ACCOUNTING INFORMATION SYSTEMS

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Preface

To the student

The first edition of *Accounting Information Systems* is designed to prepare you for a successful career in public practice, industry, or government whether that be in accounting, management or information systems. All of you will be users of accounting information systems (AISs) for it is the key system that collects data on all economic or financial activities undertaken by all organisations. As such, you should participate in the design of those systems so you receive or extract the information you need to make informed decisions.

Doing so effectively, however, requires that you have a sound understanding of how they function. In addition to being users, some of you will become managers. Others will become internal and external auditors and some of you will become consultants not just in accounting but also information systems. All of these roles require you to understand how AISs operate so that you can measure their cost-effectiveness, assess their reliability and the reliability of the information produced, or be involved in the design and implementation of new and redesigned systems. Mastering the material presented in this text will give you the foundational knowledge you need in order to excel at all these tasks.

This text discusses important new information technology (IT) developments, such as virtualisation, cloud computing, use of radio-frequency identification (RFID) tags to track inventory and adoption of XBRL for financial reporting, because such developments affect business processes and often cause organisations to redesign their accounting systems to take advantage of new capabilities. The focus, however, is not on IT for the sake of IT, but on how IT affects business processes and controls. Indeed, new IT developments not only bring new capabilities, but also often create new threats and affect the overall level of risk. This text will help you understand these issues so that you can properly determine how to modify accounting systems controls to effectively address those new threats and accurately assess the adequacy of controls in those redesigned systems. We also discuss the effect of regulatory changes, most notably the *Sarbanes–Oxley Act* and International Financial Reporting Standards (IFRS), on the design and operation of accounting systems. These changes brought new responsibilities on owners, directors, managers and employees to act more ethically following some major corporate collapses and frauds. Thus a framework to analyse ethical issues has been provided so you have a way of analysing ethical dilemmas you will encounter during your working life.

In addition to technology- and regulatory-driven changes, companies are responding to the increasingly competitive business environment by re-examining every internal activity in an effort to reap the most value at the least cost. As a result, accountants are being asked to do more than simply report results of past activities. They must take a more proactive role in both providing and interpreting financial and non-financial information about the organisation's activities.

Therefore, throughout this text we discuss how accountants can improve the design and functioning of an AIS so that it truly adds value to an organisation.

Key learning objectives

When you finish reading this text, you should understand the following key concepts:

- the basic activities performed in the major business cycles
- what data need to be collected to enable managers to plan, evaluate and control the business activities in which an organisation engages
- how IT developments can improve efficiency and effectiveness of business processes
- how to design an AIS to provide information needed to make key decisions in each business cycle
- the risk of fraud as well as motives and techniques used to perpetrate fraud including cybercrimes
- how to analyse an ethical dilemma and recommend a solution to an ethical issue in an AIS context
- the Committee of Sponsoring Organizations (COSO) and COSO-ERM models for internal control and risk management, as well as the specific controls used to achieve those objectives
- the Control Objectives for Information and Related Technology (COBIT) framework for the effective governance and control of information systems and how IT affects the implementation of internal controls
- the Trust Services framework of the American Institute of Certified Practicing Accountants (AICPA) for ensuring systems reliability by developing procedures to protect the confidentiality of proprietary information, maintain the privacy of personal information collected from customers, assure the availability of information resources and provide for information processing integrity
- fundamentals of computer information security
- goals, objectives and methods for auditing information systems
- fundamental concepts of database technology and data modelling and their effect on an AIS
- the tools for documenting how AISs work, such as data flow diagrams, flowcharts and REA diagrams
- the basic steps in the system development process to design and improve an AIS.

Features to facilitate learning

To help you understand these concepts, the text includes the following features:

- **Each chapter begins with an integrated case that introduces that chapter's key concepts and topics and identifies several key issues or problems that you should be able to solve after mastering the material presented in that chapter.** The case is referenced in the chapter and the chapter summary presents solutions to problems and issues raised in the case.
- **Focus boxes and real-world examples** help you understand how organisations are using the latest IT developments to improve their AISs.
- **Hands-on spreadsheet exercises in many chapters** help you hone your computer skills. Many of these exercises are based on 'how-to' tutorials that appeared in issues of journals.
- **Numerous problems in every chapter** provide additional opportunities for you to demonstrate your mastery of key concepts. In most chapters there is an ethical issue for you to consider and analyse. Many problems were developed from reports in current periodicals. Other problems were selected from the various professional examinations, including the CPA, CMA, CIA and SMAC exams.
- **Cases in each chapter** require more extensive exploration of specific topics.
- **Chapter quizzes** at the end of each chapter enable you to self-assess your understanding of the material. We also provide detailed explanations about the correct answer to each quiz question.
- **Extensive use of graphics** enhances your understanding. The text contains hundreds of figures, diagrams, flowcharts and tables that illustrate the concepts taught in the chapters.
- **A comprehensive glossary** located at the back of the book makes it easy to look up the definition of the various technical terms used in the text as well as a list of terms at end of each chapter.
- **A list of acronyms** is provided on the inside of the back cover for quick and easy reference.

Content and organisation
This text is divided into five parts, each focused on a major theme.

Part I: Foundations of accounting information systems
Part I consists of six chapters that lay the foundation for the whole text and present the underlying concepts fundamental to an understanding of AIS. Chapter 1 introduces a theoretical framework that underlies information systems as well as the basic terminology and discusses how an AIS can add value to an organisation. The stakeholder analysis framework is also introduced to provide a method for you to use to analyse ethical issues you will encounter during your working life. Chapter 2 provides an overview of basic business processes. It introduces transaction processing in automated systems, presenting basic information processing and data storage concepts. You will see the wide range of data that must be collected by the AIS. This information helps you to understand what an AIS does; as you read the remainder of the text, you will see how advances in IT affect the manner in which those functions are performed.

Chapter 3 covers two of the most important tools and techniques used to understand, evaluate, design and document information systems: data flow diagrams and flowcharts. Chapter 4 introduces the topic of databases, with a particular emphasis on the relational data model.

In Chapter 5 you are introduced to controls in AISs, which are discussed in more detail in Part III. It uses the COSO framework, including the expanded enterprise risk management (COSO-ERM) model, to discuss the basic concepts of internal control.

Finally, Chapter 6 describes AIS development strategies including purchasing, building and outsourcing information systems, as well as development tools and techniques such as prototyping and computer-aided software engineering (CASE).

Part II: Accounting information system cycles
Part II focuses on how an organisation's AIS provides critical support for its fundamental business processes or cycles. Most large and many medium-sized organisations use enterprise resource planning (ERP) systems to collect, process and store data about their business processes, as well as to provide information reports designed to enable managers and external parties to assess an organisation's efficiency and effectiveness. To make it easier to understand how an ERP system functions, Part II consists of five chapters, each focusing on a particular business process.

Chapter 7 covers the revenue cycle, describing all activities involved in taking customer orders, fulfilling those orders and collecting cash. Chapter 8 covers the expenditure cycle, describing all activities involved in ordering, receiving and paying for merchandise, supplies and services. Chapter 9 covers the human resources management cycle, focusing primarily on the activities involved in processing payroll. Chapter 10 covers the production cycle, with a special focus on the implications of recent cost accounting developments, such as activity-based costing, for the design of the production cycle information system. Chapter 11 covers the general ledger and reporting activities in an organisation, discussing topics such as XBRL, the balanced scorecard, the switch from GAAP to IFRS and the proper design of graphs to support managerial decision making. Each of these five chapters explains the three basic functions performed by the AIS: function of cycle, efficient transaction processing and preparation of information useful for effective decision making.

Part III: Fraud, controls and audit in accounting information systems
The seven chapters in Part III focus on threats to the reliability of AISs and applicable controls for addressing and mitigating risks associated with those threats. Chapter 12 discusses fraud and explains how and why it occurs. Chapter 13 continues the discussion of cybercrime, focusing specifically on computer attacks and abuse techniques. Chapters 14 to 16 use both COBIT and the AICPA's Trust Services frameworks to discuss effective governance and control of information systems. Chapter 14 introduces the fundamental concepts of defence-in-depth and the time-based approach to security. The chapter provides a broad survey of a variety of security topics, including access controls, firewalls, encryption and incident detection and response. Chapter 15 discusses the many specific computer controls used in business organisations to achieve objectives of ensuring privacy and confidentiality and it includes a detailed explanation of encryption. Chapter 16 addresses the controls necessary to achieve the objectives of accurate processing of information and ensuring that information is available to managers whenever and wherever

they need it. Chapter 17 discusses the provision of adequate internal controls to safeguard assets (including data) for each of the AIS cycles in Part II. Chapter 18 describes principles and techniques for the audit and evaluation of internal control in a computer-based AIS and introduces the topic of computer-assisted auditing.

Part IV: The systems development life cycle process

Part IV consists of two chapters that cover various aspects of the systems development process.

Chapter 19 introduces the systems development life cycle (SDLC) and discusses the introductory steps of this process (systems analysis, feasibility and planning). Particular emphasis is placed on the behavioural ramifications of change. Chapter 20 covers the remaining stages of the SDLC (conceptual design, physical design, implementation and operation and maintenance) and emphasises the interrelationships among the phases.

Part V: The REA data model

Part V consists of three chapters that focus on the REA data model, which provides a conceptual tool for designing and understanding the database underlying an AIS. Chapter 21 introduces the REA data model and explains how it can be used to design an AIS database. The chapter focuses on modelling the revenue and expenditure cycles. It also demonstrates how the REA model can be used to develop an AIS that not only can generate traditional financial statements and reports but also can more fully meet the information needs of management. Chapter 22 explains how to implement an REA data model in a relational database system and shows how to query a relational database in order to produce various financial statements and management reports. Chapter 23 explains how to develop REA data models of the production, human resources management/payroll and financing cycles. It also discusses a number of advanced modelling issues, such as the acquisition and sale of intangible products and services and rental transactions.

