End-of-Chapter Problems for availability and auto-grading within Connect.
- Revised and added many new Discussion Questions in most chapters.

Chapter by Chapter Updates
Specific chapter changes for *Accounting Information Systems,* 2nd Edition, are as follows:

Chapter 1
- Updated the opening vignette, highlighting the use of **Starbucks** Clover coffee machines.
- Updated real-world references.
- Edited and updated the Progress Check questions.

Chapter 2
- Increased introductory coverage of BPMN.
- Added discussion of flow object types, including gateway and event types.
- Introduced repeating activities.
- Added introduction to data objects, data stores, and associations.

Chapter 3
- Updated discussion of how the multiplicities for associations indicate where foreign keys are posted in relational tables.
- Added discussion of business rules, decision requirements, and decision tables.

Chapter 4
- Updated the section on Using Microsoft Access to Implement a Relational Database. Figures 4.6 through 4.17 were updated using Microsoft Access 2013.
- Updated Appendix A. Figures 4.A1 through 4.A9 were updated using Microsoft Access 2013.

Chapter 5
- Added additional figures related to sales activity models.
- Updated the Chapter 5 Comprehensive Exercise.

Chapter 6
- Updated the Chapter 6 Comprehensive Exercise.

Chapter 7
- Updated BPMN diagrams to include revisions to Chapter 2.

Chapter 8

- Substantially modified the chapter to describe to students how to approach an integrated project.
- Created two new integrated projects with multiple versions to accommodate various class schedules and to allow instructors to rotate projects.
- The first of the two integrated projects is a more challenging project that includes issues related to managing inventory levels and internal inventory transfers. Other topics covered include multiple sales types, including Internet, wholesale, and retail sales, where customers can pay by cash, check, or credit card.
- The second of the two integrated projects is shorter and less challenging and focuses on wholesale sales from multiple distribution centers.

Chapter 9

- This is an all-new chapter emphasizing data analytics.
- Illustrated how data analytics is used to help **Starbucks** pick its store locations.
- Inserted an all-new explanation of how data analytics is used in business and accounting.
- Added an explanation and example of how Audit Data Standards provided by the AICPA are used to facilitate data analytics between a company's financial staff and the external auditors.
- Explained how the DATA Act recently passed by Congress gives firms specific responsibilities to protect privacy and the breach of individual identifying information.
- Illustrated data analytics and data analytics techniques in both Excel and Tableau.

Chapter 10

- Updated the opening vignette, highlighting Kevin Johnson, who has substantial technology leadership as **Starbucks**'s new president and chief operating officer.
- Added an all-new example and inserted an additional figure illustrating a digital marketing dashboard.
- Updated real-world references, particularly of examples of business intelligence.
- Edited and updated Progress Check questions.

Chapter 11

- Updated COSO Internal Control Framework to COSO 2013 by updating the five components and adding the 17 relevant principles of internal controls.
- Added Figure 11.2 to summarize COSO 2013 control components and principles.

Chapter 12

- Updated the opening vignette.
- Revised the contents of computer fraud and abuse as well as vulnerability assessment and management.
- Edited and updated the Progress Check questions.

Chapter 13

- Updated the opening vignette.

Chapter 14

- Added discussion of the IT Governance Institute Val IT Framework.

Chapter 15

- Added an all-new opening vignette, highlighting Gerri Martin-Flickinger as the **Starbucks** chief technology officer.
- Edited and updated Progress Check questions.

Chapter 16

- Updated the opening vignette highlighting technology used at **Walmart**.
- Updated Figure 16.2 with recent information technology project outcomes.

Main Features

Accounting Information Systems, 2nd Edition, focuses on the accountant's role as business analyst in solving business problems by database modeling, database design, and business process modeling.

Chapter Maps

Chapter Maps provide a handy guide at the start of every chapter. These remind students what they have learned in previous chapters, what they can expect to learn in the current chapter, and how the topics will build on each other in chapters to come. This allows them to stay more focused and organized along the way.

A look at this chapter

A look back

A look ahead

Chapter-Opening Vignettes

Do your students sometimes wonder how the course connects with their future? Each chapter opens with a vignette, which sets the stage for the rest of the chapter and encourages students to think of concepts in a business context.

Chapter **Two**

Accountants as Business Analysts

A look at this chapter

As users, managers, designers, and evaluators of technology and technology-driven business processes, accountants must understand the organization and how organizational processes generate information important to management. To ensure that processes and systems are documented—and to participate in improvements to processes and systems—accountants must also be business analysts. This chapter defines business process modeling and describes how it supports the roles of accountants. It explains the potential value of business process modeling. Finally, it describes the types of business process models and introduces basic modeling tools to guide the student's development of modeling skills.