Comparative table of contents for users of US editions

Users of US editions of this text can use the following correlation table to see changes in the organisation of content for the first Australasian edition of *Accounting Information Systems*.

Chapter	US 12th edition chapter	US 11th edition chapter	Chapter title
Part 1 Foundations of accounting information systems			
1	1	1	Accounting information systems: Theoretical foundations and overview
2	2	2	Fundamentals of business processes and transaction processing
3	3	3	Systems development and documentation techniques
4	4	4	Files, database systems and relational databases
5	7	6	Controls in accounting information systems
6	21	19	Accounting information system development strategies
Part 2 Accounting information systems cycles			
7	12	10	The revenue cycle: Sales to cash collections
8	13	11	The expenditure cycle: Purchasing to cash payments
9	15	13	The human resources management cycle/payroll subcycle
10	14	12	The production cycle
11	16	14	The general ledger and reporting cycle
Part 3 Fraud, controls and audit in accounting information systems			
12	5	NA	Fraud: Prevalence, prevention and detection in accounting information systems
13	6	5	Cybercrime: Computer attack and abuse techniques
14	8	7	Information systems controls for system reliability—Part 1: Information security
15	9	8	Information systems controls for system reliability—Part 2: Confidentiality and privacy

16	10	8	Information systems controls for system reliability—Part 3: Processing integrity and availability
17	12, 13, 14, 15, 16	**10, 11, 12, 13, 14**	Transaction cycles: Threats and control procedures
18	11	9	Auditing computer-based information systems
Part 4 The systems development life cycle process			
19	20	**18**	Systems development and systems analysis
20	22	**20**	Systems design, implementation and operation
Part 5 The REA data model			
21	17	**15**	Database design using the REA data model
22	18	**16**	Implementing an REA model in a relational database
23	19	**17**	Special topics in REA modelling

To the instructor

This text is intended for use in a one-semester course in accounting information systems (AISs) at the undergraduate or graduate level, if used in its entirety. However, instructors have the flexibility to mould a course based on the emphasis they wish to pursue depending on the objectives of their courses. Part I provides the foundations of AISs. It is the base on which the remainder of the text is based. Thus Part I can be used as a standalone course for non-accounting students or managers or in combination with any of Parts II to V. For a course that emphasises controls in accounting systems and students have not been exposed to transactions cycles in detail, Part I can be combined with Parts II and III. A course which emphasises design of information systems would combine Parts I, II and IV with Part V if a database design component is required.

An introductory financial accounting course is suggested as a prerequisite and an introductory information systems course that covers software packages such as Microsoft Office applications is helpful. If Chapter 10 (The production cycle) is to be included an introductory management accounting course would provide a good base. The text can also be used as the main required reference in graduate or advanced undergraduate management information systems courses using a combination of parts depending on the course objectives and focus as described earlier. Indeed, the topics covered in this text provide information systems students with a solid understanding of transaction processing systems that they can then build on as they pursue more in-depth study of specific topics such as databases, data warehouses and data mining, networks, systems analysis and design, computer security and information system controls.

Enhancements to the first Australasian edition

The first Australasian edition of the well-used US editions of Romney and Steinbart has been extensively revised and written to incorporate local conditions, laws, standards and cases. It has also been rewritten to incorporate recent developments while retaining the features that have made prior US editions easy to use but in a new structure to provide more flexibly to suit course objectives and focus. Every chapter has been updated to include current examples of important concepts and recent events that impact on information systems. Specific changes include:

- a theoretical foundation for AIS that underpins design, development and use of systems in accounting—why should we have a well-designed AIS in an organisation
- more extensive coverage of both fraud and cybercrime over two chapters because of its impact on information system, organisations and society today
- more detailed discussion of internal control frameworks: COSO, COSO-ERM and COBIT
- updated discussion of information security countermeasures, including the security and control implications associated with virtualisation and cloud computing

- additional spreadsheet exercises, based on articles, to help students develop skills, as it is the most used software application by practitioners
- many new end-of-chapter discussion questions and problems
- incorporation of a framework to analyse ethical issues in the first chapter, with questions for students on ethics in the context of most chapters.

Dollar amounts throughout the book are in Australian dollars unless otherwise specified. GST/VAT amounts have not been included for simplicity.

For students

The *Accounting Information Systems* blog <www.pearson.com.au/romney> is an exciting and continually updated source of case studies, news items, articles and websites of interest for students using this text.

For lecturers

Our objective in preparing this edition has been to simplify the teaching of AISs by enabling you to concentrate on classroom presentation and discussion, rather than on locating, assembling and distributing teaching materials. To assist you in this process, the following supplementary materials are available to adopters of the text:

- *Solutions Manual*
- *PowerPoint Presentations* that make extensive use of high-quality graphics to illustrate key concepts. The slides do not merely consist of bullet points taken verbatim from the text, but instead are designed to help students notice and understand important relationships among concepts. The large number of slides provides instructors with a great deal of flexibility in choosing which topics they wish to emphasise in class.
- *Computerised TestBank*

You can access these resources from the protected instructor area of <www.pearson.com.au>.

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Of course, any errors in this book remain our responsibility. We welcome your comments and suggestions for further improvement.

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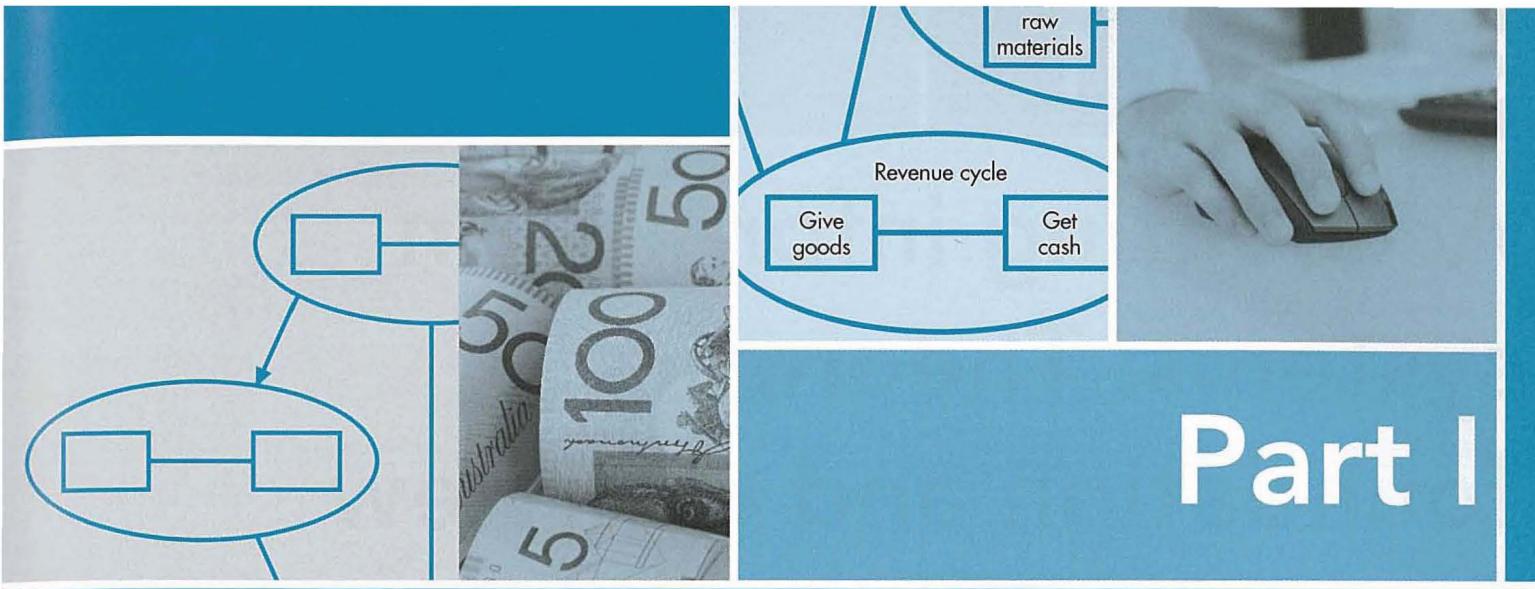
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Part I

Foundations of accounting information systems

Chapter 1

Accounting information systems: Theoretical foundation and overview

Learning objectives

After studying this chapter, you should be able to:

1. understand the theoretical foundation to accounting information systems (AISs)

2. distinguish data from information, discuss the characteristics of useful information, and explain how to determine the value of information

3. explain what decisions an organisation makes and the information needed to make them

4. identify the information that passes between internal and external parties and an AIS

5. describe the major business processes present in most companies

6. explain what an AIS is and describe its basic functions

7. discuss how an AIS can add value to an organisation

8. explain how an AIS and corporate strategy affect each other

9. explain the role an AIS plays in a company's value chain

10. explain why accountants need to be knowledgeable about AISs

11. understand how ethics are important in AISs and how to analyse an ethical issue.

INTEGRATIVE CASE S&S

After working for years as a regional manager for a retail organisation, Scott Parry opened his own business with Susan Green, one of his district managers, as his partner. They formed S&S to sell appliances and consumer electronics. Scott and Susan pursued a 'clicks and bricks' strategy by renting a building in a busy part of town and adding an electronic shopfront.

Scott and Susan plan to invest enough money to see them through the first six months. They will hire 15 employees within the next two weeks—three people to stock shelves, four sales representatives, six sales assistants, and two people to develop and maintain the electronic shopfront.

Scott and Susan will host S&S's grand opening in five weeks. To meet that deadline, they have to address the following issues:

1. What decisions do they need to make to be successful and profitable? For example:
   a. How should they price products to be competitive yet earn a profit?
   b. Should they extend credit and, if so, on what terms? How can they accurately track what customers owe and pay?
   c. How should they hire, train and supervise employees? What compensation and benefits package should they offer? How should they process the payroll?
   d. How can they track cash inflows and outflows to avoid a cash squeeze?
   e. What is the appropriate product mix? What inventory quantities should they carry, given their limited showroom space?

2. What information do Scott and Susan need to make these decisions?
   a. What information do external entities, such as suppliers and banks, need?
   b. What information do management and other employees need?
   c. How can they gather, store, and disseminate that information?

3. What business processes are needed, and how should they be carried out?

4. What functionality should be provided on the website?

5. What controls are required to secure the firm's resources and counter agency effects?

Although Scott and Susan could use an educated guess or 'gut feeling' to make these decisions, they know they can make better decisions if they obtain additional information. A well-designed accounting information system (AIS) can solve these issues and provide information they need to make any remaining decisions and control their business.

Theoretical foundation of AISs

Information systems exist because they are an integral part of a modern organisation. Understanding the reason for information systems and justification for their existence flows from an understanding of why a modern organisation exists. Coase (1937) provided one answer in his *Theory of the Firm*.[1] His argument was relatively simple. Firms are established because it is profitable to do so; firms organise to reduce the transaction costs of repeated and complicated activities involved in creating, selling and distributing goods and services.

While the market system has proven both enduring and robust, there are costs in using the *price mechanism*.[2] A firm saves on these costs. The most obvious cost of organising production through the price mechanism is negotiating and writing a contract every time you want a new one. If, in our case of Scott and Susan's retailing venture, they wished to sell clothing then to do so without other firms' involvement, such as selling ready-to-wear clothes, would be difficult even prohibitive if they had to make clothes themselves.

First, they would need to purchase cotton from growers in northern New South Wales. They would need to organise for yarn manufacturers to make the thread; weavers to make the cloth; dyers to dye the cloth; and tailors or dressmakers to make the clothing. Setting aside designer and transport contracts, the process of 'making' their own clothing while being part of every aspect of the cost of the process would be prohibitive.

The main reason why it is profitable to establish a firm is the huge cost in doing everything for oneself. We can see that Susan and Scott face the obvious cost of 'organising' production through the price mechanism, which is the cost of what relevant prices are. They have to find suppliers and negotiate contracts including delivery terms. This cost may be reduced but it will not be eliminated by the emergence of specialist firms. There are specialist growers who contract to supply seed, fertilisers, water, labour, and as suppliers or intermediaries for capital. There are specialist yarn makers who contract with growers to provide the cotton and with labour and capital to fabricate cloth, and so on. There are specialist clothes designers and manufacturers. These firms reduce S&S's costs of contracting allowing them to specialise in 'retailing'.

It is true that contracts are not eliminated for Scott and Susan when they become a specialist retailer but they are greatly reduced. As owners, they do not have to make a series of contracts with resources they employ within the firm. This would be the case if they were working purely within the price system. Every time they wished to vary an employee's task, they would need to write a new contract. For this series of contracts one contract is substituted. At this stage, it is important to note the character of an employee's contract; for example, the employee agrees, for certain remuneration (which may be fixed or fluctuating), to obey the directions of Scott and Susan within certain limits. The essence of the contract is that it should only state the limit to the powers of the employer.

Here we see the efficiency of the firm as an organising mechanism over the market. Indeed some firms such as BHP-Billiton and Microsoft have larger turnovers than do many of the world's smaller nations. They manage huge resources, continually allocating and reallocating these resources all outside the market system. A pertinent question to ask would be: If by organising, one can eliminate certain costs and in fact reduce the cost of production, why are there any market transactions at all? Why isn't all production carried out by one big firm? There are three plausible explanations.

First, as a firm gets larger, there may be decreasing returns to the entrepreneurial function. That is, costs of organising additional transactions within a firm may rise. Second, as a firm grows, an entrepreneur fails to place resources in uses where their value is greatest; that is, fails to make the best use of resources available. Finally, the supply price of one or more of production resources may rise because 'other advantages' of a small firm are greater than those of a large firm. The actual point where the expansion of a firm ceases is determined by a combination of the above three factors. Figure 1.1 depicts these costs of organising. Note that the graph is rising; this reflects the 'diminishing returns to management'.[3] Figure 1.1 also depicts the costs of organising through the market mechanism. It shows the point where the loss through waste of resources is equal to the 'market costs' of exchange transactions in the open market. This is the optimum size for a firm.

Firms compete with each other in the market for resources and customers. The efficiency of the entrepreneurial decision-making is, in part, based on the relevance and efficiency of its

information system. The more efficient management decision-making is with respect to resource allocation within the firm, the lower its organising costs and the larger it can grow.

While an information system is paramount to the success and growth of a firm, it also has a role in managing managers of a firm. The existence of a firm can lead to agency costs where ownership of a firm is separate from its management as postulated in *Agency Theory*. Such would be the case if Susan and Scott chose to hire a manager and removed themselves from day-to-day operations. Scott and Susan as the owners want to extract maximum performance for minimum remuneration while a manager wants maximum remuneration for minimum effort. The owners will sensibly adjust a manager's remuneration downwards to compensate for their poor performance and consumption of benefits or perks. To maximise their remuneration, managers have incentives to *bond* themselves to owners by writing contracts which constrain managers' actions. Inclusive in managers' contracts will be a need for monitoring and this monitoring function is performed or supported by information systems. The demand for information systems is also a function of contracting relationships between various principals (owners) and agents (managers). Contracts will often be written to use outputs of an information system—for example, management bonuses based on accounting profits. The key point is that the nature of agency relationships will determine the nature of the information system.
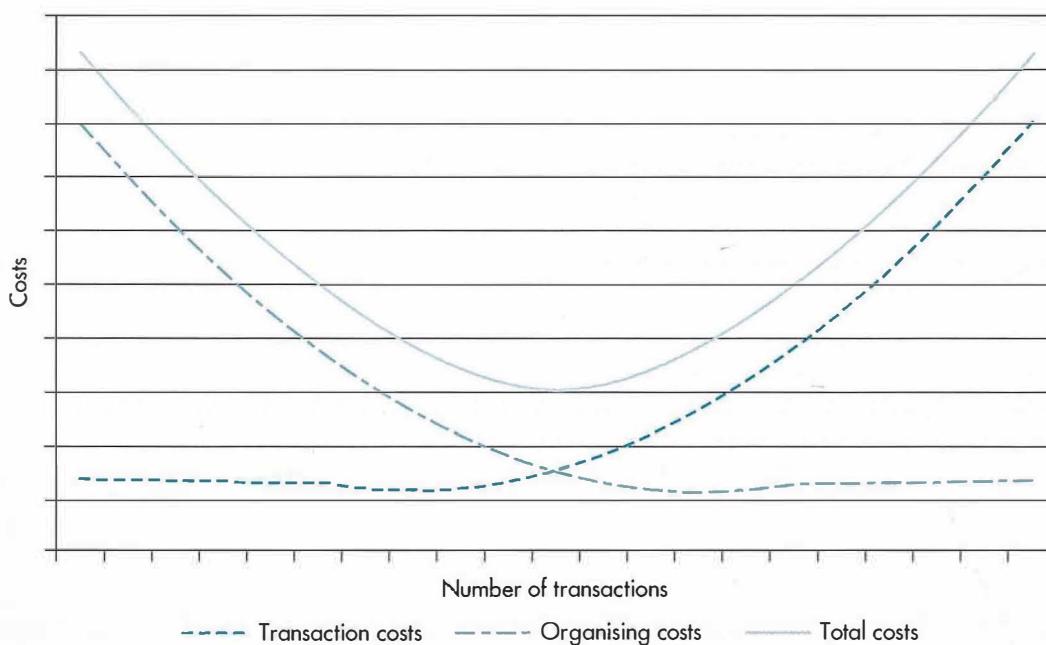
FIGURE 1.1
Transaction costs and costs of organising

Introduction

We began this chapter by providing a theoretical framework for AISs to show that, although AIS is a practical subject, it has underlying concepts supported by research. It is an emerging area of applied science with a burgeoning body of literature.

Next we will explain important terms and discuss the kinds of information that organisations need as well as business processes used to produce that information. We will continue with an exploration of what an *accounting information system (AIS)* is, how an AIS adds value to an organisation, how an AIS and corporate strategy affect each other, and the role of an AIS in a value chain.

Drivers of business and information system change

Having established the importance and role of information systems, we now turn to address some of the issues that drive change in information systems. As an information system is the primary source

of information for managerial decision-making, drivers of systems' changes are the same drivers of changes in the business itself. Figure 1.2 describes the cycle of business pressures as well as corporate and technological responses and their impacts on information systems. These pressures and responses in turn drive changes in technology placing further pressure on business. Drivers of change can also lead to rewards for an organisation. Some of these pressures derive from the push from globalisation, moves to deregulate business and capital markets, advances in technology, the trend to outsourcing, and the push to downsize organisations in order to contain costs.