A look back

Chapter 1 discussed the importance of accounting information systems and the role accountants play in those systems. It further described how investments in information technology might improve the ability to manage business processes and create value for the firm.

A look ahead

Chapter 3 introduces data modeling. It describes how data modeling supports the design, implementation, and operation of database systems. It introduces basic modeling tools that will be used throughout the rest of the text.

© AFP/Getty Images

One recent morning, I stopped at a very busy **Starbucks** in San Francisco. I looked at the line coming out of the door and immediately thought that it would take at least 20 minutes to get my morning coffee. Instead, I was pleasantly surprised at the efficiency of the employees who got me through that line in less than 2 minutes.

I watched closely as the Starbucks partners behind the counter executed the workflow of the process. One partner took my order and relayed my pastry order to another partner behind the pastry case. He also relayed my coffee order to the barista at the other end of the counter. As I moved through the line to the register, my order arrived just as I did, and a fourth partner

Chapter Outline

Each chapter opens with an Outline that provides direction to the students about the topics they can expect to learn throughout the chapter.

Learning Objectives

Learning Objectives are featured at the beginning of each chapter. The objectives provide students with an overview of the concepts they should understand after reading the chapter. These Learning Objectives are repeated in the margin of the text where they apply.

checked the order and took my payment. Within those 2 minutes, they had served at least a dozen other customers, too.

I thought about the number of options they had to deal with, the variety of hot and cold drinks, the pastries and other breakfast items, while also keeping a supply of freshly brewed coffee ready. I was sure that Starbucks had analyzed the process in detail to eliminate waste and enhance their partners' productivity. Then, they had to train all their partners in that process so they could work as one highly synchronized team. Finally, they delivered a hot cup of coffee to a grateful customer on a cool San Francisco morning.

Chapter Outline

Changing Roles of Accountants in Business
Business Process Documentation
Definitions
Purposes of Process Documentation
Value of Business Models
Types of Business Models
Activity Models
Business Process Modeling Notation
Building Blocks for BPMN Diagrams
Example of a Business Process Diagram
Identifying Participants in Business Process Diagrams
Messages in BPMN
Extended Building Blocks for BPMN Diagrams and Modeling Concepts
Subprocesses and Repeating Activities
Data Objects, Datastores, and Associations
Best Practices in Preparing BPMN Diagrams
Appendix A: Flowcharting
Appendix B: Data Flow Diagrams

Learning Objectives

After reading this chapter, you should be able to:

2-1 Describe the roles of the accounting/finance function in business and why those roles require knowledge of technology and business processes.

2-2 Understand the importance of business process documentation.

2-3 Recognize the value of business models.

2-4 Articulate the characteristics of activity models.

2-5 Understand and apply the building blocks for BPMN (activity) diagrams.

2-6 Use pools and lanes to identify process participants.

2-7 Apply message flows to show interactions between pools.

2-8 Understand and apply flow object types.

2-9 Recognize and model repeating activities.

2-10 Understand and apply data objects and datastores to model data created, updated, transferred, and deleted in a process.

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Integrated Project

Projects can generate classroom discussion, foster good teamwork, and prepare students for their accounting careers. Chapter 8 provides guidance to students on how to approach a systems project; related material provides information and data for the projects. There are now two different projects, so instructors can select the project level of difficulty to match the time available or the sophistication of their students. Both integrated projects require students to apply the different techniques they have learned in Chapters 5, 6, and 7 to a realistic situation. One project focuses on inventory management in a small business with multiple retail stores and a central warehouse. The second project also involves a small wholesale distribution business with multiple stores but without inventory management complications. Students use Microsoft Access to implement their data models and prepare financial reports in both projects.

LO 8-5
Employ the relational database to answer a variety of business performance questions

Prepare Queries

After importing all the data and setting the relationships to match the UML class diagram, you are ready to prepare queries for the financial statements and any other operational performance information. Each deliverable may require multiple queries. For example, to determine sales revenue for the quarter, you would first extend the SALES ITEMS table information to determine the amount for each item sold on each sale, as shown in Figure 8.11.

Then, using the query shown in Figure 8.11 and the SALES table, calculate the amount of each sale within the fiscal period, in this case the first calendar quarter, as shown in Figure 8.12. Set the criteria to constrain transactions to the first quarter. Sum the amount field, calculated as shown in Figure 8.11. Then, the summed amount from this query can be used to calculate overall sales revenue for the quarter in a subsequent query.