Globalisation

The force behind the push of globalisation is technology. It is the enabler that has changed the way we communicate, transport goods and services, and travel. Technology has raised expectations of the isolated and the impoverished. The result is recognition by management of a new commercial technology that incorporates the benefits and risks of a global marketplace. Corporations who recognise this benefit from economies of scale in production, distribution, marketing and management of global markets may translate these economies into reduced world prices to the benefit of consumers and to the detriment of their competitors. But enhanced use of technologies has enabled organisations to interact with partners, suppliers, customers and joint venturers in a non-physical environment—a virtual environment. Even within a large multi-national organisation, such as IBM, BHP-Billiton, Shell or Pepsi, various regional business units are acting locally but doing business globally in a virtual organisation. Our information systems have to adjust to this virtual business space so that appropriate collection, storage and processing of data can produce separate and consolidated reports for local and headquarter management decision-making. Firms also recognise the need and capability to use systems' costs as a way of reducing organising costs (Figure 1.1) if they are to stay in business in a globalised market.
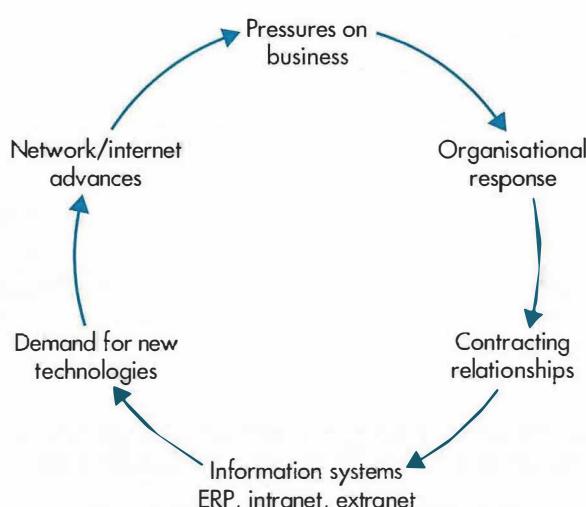
Deregulation

While globalisation is a trend in modern markets, the focus of legislators is the deregulation of markets. Australia and other countries in Asia and South America have moved a long way over the past 20 years to deregulate their financial, labour and business markets. The focus of this deregulation is the removal of constraints on competitive market forces through bi-lateral and multi-lateral free trade agreements, for example Australia–China, Australia–New Zealand, Australia–USA.[4] Controls over commercial and financial systems have been relaxed and business competition has increased. Foreign exchange controls have been abolished; the Australian currency is one of the few that floats in response to competition and demand, with international trade barriers halved in that time. Import quotas have been abolished while transport and communication competition has increased. The effect is increased competition and the resultant need for companies to be more efficient both with their product markets and their information systems.

Advances in technology

While advances in *information technology (IT)* and communications have enabled the virtual organisation, the impact of technological change is best described by two laws: Metcalfe's Law and

FIGURE 1.2

Business pressures and responses

Moore's Law. Metcalfe's Law is often cited as a description of the rapid growth of the World Wide Web. Together with Moore's Law about the rate at which computer power is accelerating, Metcalfe's Law can be used to explain the rising wave of IT that we are riding through the 21st century.

Metcalfe's Law[5] is related to the fact that the number of unique connections in a network of a number of nodes (n) can be expressed mathematically as the triangular number $n(n-1)/2$, which is proportional to n^2 asymptotically. Simply put, the value of a network doubles with every new connection (node n). The more interconnected people are, the more valuable the network. *Moore's Law*[6] argues that chip density doubles every 18 months. However, there are no laws currently describing increases in storage capacity or increases in the speed of communication.

Describing the change of pace in technology as 'rapid' is an understatement. What we do know is that there is no sign of a slowdown in the pace of change. While changes in technology are partly in response to the needs of the business community, developments in technology also place pressure on businesses. In 2011, the placement in receivership of one of Australia's largest book-sellers (Borders and Angus and Robertson)[7] was initially attributed to the trend in buyers' habits to make their purchases over the internet rather than in stores. This is a classic example of technology enabling consumers to undertake transactions more cheaply via the web than through traditional corporations. Thus companies need to use information systems to be more efficient and reduce costs of transacting with customers, such as an *enterprise resource planning (ERP)* system which integrates all aspects of an organisation's activities into one system, including its traditional AIS.

Outsourcing and downsizing

Outsourcing and downsizing are two organisational responses to business pressures. Almost all of Australia's communications and banking companies have outsourced their customer relations to offshore call centres. Telstra, Australia's largest telecommunications company, has downsized its programming functions and outsourced much of that activity to cheaper labour countries such as India.[8] Again we see the need for information systems that can support virtual organisations.

We have now laid the theoretical foundation and concepts for information systems in general; future chapters will relate these concepts to accounting information systems and, where appropriate, to aspects of control, cycles and other issues. Before we go on to these areas, we need to have a clear understanding of systems, data and information, and how modern organisations can gain value from these resources, which cost firms a lot of money to acquire and use.

Systems, data, information and its value

Good design can be defined as the process of inventing objects or items that display a new physical order in response to function. Good design is the successful execution of the following three components of design:

1. Determine objectives (not always an easy task).
2. Determine what needs to be done to achieve those objectives.
3. Choose the 'best' components to execute the actions needed to achieve objectives.

These components of good design also need to be applied when designing non-physical things such as systems.

A *system* is a set of two or more interrelated components that interact to achieve a goal. Most systems are composed of smaller subsystems that support the larger system. For example, a faculty of business is a system composed of various departments, each of which is a subsystem. Moreover, a faculty itself is a subsystem of a university.

Each subsystem is designed to achieve one or more organisational goals. Changes in subsystems cannot be made without considering the effect on other subsystems and on the system as a whole. *Goal conflict* occurs when a subsystem is inconsistent with the goals of another subsystem or with the system as a whole. *Goal congruence* occurs when a subsystem achieves its goals while contributing to the organisation's overall goal. The larger the organisation and the more complicated the system, the more difficult it is to achieve goal congruence.

In designing a system we need to focus on a few system aspects. *Simplicity* is desirable, but is usually at variance with the range of components that can be used. *Performance* is best if we

choose the best components but this often makes interfacing components (jointing) more difficult. *Economy* is desirable, but is usually at variance with performance. Good design results in a system that delivers these key aspects in combination with the system's environment. The question is, 'How do we know good design?' To specify all that is good in a system is a Herculean task. What good designers in other fields have recognised is that good design is an absence of 'wrong things'.

Data is a set of facts that are collected, recorded, stored and processed by an information system. Businesses need to collect several kinds of data, such as activities that take place, resources affected by activities, and people who participate in activities. For example, a business needs to collect data about a sale (date, total amount), the resource sold (good or service, quantity sold, unit price), and the people who participated (customer, salesperson).

Information is data that has been organised and processed to provide meaning and improve decision-making processes. As a rule, users make better decisions as the quantity and quality of information increase.

There are limits to the amount of information a human mind can absorb and process. Information overload, or more correctly, *data overload*, occurs when those limits are passed, resulting in a decline in decision-making quality and an increase in the cost of providing that information. Information system designers use IT to help decision-makers more effectively filter and condense information. For example, Wal-Mart has over 500 terabytes (trillions of bytes) of data in its data warehouse. That is equivalent to 3200 kilometres of bookshelves, or about 100 million digital photos. McKinsey Global Institute estimates that in 2009, nearly all companies in the United States with at least 1000 employees on average stored at least 200 terabytes of data — twice the size of Wal-Mart's data warehouse in 1999.[9] Wal-Mart has invested heavily in IT so it can effectively collect, store, analyse and manage data to provide useful information.

The *value of information* is the benefit produced by the information minus the cost of producing it. Benefits of quality information are reduced uncertainty, improved decisions, and improved ability to plan and schedule activities, resulting in lower organising costs. The costs are the time and resources spent to produce, store and distribute information. Information costs and benefits can be difficult to quantify, and it is difficult to determine the value of information before it has been produced and utilised. Nevertheless, the expected value of information should be calculated as effectively as possible so that costs of producing information do not exceed its benefits.

To illustrate the value of information, consider the case of 7-Eleven. In 1973, a Japanese company licensed the very successful 7-Eleven name from Southland Corporation in America. As it opened its stores, 7-Eleven Japan invested heavily in IT, but the USA stores did not. Each 7-Eleven store in Japan was given a computer that:

- kept track of the 3000 items sold in each store and determined what products were moving, at what time of day, and under what weather conditions
- kept track of what and when customers bought to make sure it had in stock products most frequently purchased
- ordered sandwiches and rice dishes from suppliers automatically; orders were placed and filled three times a day so that stores always had fresh food; in addition, 7-Eleven allowed its suppliers to access sales data in its computers so that they could forecast demand
- coordinated deliveries with suppliers; this reduced deliveries from 34 to 12 a day, resulting in less clerical receiving time
- prepared a colour graphic display that indicated which store areas contributed the most to sales and profits.

Average daily sales of 7-Eleven Japan were 30% higher and its operating margins almost double those of its closest competitor. What happened to Southland and its 7-Eleven stores in the United States? Profits declined, and Southland eventually had to file for bankruptcy. Who came to the company's rescue? Along with its parent company, 7-Eleven Japan purchased 64% of Southland.

Table 1.1 presents 10 characteristics that make information useful and meaningful.

These characteristics can also be viewed as the 'wrongness' that must be avoided to achieve a good system design. One.Tel Limited is an example of where these characteristics went wrong.[10] One.Tel was a mobile phone company expected to make considerable inroads into the Australian market. Its information system failed to meet the first three characteristics of a good system that provides useful information. The system failed to capture all its sales (lack of completeness), it

TABLE 1.1 Characteristics of useful information

Relevant	Reduces uncertainty, improves decision-making, or confirms or corrects prior expectations.
Reliable	Free from error or bias; accurately represents organisation events or activities.
Existence	The transactions, assets, obligations and equity generated in the system exist.
Valid	Only those transactions and reports that are authorised by the firm should be processed.
Complete	Does not omit important aspects of the events or activities it measures.
Timely	Provided in time for decision-makers to make decisions.
Measurable	Transactions, assets, liabilities, and equities processed in the system are measured accurately.
Understandable	Presented in a useful and intelligible format.
Verifiable	Two independent, knowledgeable people can produce the same information.
Accessible	Available to users when they need it and in a format they can use.

failed to reliably report amounts owing by its customers (lack of reliability) because it failed to measure customers' transactions accurately (measurability), and it failed to inform management of the cash position of the company as a result of these problems (lack of relevance).

When designers design, whether it is a building or an information system, it is not possible to specify all of the things that make the product, building or system effective and efficient. The list of things that must be right is almost infinite. Designers deal with this problem by changing the perspective of a problem. They seek to eliminate all the things that can go wrong. Architects have specifications that apply to all buildings in terms of safety, ventilation, etc. Systems' designers have the list specified in Table 1.1 to guide them about the things that may go wrong.

If we design an AIS that only processes real transactions the system will be more relevant and reliable. The situation of the National Safety Council of Victoria is one where the bulk of the organisation was fictitious. Assets did not exist and transactions were faked.[11] If we design a system where only valid transactions are processed, we are unlikely to face the problems associated with the demise of Clive Peeters Limited, which was stung in 2010 by a $20 million employee fraud.[12]

Information for decision-making will only be relevant if it is valid. If we design a system that processes all transactions in which it engages, it will maximise revenue to an organisation and increase its likelihood of survival—thus avoiding a situation like that of One.Tel Limited.

If we design a system that produces timely information, that information will be more relevant to a decision-maker. If we design a system that measures its transactions accurately, presents its information in an understandable form, and allows that information to be audited and accessible to authorised users, we will have a relevant and reliable system. For designers, relevance and reliability are necessary end products, and it is the other characteristics—existence, valid, complete, timely, measureable, understandable, verifiable, and accessible—that allow us to achieve these higher level objectives.

Information needs and business processes

All organisations need information in order to make effective decisions. In addition, all organisations have certain business processes that they are continuously engaged in. A *business process* is a set of related, coordinated, and structured activities and tasks that are performed by a person, or by a computer or a machine, and help accomplish a specific organisational goal.

To make effective decisions, organisations must decide what decisions they need to make, what information they need to make decisions, and how to gather and process data needed to produce information. This data gathering and processing is often tied to basic business processes in an organisation. To illustrate the process of identifying information needs and business processes, let's return to our case study of S&S.

Information needs

Scott and Susan decide they must understand how S&S functions before they can identify the information they need to manage S&S effectively. Then they can determine the types of data and procedures they will need to collect and produce that information. They created Table 1.2 to summarise part of their analysis. It lists S&S's basic business processes, some key decisions that need to be made for each process, and information they need to make decisions.

Scott and Susan realise that the list is not exhaustive, but they are satisfied that it provides a good overview of S&S. They also recognise that not all information needs listed in the right-hand column (Table 1.2) will be produced internally by S&S. Information about payment terms for merchandise purchases, for example, will be provided by vendors. Thus, S&S must effectively integrate external data with internally generated data so that Scott and Susan can use both types of information to run S&S.

TABLE 1.2 Overview of S&S's business processes, key decisions and information needs

Business process	Key decisions	Information needs
Acquire capital	How much Find investors or borrow funds If borrowing, obtaining best terms	Cash flow projections Pro forma financial statements Loan amortisation schedule
Acquire building and equipment	Size of building Amount of equipment Rent or buy Location How to depreciate	Capacity needs Building and equipment prices Market study Tax tables and depreciation regulations
Hire and train employees	Experience requirements How to assess integrity and competence of applicants How to train employees	Job descriptions Applicant job history and skills
Acquire inventory	What models to carry How much to purchase How to manage inventory (store, control, etc.) Which vendors	Market analyses Inventory status reports Vendor performance
Advertising and marketing	Which media Content	Cost analyses Market coverage
Sell merchandise	Mark-up percentage Offer in-house credit Which credit cards to accept	Pro forma income statement Credit card costs Customer credit status
Collect payments from customers	If offering credit, what terms How to handle cash receipts	Customer account status Accounts receivable ageing report Accounts receivable records
Pay employees	Amount to pay Deductions and withholdings Process payroll in-house or use outside service	Sales (for commissions) Time worked (hourly employees) Payroll summary Costs of external payroll service
Pay taxes	Payroll tax requirements Goods & services/ value added tax requirements	Government regulations Total wage expense Total sales
Pay vendors	Whom to pay When to pay How much to pay	Vendor invoices Accounts payable records Payment terms

S&S will interact with many external parties, such as customers, vendors and governmental agencies, as well as with internal parties such as management and employees. To get a better handle on the more important interactions with these parties, they prepared Figure 1.3.
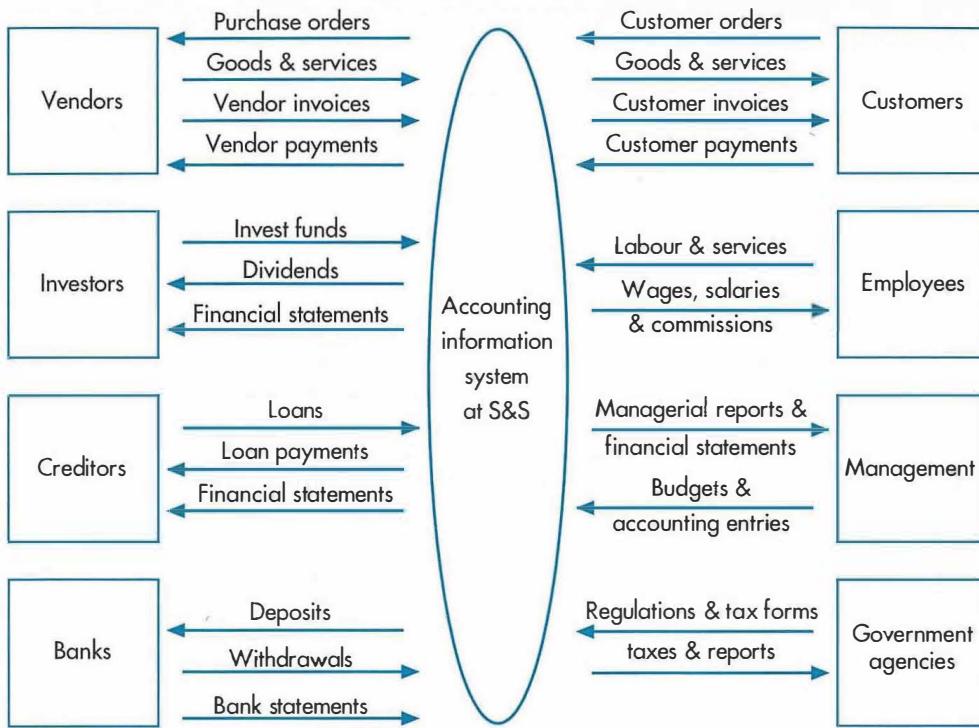
FIGURE 1.3

Interactions between S&S and external and internal parties

Business processes

Scott decides to reorganise the business processes listed in Table 1.2 into groups of related transactions. A *transaction* is an agreement between two entities to exchange goods or services or any other event that can be measured in economic terms by an organisation. Examples include selling goods to customers, buying inventory from suppliers and paying employees. The process that begins with capturing transaction data, then storing data and ends with informational output, such as financial statements, is called *transaction processing*. Transaction processing is covered in more depth in Chapter 2.

Many business activities are pairs of events involved in a *'give-get' exchange*. Most organisations engage in a small number of 'give-get' exchanges, but each type of exchange happens many times. For example, S&S will have thousands of sales to customers every year in exchange for cash. Likewise, S&S will continuously buy inventory from suppliers in exchange for cash.

These exchanges, sometimes called a 'nexus of contracts' (Figure 1.4) can be grouped into five major *business processes* or *transaction cycles* and form the subsystems of the total accounting information system:

- *Revenue cycle,* where goods and services are sold for cash or a future promise to receive cash. This cycle is discussed in Chapter 7.
- *Expenditure cycle,* where companies purchase inventory for resale or raw materials to use in producing products in exchange for cash or a future promise to pay cash. This cycle is discussed in Chapter 8.
- *Human resources management (HRM) cycle/payroll subcycle,* where employees are hired, trained, compensated, evaluated, promoted, and terminated. This cycle is discussed in Chapter 9.
- *Production* or conversion *cycle,* where raw materials are transformed into finished goods. This cycle is discussed in Chapter 10.
- *Financing cycle,* where shares of a company are sold to investors, where companies borrow money, and where investors are paid dividends and interest is paid on loans. This cycle is not covered in detail in this text but is referred to in various chapters.
- *General ledger and reporting cycle* brings together the data processed through the other cycles. This is discussed in Chapter 11.

These cycles process a few related transactions repeatedly. For example, most revenue cycle transactions are either selling goods or services to customers or collecting cash for those sales. Figure 1.5 shows the main transaction cycles and the 'give-get' exchange inherent in each cycle.