FIGURE 8.10
Setting Relationship between SALES and SALES ITEMS Tables

© Microsoft Excel
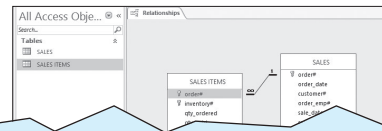
> **"I like comprehensive problems that extend across multiple chapters so students can see how different components of a problem fit together."**
>
> —*Janice Benson, University of Wyoming*

Data Analytics

Due to its importance and popularity, we have added an all-new chapter on data analytics (Chapter 9). That chapter introduces the importance and impact of data analytics in the business world and specifically on the accounting profession. Data analytics holds great value to these businesses, whether the data reveal certain patterns in their marketing or advertising, provide insight into seasonal trends, or offer anything else that could be relevant to the businesses' success. However, the value of data analytics is really only as valuable as the insight it provides. We highlight the importance of data analytics in accounting, especially in auditing. The chapter also introduces several data analytics techniques in Excel and Tableau.

LO 9-7
Use Excel spreadsheet tables for data analytics

DATA ANALYTICS TOOLS

Using Excel for Data Analytics

This section provides an introduction to the use of Excel to perform data analytics. The example employs freely available U.S. Census data,[23] and it shows state and county population and changes in population due to births and deaths over the period from 2010 to 2015. This particular example uses only state population data as shown in Figure 9.2. Note that the data start in the first row of the worksheet, and any blank rows or blank columns are deleted. Thus, the data extend from cell A1 to cell AD52 with variable names in the first row. The region numbers indicate areas of the country, such as Northeast or South. The division numbers represent further subdivisions of the regions, such as New England or South Atlantic. We describe tab, section, and item selection as X > Y > Z, where X represents the Excel tab, Y is the section of the ribbon bar, and Z is the specific icon on the ribbon bar.

The first step is to convert the raw data to a **table in Excel.** Click on any cell within the data. Select INSERT > Table > Table, as shown in Figure 9.3. A Create Table popup will appear to specify where the data for the table are and whether the table has headers. If there are no blank rows or columns in the data, Excel will correctly identify the extent of the data for the table. Check the box to specify that the table has headers, as shown in Figure 9.4.

Progress Checks

These self-test questions and problems in the body of the chapter enable the student to determine whether he or she has understood the preceding material and to reinforce that understanding before reading further. Detailed solutions to these questions are found at the end of each chapter.

"I really like the Progress Check box. It is a great tool for students' self assessment."

—Chih-Chen Lee, Northern Illinois University

Data Modeling and Microsoft Access

Chapter 3 describes how data modeling supports the design, implementation, and operation of database systems. Basic modeling tools are used throughout the rest of the text.

"This textbook would be good when using the database approach. It provides the information needed to develop and use a database without getting into the details of transaction processing (activities, documents, and internal control)."

—Janice Benson, University of Wyoming

Connect Accounting for *Accounting Information Systems*

The 2nd Edition of *Accounting Information Systems* has a full Connect package, with the following features available for instructors and students.

- **SmartBook®** is the market-leading adaptive study resource that is proven to strengthen memory recall, increase retention, and boost grades. SmartBook, which is powered by LearnSmart, is the first and only adaptive reading experience designed to change the way students read and learn. It creates a personalized reading experience by highlighting the most impactful concepts a student needs to learn at that moment in time. As a student engages with SmartBook, the reading experience continuously adapts by highlighting content based on what the student has mastered or is ready to learn. This ensures that the focus is on the content he or she needs to learn, while simultaneously promoting long-term retention of material. Both students and instructors can use SmartBook's real-time reports to quickly identify the concepts that require more attention from individual students—or the entire class. The end result? Students are more engaged with course content, can better prioritize their time, and come to class ready to participate.

- **Online Assignments.** New to Connect for *Accounting Information Systems,* 2nd Edition, is the addition of all End-of-Chapter Multiple Choice questions as assignable. Additionally, applicable End-of-Chapter Problems from each chapter have been added to Connect in an auto-gradable format. Connect helps students learn more efficiently by providing feedback and practice material when and where they need it. Connect grades homework automatically, and students benefit from the immediate feedback that they receive, particularly on any questions they may have missed.

Example of End-of-Chapter Problem

Required:
Using the Cash table below, show the output for the following SQL query: (Using the dropdowns, identify which rows and columns would included in the SQL query output shown below. Select "Not included" for rows and columns that would not be included in the output.)