FIGURE 1.4
Nexus of contracts
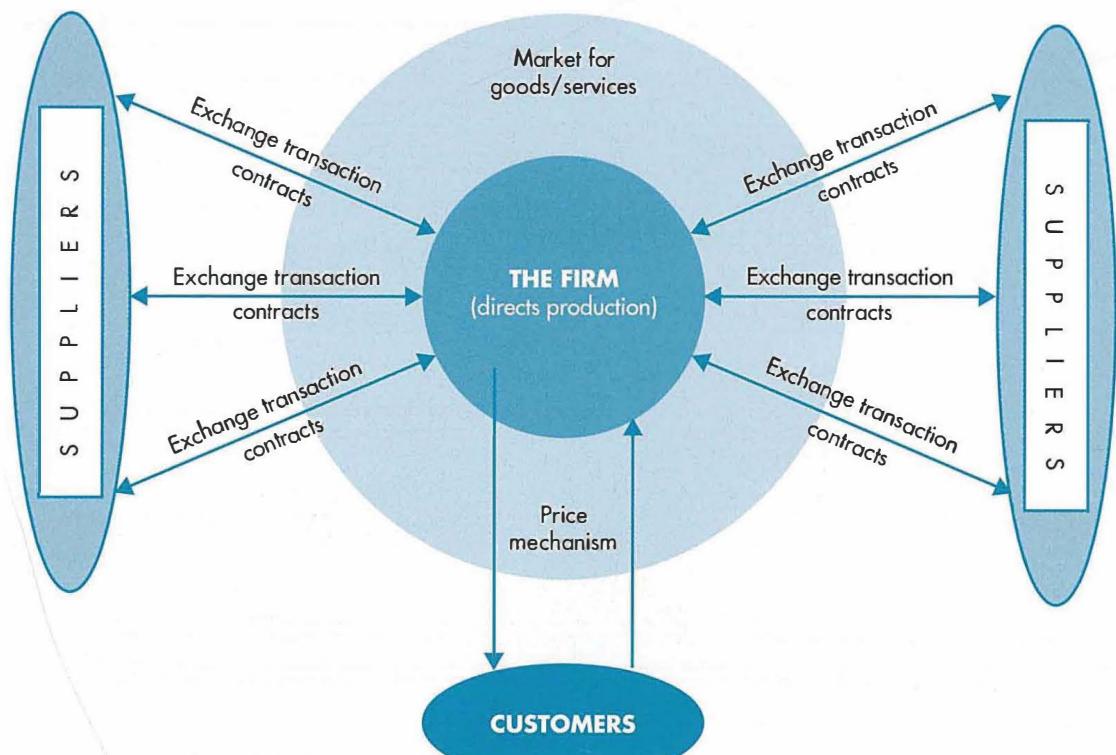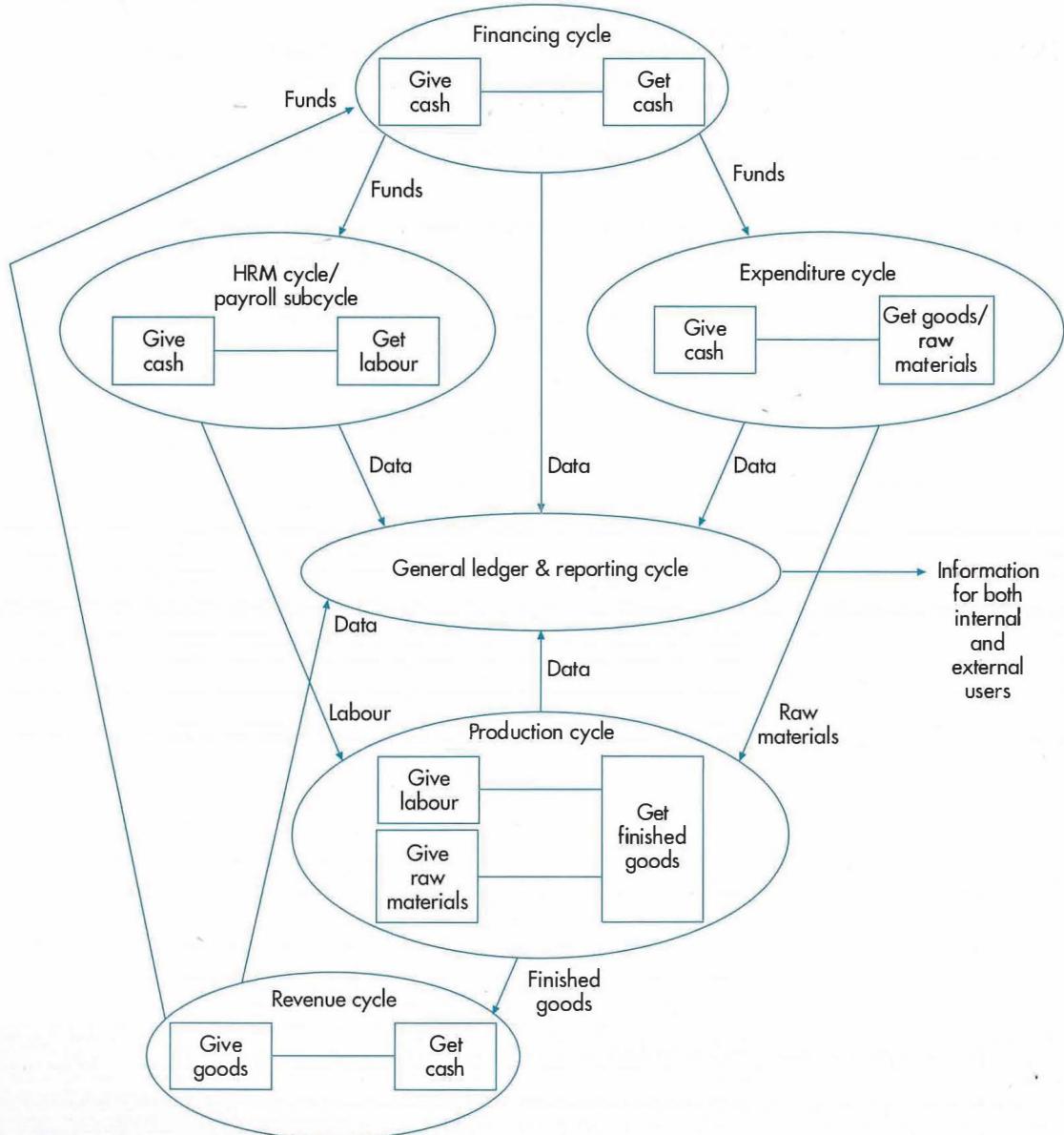
FIGURE 1.5
AIS and its subsystems

These basic 'give-get' exchanges are supported by a number of other business activities. For example, S&S may need to answer a number of customer enquiries and check inventory levels before it can make a sale. Likewise, it may have to check customer credit before a credit sale is made. Accounts receivable will have to be increased each time a credit sale is made and decreased each time a customer payment is received. Figure 1.6 shows the major activities in each transaction cycle.

Notice that the last activity in Figure 1.6 for each transaction cycle is 'Send appropriate information to other cycles'. Figure 1.7 shows how these various transaction cycles relate to one another and interface with the general ledger and reporting cycle, which is used to generate information for both management and external parties.

In many accounting software packages, the various transaction cycles are implemented as separate modules. Not every organisation needs to implement every module. Retail stores like S&S, for example, do not have a production cycle and would not implement that module. Moreover, some types of organisations have unique requirements. Financial institutions, for example, have demand deposit (deposit of money that can be withdrawn without prior notice) and instalment-loan (a loan that is paid back in several payments, or instalments, rather than all at once) cycles that relate to transactions involving customer accounts and loans, respectively. In addition, the nature of a given transaction cycle differs across different types of organisations. For example, the expenditure cycle of a service company, such as a public accounting firm or a law firm, does rarely involve processing transactions related to the purchase, receipt and payment for merchandise that will be resold to customers.

Each transaction cycle can include many different business processes or activities. Each business process can be relatively simple or quite complex. Focus 1.1 shows how Toyota's attention to continuously improving its business processes has helped it become the largest and one of the most profitable automobile manufacturers in the world.
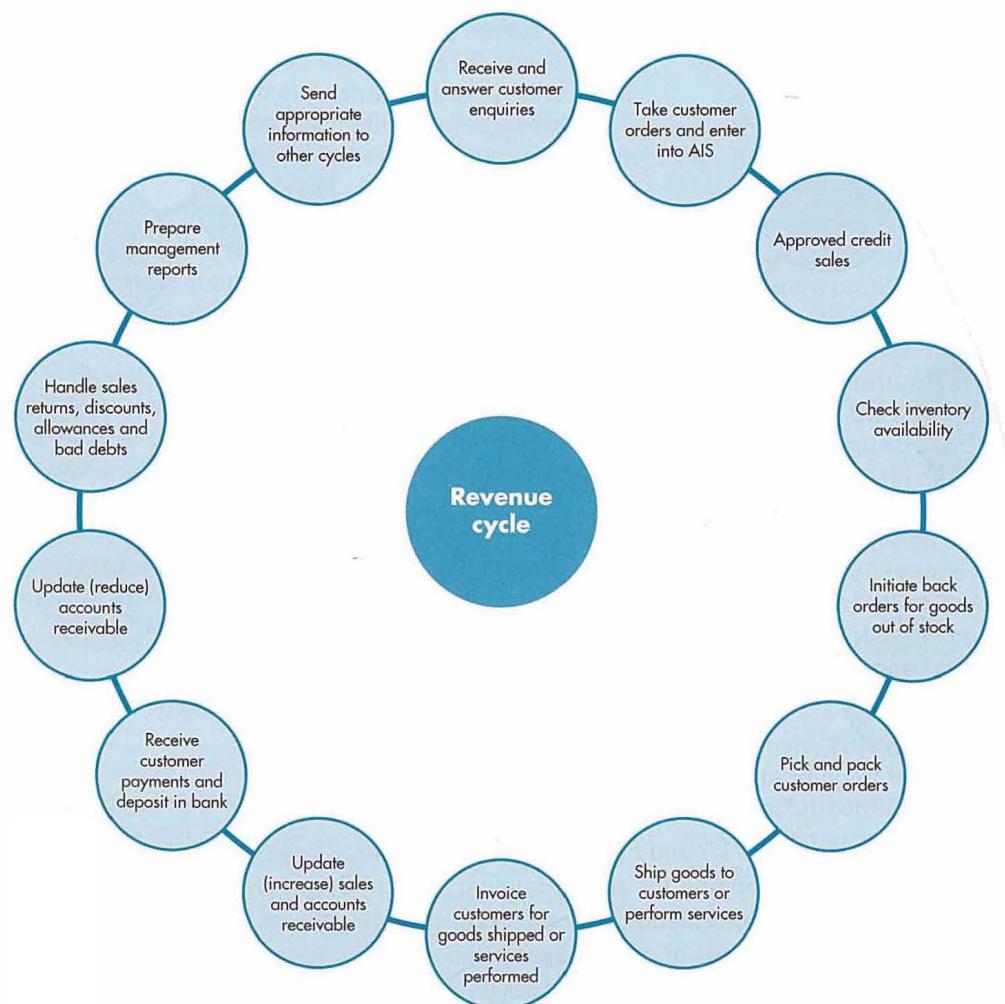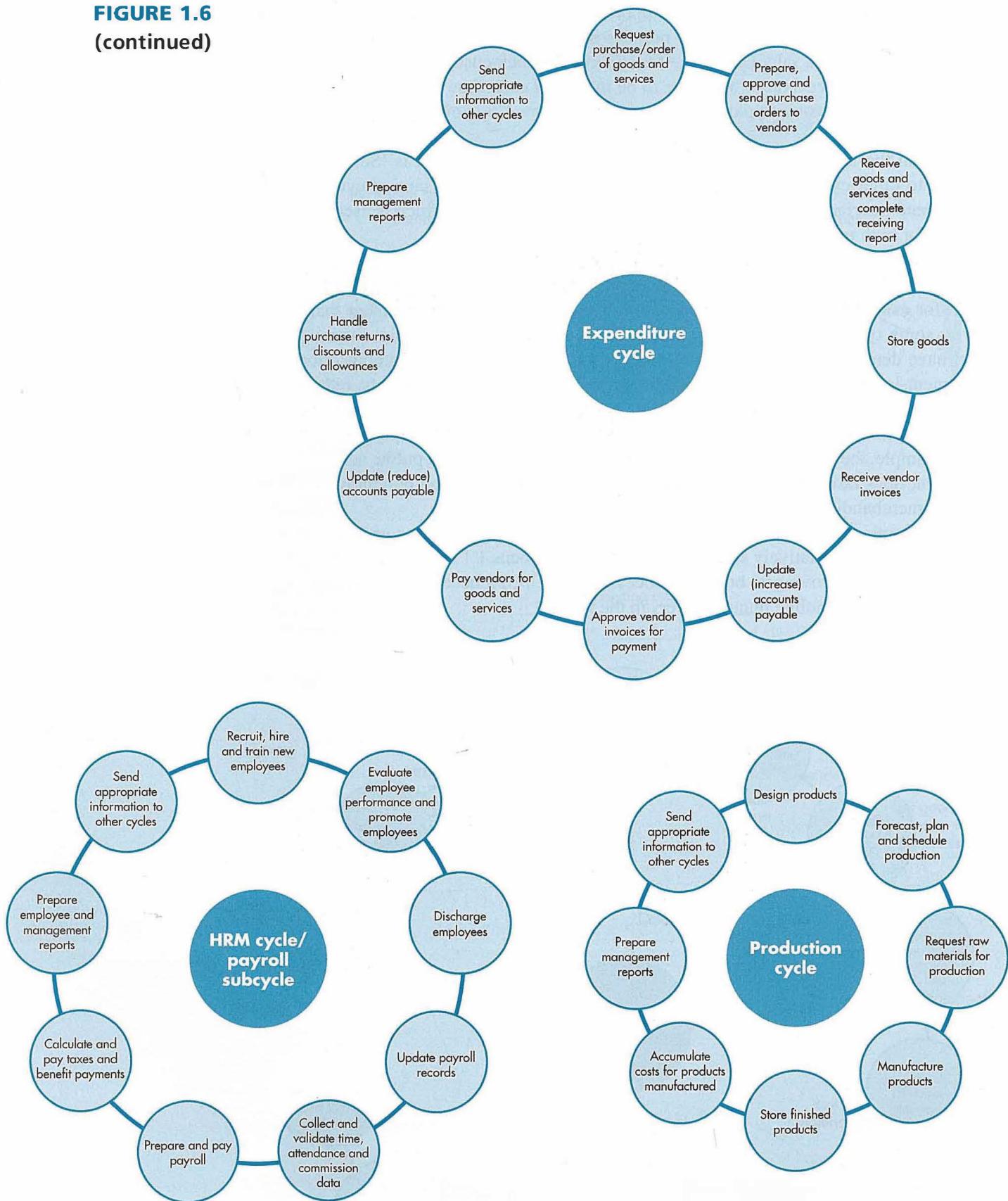
FIGURE 1.6
Activities of each transaction cycle