SELECT Account#, Balance
FROM Cash
WHERE Balance < 50000;

Cash	Included
	Account #	Type	Bank	Balance
	BA-6	Checking	Boston 5	253
	BA-7	Checking	Shawmut	48,000
	BA-8	Draft	Shawmut	75,000
	BA-9	Checking	Boston5	950

- **Comprehensive Exercises and Integrated Project.** The setup information for the Comprehensive Exercises for Chapters 5 and 6 and the Integrated Project in Chapter 8 have been added to Connect, along with the ability for students to upload their submission files for their instructors to grade. Narrated videos explaining the background, setup, and goals of the Exercises and Project have also been provided.
- **Multiple Choice Quizzes.** The Multiple Choice Quizzes from the Online Learning Center have been revised and can now be assigned to students through Connect for grading.
- **Test Bank.** The Test Bank for each chapter has been updated and significantly expanded for the 2nd Edition to stay current with new and revised chapter material, with all questions available for assignment through Connect. Instructors can also create tests and quizzes from the Test Bank through our TestGen software.
- The Instructor and Student Resources have been updated for the 2nd edition and are available in the Connect Instructor Resources page. Available resources include Instructor Resource and Solutions Manuals, Comprehensive Exercise and Integrated Project setup and solutions files, PowerPoint presentations, Test Bank files, and other ancillary materials. All applicable Student Resources will be available in a convenient file that can be distributed to students for classes either directly, through Connect, or via courseware.

Example of Test Bank Question in Connect

Which of the following is <u>not</u> a best practice in preparing Unified Modeling Language (UML) Class diagrams?

○ Opt for simplicity.

○ Model each process separately.

○ Avoid crossing lines whenever possible.

○ Avoid confusing abbreviations.

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C	22.9%		18.7%
D	11.5%		6.1%
F	15.4%		9.9%

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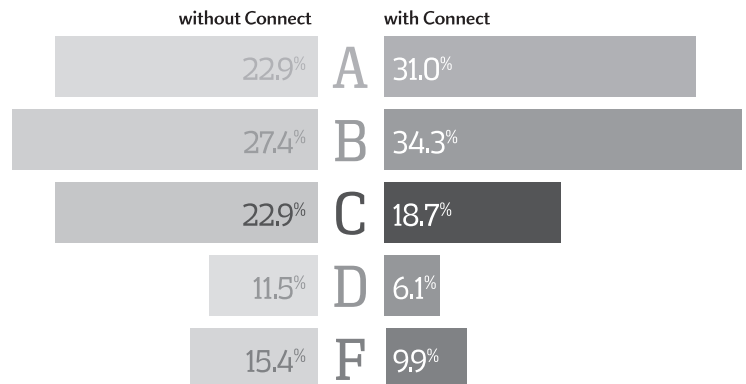
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Acknowledgments

Throughout the development of this book, we were privileged to have the candid and valuable advice of our contributors, reviewers, and survey and focus group participants. These reviewers instructors provided us with priceless suggestions, feedback, and constructive criticism. The depth and sincerity of their reviews indicate that they are a devoted group of teacher-scholars. The content of the book over various versions and editions was greatly enhanced because of their efforts.

Dedications

To Joe and Mossi White, for being wonderful second parents.

—Vern Richardson

To my students and my family who have inspired and supported me.

—Janie Chang

To my wife, Gayla.

—Rod Smith

Brief Contents

Contents

Chapter **One**

Accounting Information Systems and Firm Value

A look at this chapter

Information plays a crucial role in today's information age. In this chapter, we discuss the importance of accounting information systems and the role accountants play in those systems. Firms invest in accounting information systems to create business value. In this chapter, we also describe investments in information systems to manage internal and external business processes and how they create value for the firm.

A look ahead

Chapter 2 examines the role of accountants as business analysts. The chapter defines business process modeling and describes how it supports the business analyst role of accountants. It explains the potential value of business process modeling and introduces basic modeling tools to guide the accountant's development of modeling skills.
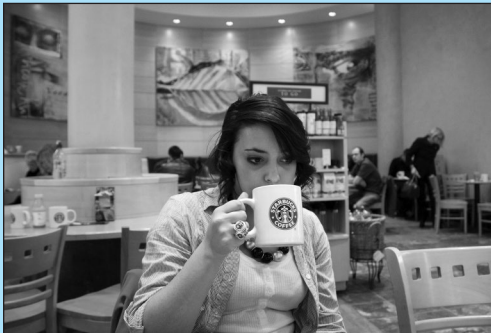
© Kumar Sriskandan/Alamy

Walking in to **Starbucks** and ordering a latte, you notice the atmosphere and the quality and variety of its coffees and related offerings. What you may not immediately notice is the accounting information system that supports the recordkeeping, replenishment, financing, etc. To be sure, Starbucks has invested immense resources into planning, designing, and developing a number of accounting information systems to track information needed to run an effective business and to report to its shareholders and regulators (e.g., Internal Revenue Service and Securities and Exchange Commission) on its performance. This accounting information system tracks information as diverse as the number of hours worked each day by each of its 191,000 employees throughout the world to the amount of sales taxes to be paid and remitted to local and national tax authorities at its 22,000 stores in 66 countries.

In addition, through its Clover coffee machines (which track customer preferences through the cloud and also track the expiration dates of milk), Starbucks is always collecting information and making it accessible from headquarters. Many increasingly view Starbucks as a technology company. This chapter focuses on the role accounting information systems play in creating value for a firm such as Starbucks.

Source: *Forbes* Profile, 2015; *Computerworld,* 2014.

Chapter Outline

Learning Objectives

After reading this chapter, you should be
able to:

1-1 Define an accounting information
system, and explain characteristics of
useful information.

1-2 Distinguish among data, information,
and an information system.

1-3 Distinguish the roles of accountants
in providing information, and explain
certifications related to accounting
information systems.

1-4 Describe how business processes
affect the firm's value chain.

1-5 Explain how AIS affects firm value.

1-6 Describe how AIS assists the firm's
internal business processes.

1-7 Assess how AIS facilitates the firm's
external business processes.

1-8 Assess the impact of AIS on firm
profitability and stock prices.

INTRODUCTION

Information on business facts, numbers, and other useful indicators for business purposes is all around us. Most firms consider information to be a strategic asset and will use it to develop a competitive advantage to run their business better than their competitors. **Starbucks**, for example, uses information about its customers, suppliers, and competitors to predict how much coffee it will sell and how much coffee it will need to purchase. If the company predicts more customers than it actually has, it will have excess coffee and may incur extra carrying costs of its inventory. If Starbucks underestimates the demand for its products, the store could potentially run out of coffee and miss out on profitable sales. Information is a strategic asset if the firm knows what information it needs, develops systems to collect that information, and uses that information to make critical decisions that will affect performance.

LO 1-1

Define an accounting information system, and explain characteristics of useful information.

ACCOUNTANTS AS BUSINESS ANALYSTS

Firms have access to a tremendous amount of data—for instance, transactional data produced from point-of-sale terminals or bank deposits, consumer behavior data, operational statistics generated throughout a supply chain, and more—that can contain valuable insights to enable decision making. With such data, firms can more easily benchmark activity and compare and contrast results. In that way, firms can determine the most effective way to allocate resources such as talent, capital, and expense dollars (e.g., marketing).[1]

At the same time, however, surveys suggest that 28 percent of senior financial executives say they have little or no information to predict the performance of their firms. Another 54 percent said they had only half the information needed to provide visibility into performance.[2]

Therefore, even with information all around us, it often lacks the needed relevance, clarity, and accuracy. To be sure, as you've learned in your classes to date, accountants keep financial records, prepare financial reports, and perform audits. Because the role of the accountant is to access and attest to the quality of information, accountants may increasingly be considered to be in the best position to serve as a business analyst in looking at the organization as a whole and discussing how best to optimize the overall performance.

Specific questions accountants might be able to address include such business opportunities as whether to outsource a business function to India, promote one electronics product over another based on which will sell best or be most profitable, or structure a warehouse lease in such a way as to minimize current or future taxes.

To address such critical, but diverse, business opportunities, accountants need to decide what information is required, then build an information system to access the necessary information, and finally analyze that information to offer helpful advice to management as input for their decisions.[3]

DEFINITION OF ACCOUNTING INFORMATION SYSTEMS

Of the many information systems that might be used in a firm, one type of information system is used in every firm: an **accounting information system (AIS)**. An AIS is defined as a system that records, processes, summarizes, and reports on business transactions to provide financial and nonfinancial information to facilitate decision making. In addition, an AIS is designed to ensure appropriate levels of internal controls (security measures to

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[1]B. McCarthy, "A Manual for the Data-Driven Finance Chief," CFO.com (November 6, 2015).
[2]J. Hagel, "Why Accountants Should Own Big Data," *Journal of Accountancy* (November 2013.)
[3]F. Borthick, "Helping Accountants Learn to Get the Information Managers Want: The Role of the Accounting Information Systems Course," *Journal of Information Systems* 10, no. 2 (1996), pp. 75–85.

protect sensitive data) for those transactions. This is the focus of this book. Some might call an AIS just a financial reporting system. Others might include in their AIS a much broader set of data that includes nonfinancial information such as sales and marketing activities or the results of research and development expenditures. Viewed broadly, an AIS collects, processes, and reports information deemed useful in decision making.