FIGURE 1.6
(continued)

Expenditure cycle

- Request purchase/order of goods and services
- Prepare, approve and send purchase orders to vendors
- Receive goods and services and complete receiving report
- Store goods
- Receive vendor invoices
- Update (increase) accounts payable
- Approve vendor invoices for payment
- Pay vendors for goods and services
- Update (reduce) accounts payable
- Handle purchase returns, discounts and allowances
- Prepare management reports
- Send appropriate information to other cycles

HRM cycle/payroll subcycle

- Recruit, hire and train new employees
- Evaluate employee performance and promote employees
- Discharge employees
- Update payroll records
- Collect and validate time, attendance and commission data
- Prepare and pay payroll
- Calculate and pay taxes and benefit payments
- Prepare employee and management reports
- Send appropriate information to other cycles

Production cycle

- Design products
- Forecast, plan and schedule production
- Request raw materials for production
- Manufacture products
- Store finished products
- Accumulate costs for products manufactured
- Prepare management reports
- Send appropriate information to other cycles

After preparing Table 1.2 and Figure 1.3, Scott and Susan believe that they understand S&S well enough to begin shopping for an information system. Susan recalled a previous employer that had several separate information systems, because their software was not designed to accommodate the information needs of all managers. She also vividly recalled attending one meeting where she witnessed the negative effects of having multiple systems. The head of marketing had one report on year-to-date sales by product, the production manager had a different report that
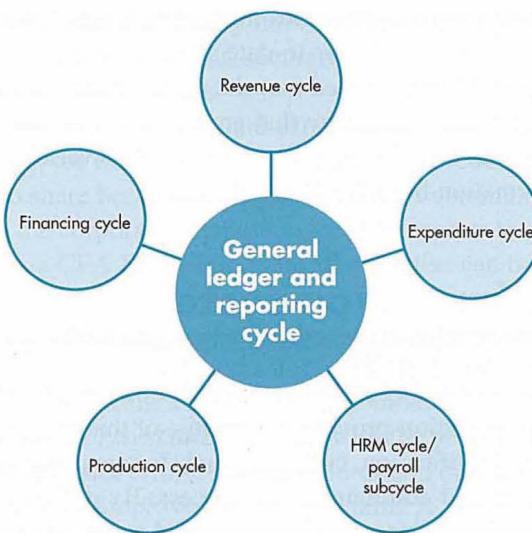
Improving business processes helps drive Toyota's success

FOCUS 1.1

Toyota builds three models—Camry, Hybrid Camry and Aurion—in Australia. The fully integrated Altona manufacturing plant incorporates state-of-the-art weld, paint and assembly shops to produce cars that have been independently recognised as Australia's best quality locally built vehicles. Toyota Australia manufactured a record 119 455 vehicles and 88 864 engines at the Altona plant in 2010.[13]

A major factor in its success is the Toyota Production System (TPS), which is a set of philosophies, principles and business processes supported by IT. Its goal is to improve continually so Toyota has the most effective and most efficient manufacturing and business processes possible. Toyota willingly shares the TPS and its manufacturing and business processes with its suppliers to help them improve their quality and efficiency. It also shares the TPS with its competitors, knowing that by the time they duplicate it Toyota will have a greatly improved TPS.[14]

The following are some of the principles and business processes on which the TPS is built and which Toyota's information systems must support and enable.

- Performance-monitoring software warns assembly line workers of equipment problems. Workers stop production whenever necessary to prevent or correct defects.
- Its just-in-time (JIT) inventory system is one of the most sophisticated in the world. Driverless carts take parts to assembly stations when they are needed so that inventory does not pile up. Suppliers must meet rigid delivery standards. Four hours before they are needed, Toyota software electronically notifies Johnson Controls of exactly what kind of car seats are needed for each car and the exact order in which they must be shipped.

- Continuous improvement is a critical and ongoing process. No process or detail is too small or insignificant o improve. Technology is especially important in the continuous improvement process. This emphasis on continuous improvement creates a culture that values continuous learning and embraces change.
- Electronic displays connected to the manufacturing equipment help workers monitor the assembly line. Information is communicated by light colours (green means the process is operating correctly, yellow means a problem is being investigated and red means the assembly line has stopped) and by printed messages (which machine malfunctioned, its speed and temperature when it broke down, and who was operating the machine).
- Electronic quality control devices, such as an electronic sensor on a tool or a beam of light, monitor a process. These devices let a computer know when a tool is not used or a required part is not picked up and used at the appropriate time.
- More than half of Toyota's information systems employees work in operations at its plants so they can accompany executives, team leaders and factory workers when they go to solve assembly line problems.

In summary, Toyota has a very clear and in-depth understanding of the business processes that make it successful, continuously improves those process, and understands the role information systems play in managing, supporting and facilitating those processes.

Source: Adapted from M. Duvall (2006). 'What's driving Toyota', *Baseline Magazine*, 5 September.

contained different sales figures, and the controller's report, which was produced by the general ledger cycle, had yet a third version of year-to-date sales. Over an hour was wasted trying to reconcile those different reports! Susan vowed that she would make sure that S&S did not ever find itself in such a mess. She would make sure that any system selected would have the capability to integrate both financial and non-financial data about S&S's various business processes so that everyone could pull information from the same system.

Accounting information systems

It has often been said that accounting is the language of business. If that is the case, then an AIS is the intelligence—the information-providing vehicle—of that language.

Accounting is a data identification, collection and storage process as well as an information development, measurement and communication process. By definition, accounting is an information system, since an AIS collects, records, stores, and processes accounting and other data to produce information for decision-makers. This is illustrated in Figure 1.8.

An AIS can be a paper-and-pencil manual system, a complex system using the latest in IT, or something in between. Regardless of the approach taken, the process is the same. An AIS must collect, enter, process and store data as well as report information. Paper and pencil or computer hardware and software are merely tools used to produce information.

This text does not distinguish an AIS from other information systems. Instead, our viewpoint is that an AIS can and should be an organisation's primary information system and that it provides users with information they need to perform their jobs.

There are six components of an AIS:
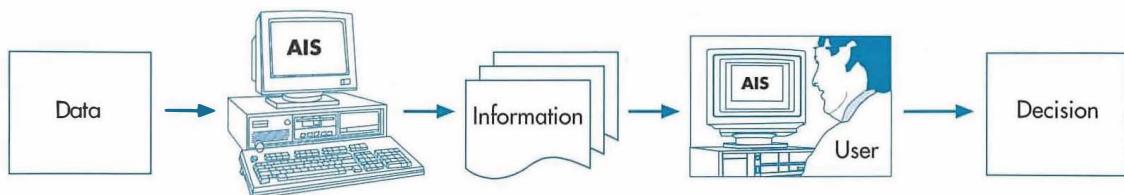
1. *people* who use a system
2. *procedures and instructions* used to collect, process and store data
3. *data* about an organisation and its business activities
4. *software* used to process data
5. *IT infrastructure,* including computers, external devices (e.g. printers, external hard drives), and network communications devices used in an AIS
6. *internal controls and security measures* that safeguard AIS data.