The study of AISs lies at the nexus of two traditional disciplines: information systems and accounting. In this book, we will highlight knowledge from both of these disciplines to more fully understand an AIS. While an AIS could take the form of a paper-and-pencil manual bookkeeping system, we will view an AIS in this book as computerized systems.

A Simple Information System

An AIS, just like any system, can be explained using a general systems approach (as in Figure 1.1) with input, storage, processing, and output activities. We cover these activities in subsequent chapters, but the input may come in the form of sales recorded on a **Starbucks** cash register or point-of-sale terminal. Processing those data may take the form of getting the input into storage (such as a database or a data table). Processing might involve querying that database (e.g., using SQL queries) to produce the output in the form of a report for management use. As an example, Starbucks may query its sales database to report how much coffee it sells around Christmas to see if additional sales incentives need to be made to increase sales around Christmas in the future. Whether this report has information that is ultimately useful to management is covered in the next section.

FIGURE 1.1
A Simple Information System
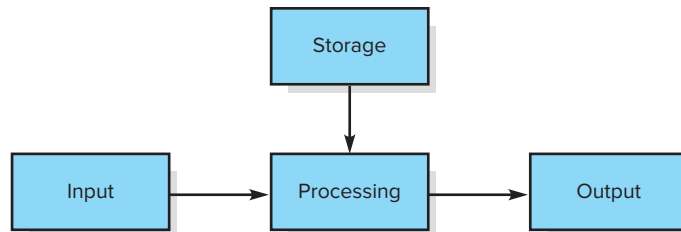
Attributes of Useful Information

To be most useful to decision makers, information from an AIS must be both relevant and reliable and have these attributes:

1. **Relevance**
   a. Predictive value (helps with forecasting the future).
   b. Feedback value (corrects or confirms what had been predicted in the past).
   c. Timeliness (available when needed or in time to have an impact on a decision).
2. **Reliability**

   a. Verifiable (can be confirmed by an independent party).
   b. Representational faithfulness (reports what actually happened).
   c. Neutrality (information is not biased).

Relevance

To be useful, information must be relevant to the decision maker. Information is relevant only if it would affect a business decision. In other words, information is relevant when it helps users predict what will happen in the future (predictive value) or evaluate how past decisions actually worked out (feedback value). It is also relevant if the information is received in time to affect their decisions (timeliness).

Reliability

Information is reliable if users can depend on it to be free from bias and error. Reliable information is verifiable by internal and external parties and faithfully represents the substance of the underlying economic transaction. If **Best Buy** sells a high-definition television for $3,200, it should be recorded and subsequently reported in its sales revenue account as $3,200. Accounting information should not be designed to lead users to accept or reject any specific decision alternative, but rather to offer reliable accounting information that is neutral, or free from bias, to let users make the best decisions.

Sometimes there are trade-offs between information that is relevant and information that is reliable. The best information may be information that only becomes reliable once an audit performed by external auditors is complete. But waiting for an audit to be completed may take so long that it is no longer relevant. The most relevant information may require an estimate of the value of a building, but that estimate might be subject to bias of the building appraiser, which will limit the information's reliability. Management often must make choices and trade off between relevance and reliability of the data.

For certain problems, the best information might include some information that tends to be more reliable (e.g., last period's sales, sales of competitors selling similar products) and other information that tends to be more relevant (estimates, appraisals, predictions gained by running regression models predicting year-ahead sales, etc.) that, in combination, complement each other and give management the necessary information.

AISs exist to provide useful information to decision makers. Considering the attributes of useful information helps AIS designers and users construct a system that delivers useful information.

Data versus Information

Hal Varian, **Google**'s chief economist, explains that while data are widely available, "what is scarce is the ability to extract wisdom from them." In that short statement, we learn that data and the information actually needed to make decisions may well have different definitions. **Data** are simply raw facts that describe the characteristics of an event that, in isolation, have little meaning.

Useful Information or Just Data? On September 12, 2001, Walmart sold 88,000 U.S. flags, compared to only 6,400 that same day a year earlier.

Attributes of a simple sale of a U.S. flag at a **Walmart** store in Tempe, Arizona, may include the time and date of sale, bar code number, price, and quantity purchased. However, to be most useful to Walmart, these data must be processed in a meaningful way to provide information useful to Walmart management. Thus, Walmart management would like the information to potentially address such questions as:

- How many flags does Walmart need on hand to prepare for the July 4th holiday each year?
- What is the right price to charge for flags to maximize Walmart's profits?
- Which size of U.S. flag sells best in Tempe, Arizona; Stamford, Connecticut; or Champaign, Illinois? Does it depend on location?
- Do consumers replace flags, or do they last many years and not really need to be replaced?

Data are considered to be an input, whereas information is considered to be the output.

Information is defined as being data organized in a meaningful way to be useful to the user. Thus, data are often processed (e.g., aggregated, sorted, etc.) and then combined with the appropriate context. Decision makers typically require useful information to make decisions. As another example, while the sales prices of a particular toy might be just considered data, subtracting the cost of goods sold from the sales price to compute the net profit would be considered information if the data help a retailer decide whether to carry that particular toy in its inventory. To the extent that computers can process and organize data in a way that is helpful to the decision maker, it is possible that there may be so much information available to actually cause **information overload**, which we define as the

difficulty a person faces in understanding a problem and making a decision as a consequence of too much information. Therefore, an AIS must be carefully designed to provide the information that is most useful without overwhelming the user.

The overall transformation from a business need and business event (like each individual sale of a U.S. flag) to the collection of data and information to an ultimate decision is called the **information value chain** and is reflected in Figure 1.2. If Walmart needs to know how many flags it should have at each location (i.e., business need), it will collect transactions involving flag sales (i.e., business event). Then it can take those data and turn them into useful information that might be used to make decisions on flag supply levels at each store. Certainly, the transformation from data to information is a key part of that value chain. Information that is useful (i.e., relevant or reliable) may get to the point of being knowledge and, ultimately, may be helpful in forming the basis for a decision.

FIGURE 1.2
Information Value Chain

Source: Statements on Management Accounting, Institute of Management Accountants, 2008.
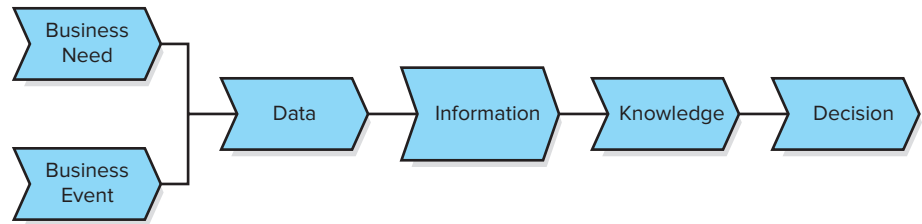
Discretionary versus Mandatory Information

Because you have already taken a few accounting classes, you understand the types of information that are recorded, processed, and subsequently reported for different purposes, including managerial, financial, or tax purposes. Managerial accounting information is generally produced for internal information purposes and would usually be considered to be **discretionary information** because there is no law requiring that it be provided to management. Management simply decides what information it needs to track and builds an information system to track it. For example, management may want an activity-based costing (ABC) system to figure out how overhead costs should be allocated at **Microsoft** to a set of products (like the Microsoft Surface Book as compared to a Microsoft XBox). The value of information equals the difference between the benefits realized from using that information and the costs of producing it. Because discretionary information is not required, management must determine if the benefits of receiving that information are greater than the costs of producing it.

In contrast, much of the financial and tax accounting information is produced for external information purposes such as for investors, banks, financial analysts, bondholders, and the Internal Revenue Service (IRS). This financial and tax accounting information would generally be considered to be **mandatory information**. As mentioned earlier, discretionary information should be produced if the value of the information it provides to management is worth more than the cost to produce it. However, mandatory information is usually produced at the lowest possible cost to comply with the laws of the regulators (e.g., Securities and Exchange Commission, IRS, state banking commission, state tax commission, etc.).

As early as 1989, **Starbucks** installed a costly computer network and hired a specialist in information technology from **McDonald's** Corporation to design a point-of-sale (cash register) system for store managers to use. Every night, stores passed their sales information to the Seattle headquarters, which allowed managers to highlight regional buying trends almost instantly.
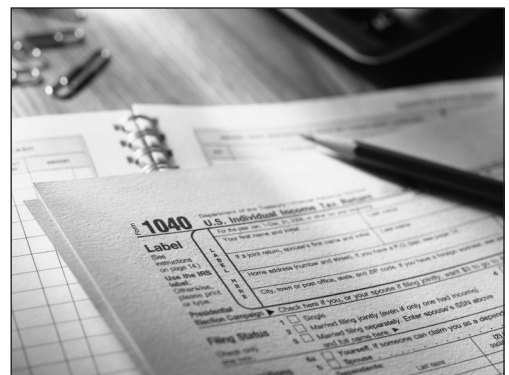
An AIS is used to support the mandatory information required by tax returns.
© Digital Vision/Getty Images RF

Progress Check

1. Propose useful information that is relevant to a college basketball coach. Also propose useful information that is reliable to a college basketball coach.
2. Give an example of data versus information at a **Walmart** store.
3. Provide two types of discretionary information and two types of mandatory information that might come from an accounting information system.

LO 1-3

Distinguish the roles of accountants in providing information, and explain certifications related to accounting information systems.

ROLE OF ACCOUNTANTS IN ACCOUNTING INFORMATION SYSTEMS

In today's age, technology is a key tool in creating information systems for today's businesses. As a result, accounting and information technology are now more closely linked than ever. As information technology (IT) has gained operational and strategic importance in the business world, the role of accountants, understandably, must adjust as well. The International Federation of Accountants (IFAC) notes:

> IT has grown (and will continue to grow) in importance at such a rapid pace and with such far reaching effects that it can no longer be considered a discipline peripheral to accounting. Rather, professional accounting has merged and developed with IT to such an extent that one can hardly conceive of accounting independent from IT.[4]

Indeed, accountants have a role as business analysts and business partners; that is, they gather information to solve business problems or address business opportunities. They determine what information is relevant in solving business problems, create or extract that information, and then analyze the information to solve the problem. An AIS provides a systematic means for accountants to get needed information and solve a problem. Another illustration of the role of accountants in AIS comes from the Institute of Management Accounting. In this definition, note the role of the accountant in devising planning and performance information systems:

> Management accounting is a profession that involves partnering in management decision making, devising planning and performance management systems, and providing expertise in financial reporting and control to assist management in the formulation and implementation of a firm's strategy.[5]

Specific Accounting Roles

Understanding the design, use, and management of information technology is of vital importance to not only management accountants, but to all of those within the accounting profession. To recognize the needed competencies for accountants with respect to

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[4]Source: "Information Technology Competencies in the Accounting Profession: AICPA Implementation Strategies for IFAC International Education Guideline No. 11," American Institute of Certified Public Accountants, 1996.
[5]Source: Institute of Management Accountants, *Statements on Management Accounting,* 2008.

information technology, it is important to recognize the potential role of accountants in accounting information systems, including the following:

1. The accountant as *user* of accounting information systems—whether it be inputting journal entries into an accounting system, using a financial spreadsheet to calculate the cost of a product, or using anti-virus software to protect the system, accountants use an AIS.

   • As an example, accountants serving in an audit role should be able to understand how to access their client's AIS and how to use at least one major computer-assisted auditing package (such as Audit Control Language, or ACL), an online or local data-base system, or a professional research tool.

2. The accountant as *manager* of accounting information systems (e.g., financial manager, controller, CFO).

   • Accountants serving as managers of AISs must be able to plan and coordinate accounting information systems and be able to organize and staff, direct and lead, and monitor and control those information systems.

3. The accountant as *designer* of accounting information systems (e.g., business system design team, producer of financial information, **systems analyst**).

   • Accountants serving in a design capacity must have significant practical exposure as they work to develop a system that will meet the needs of users. Specifically, they need to work with key phases of system analysis and design, such as the preparation of a feasibility analysis; information requirements elicitation and documentation techniques; data file design and documentation techniques; and document, screen, and report design techniques. In particular, accountants must understand business processes and the information requirements of other systems.

4. The accountant as *evaluator* of accounting information systems (e.g., IT auditor, assessor of internal controls, tax advisor, general auditor, consultant)

   • As will be discussed in Chapter 11, the **Sarbanes-Oxley Act of 2002 (SOX)** requires an evaluation of the internal controls in an AIS. As part of that act, and as part of a standard audit, accountants must be able to tailor standard evaluation approaches to an AIS and offer practical recommendations for improvement where appropriate. In addition, the accountant must be able to apply relevant IT tools and techniques to effectively evaluate the system.

In considering the information technology competencies in the accounting profession, the American Institute of Certified Public Accountants (AICPA) and International Federation of Accountants (IFAC) assume that, at a minimum, all accountants will be proficient in the AIS user role and at least one of the other listed roles (e.g., manager, designer, or evaluator). Accountants will be better users, managers, and evaluators of AISs if they understand the design of the system. Thus, throughout the text we touch on all of the roles that accountants have in the firms, but we particularly emphasize skills relevant to the designer role.

Certifications in Accounting Information Systems

In addition to the various roles that accountants play, accountants and related professionals may also seek various certifications to show they are proficient in specific areas of AISs. This will show their competence to specific employers or clients that need some specific services. There are three primary certifications that most directly apply to accounting and information systems (see Figure 1.3).