These six components enable an AIS to fulfil three important business functions:

1. collect and store data about organisational activities, resources and personnel—organisations have a number of business processes, such as making a sale or purchasing raw materials, which are repeated frequently
2. transform data into information so management can plan, execute, control and evaluate activities, resources and personnel—decision-making is discussed later in this chapter
3. provide adequate controls to safeguard an organisation's assets and data—control concepts are overviewed in Chapter 5 and discussed in detail in Chapters 12 to 17.

FIGURE 1.8

An AIS processes data to produce information for decision-makers

How an AIS can add value to an organisation

A well-designed AIS can add value to an organisation by:

1. *improving the quality and reducing costs of products or services*—for example, an AIS can monitor machinery so that operators are notified immediately when performance falls outside acceptable quality limits; this helps maintain product quality, reduces waste and lowers costs

2. *improving efficiency*—for example, timely information makes a just-in-time manufacturing approach possible, as it requires constant, accurate, up-to-date information about raw materials inventories and their locations

3. *sharing knowledge*—sharing knowledge and expertise can improve operations and provide a competitive advantage; for example, certified practicing accountant (CPA) firms use their information systems to share best practices and to support communication between offices; employees can search the corporate database to identify experts to provide assistance for a particular client; thus, a CPA firm's international expertise can be made available to any local client

4. *improving efficiency and effectiveness of its supply chain*—for example, allowing customers to directly access inventory and sales order entry systems can reduce sales and marketing costs, thereby increasing customer retention rates

5. *improving the internal control structure*—an AIS with the proper internal control structure can protect systems from fraud, errors, system failures and disasters

6. *improving decision-making*—improved decision-making is vitally important and is discussed below in more detail.

Decision-making is a complex, multi-step activity: identify the problem, collect and interpret information, evaluate ways to solve the problem, select a solution methodology, and implement the solution. An AIS can provide assistance in all phases of decision-making. Reports can help to identify potential problems. Decision models and analytical tools can be provided to users. Query languages can gather relevant data to help make decisions. Various tools, such as graphical interfaces, can help a decision-maker interpret decision model results, evaluate them and choose among alternative courses of action. In addition, an AIS can provide feedback on results of actions.

An AIS can help improve decision-making in several ways:

- it can identify situations requiring management action—for example, a cost report with a large variance might stimulate management to investigate and, if necessary, take corrective action
- it can reduce uncertainty and thereby provide a basis for choosing among alternative actions
- it can store information about results of previous decisions, which provides valuable feedback that can be used to improve future decisions—for example, if a company tries a particular marketing strategy and the information gathered indicates that it did not succeed, a company can use that information to select a different marketing strategy
- it can provide accurate information in a timely manner—for example, Wal-Mart, Coles and Myer have enormous databases that contain detailed information about sales transactions at each store; they use this information to optimise the amount of each product carried at each store
- it analyses sales data to discover items that are purchased together, and it uses such information to improve the layout of merchandise to encourage additional sales of related items—in a similar vein, Amazon.com uses its database of sales activity to suggest additional books for customers to purchase.
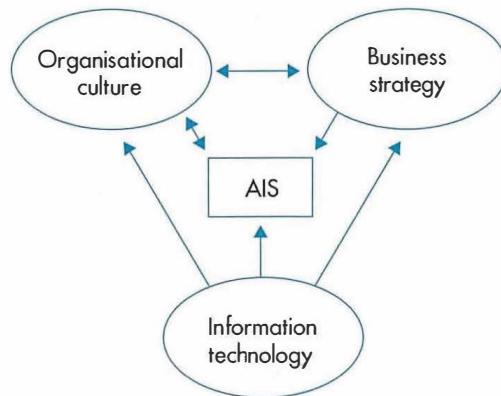
AIS and corporate strategy

Since most organisations have limited resources, it is important to identify AIS improvements likely to yield the greatest return. Making a wise decision requires an understanding of an organisation's overall business strategy. To illustrate, consider the results of a survey of Australian chief information officers (CIOs) conducted by a CIO magazine. Asked to identify the most important CIO management priorities, aligning IT and strategic goals of the organisation was one of the top priorities in 2008 and second in 2010. Long-term strategic thinking and planning was the most critical leadership capability.[15]

Figure 1.9 shows three factors that influence the design of an AIS: developments in IT, business strategy and organisational culture. It is also important to recognise that the design of an AIS can influence an organisation's culture by controlling the flow of information within an organisation. For example, an AIS that makes information easily accessible and widely available is likely to increase pressures for more decentralisation and autonomy.

IT developments can affect business strategy. For example, the internet has profoundly affected ways many activities are performed, significantly affecting both strategy and strategic

FIGURE 1.9

Factors influencing design of an AIS

positioning. The internet dramatically cuts costs, thereby helping companies to implement a low-cost strategy. If every company used the internet to adopt a low-cost strategy, then the effects might be problematic. Indeed, one possible outcome may be intense price competition among firms, with the likely result that most cost savings provided by the internet get passed on to an industry's customers, rather than being retained in the form of higher profits. Moreover, because every company can use the internet to streamline its activities, a company is unlikely to gain a sustainable long-term competitive advantage.

Many other technological advances affect company strategy and provide an opportunity to gain a competitive advantage. An example is *predictive analysis,* [16] which uses data warehouses and complex algorithms to forecast future events, based on historical trends and calculated probabilities. Predictive analysis provides an educated guess of what one may expect to see in the near future, allowing companies to make better business decisions and improve their processes. FedEx uses predictive analysis to predict, with 65% to 90% accuracy, how customers respond to price changes and new services.[17] Stock market analysts are using predictive analysis to predict short-term trends in the stock market.

An organisation's AIS plays an important role in helping it adopt and maintain a strategic position. Achieving a close fit among activities requires that data be collected about each activity. It is also important that an information system collects and integrates both financial and non-financial data about an organisation's activities.

Focus 1.2 shows how an information system that was used to create and implement a balanced scorecard helped the Ministry of Work Bahrain define and execute its strategy.

Role of an AIS in a value chain

To provide value to their customers, most organisations perform a number of different activities. Figure 1.10 shows that those activities can be conceptualised as forming a *value chain* consisting of *five primary activities* that directly provide value to customers:

1. *Inbound logistics* consist of receiving, storing and distributing materials an organisation uses to create services and products it sells. For example, an automobile manufacturer receives, handles and stores steel, glass and rubber.
2. *Operations* activities transform inputs into final products or services. For example, motor vehicle assembly line activities convert raw materials into a finished car.
3. *Outbound logistics* activities distribute finished products or services to customers. An example is shipping automobiles to car dealers.
4. *Marketing and sales* activities help customers buy an organisation's products or services. Advertising is an example of a marketing and sales activity.
5. *Service* activities provide post-sale support to customers. Examples include repair and maintenance services.

Support activities allow the five primary activities to be performed efficiently and effectively. They are grouped into four categories:

1. *Firm infrastructure* is usually made up of accounting, finance, legal and general administration activities that allow an organisation to function. An AIS is part of a firm's infrastructure.

FOCUS 1.2 The use of information systems to integrate a balanced scorecard with strategy implementation

The Kingdom of Bahrain, United Arab Emirates, aimed to achieve economic and social transformation. It knew that its oil reserves would eventually run out and it needed to become less dependent on the revenue it generated. An Office of Strategy Management was established to facilitate the strategic management process that included the creation and implementation of a world-class balanced scorecard system for which it was inducted into the prestigious Balanced Scorecard Hall of Fame in 2009.

The Office of Strategy Management used a long-range strategy called Bahrain Vision 2030, which took four years of consultation and was presented to the Kingdom by the Economic Development Board in November 2007. In 2008 the Ministry of Works with 1600 professional staff and responsibility for roads, utilities and construction of public works mapped its strategy against the Kingdom's vision and integrated with the other 15 ministries. They used the balanced scorecard approach to do this mapping of strategy with the vision.

Implementing a sound process for prioritising initiatives is crucial as budgets are bound by initiatives and projects. These budgets need to be submitted to the Ministry of Finance in a timely fashion to be integrated into the Kingdom's budget. After the creation of the overall budget checks need to be made to align it back to the Bahrain Vision 2030 using the balance scorecards of sectors and directorates.

Given the size of the strategic management and scorecard effort, the Office of Strategy Management (OSM) was formed. They adopted the evidence-based management framework and methodology described in Bernard Marr's book *The Intelligent Company: Five Steps to Success with Evidence-Based Management*.[18] The key steps in this model, which is fed with the business strategy and supported by the IT infrastructure and business intelligence applications, are:

1. define objectives and information needs
2. collect the right information
3. analyse the data and gain insights
4. present and communicate the information
5. make evidence-based decisions.

Automation played a critical role in improving strategic management. The balanced scorecard system improved decision-making, performance management and tracking progress of projects. It also handled the large documentation and reporting required. This had previously been handled by SharePoint but was found to be insufficient for the needs they had and the demands for strategic management information.

Source: Based on B. Marr & J. Creelman (2010). *Creating and Implementing a Balanced Scorecard: The Case of the Ministry of Works—Bahrain, Management Case Study*, The Advanced Performance Institute, <www.ap-institute.com>.

2. Human resources activities include recruiting, hiring, training and compensating employees.
3. *Technology* activities improve a product or service. Examples include research and development, investments in IT and product design.
4. *Purchasing* activities procure raw materials, supplies, machinery and buildings used to carry out primary activities.

FIGURE 1.10
Value chain

Support activities

1. Firm infrastructure
2. Human resources
3. Technology
4. Purchasing

1. Inbound logistics	2. Operations	3. Outbound logistics	4. Marketing and sales	5. Service
Receiving and storing materials	Manufacturing Repackaging	Distribution Shipping	Advertising Selling	Repair Maintenance

Primary activities
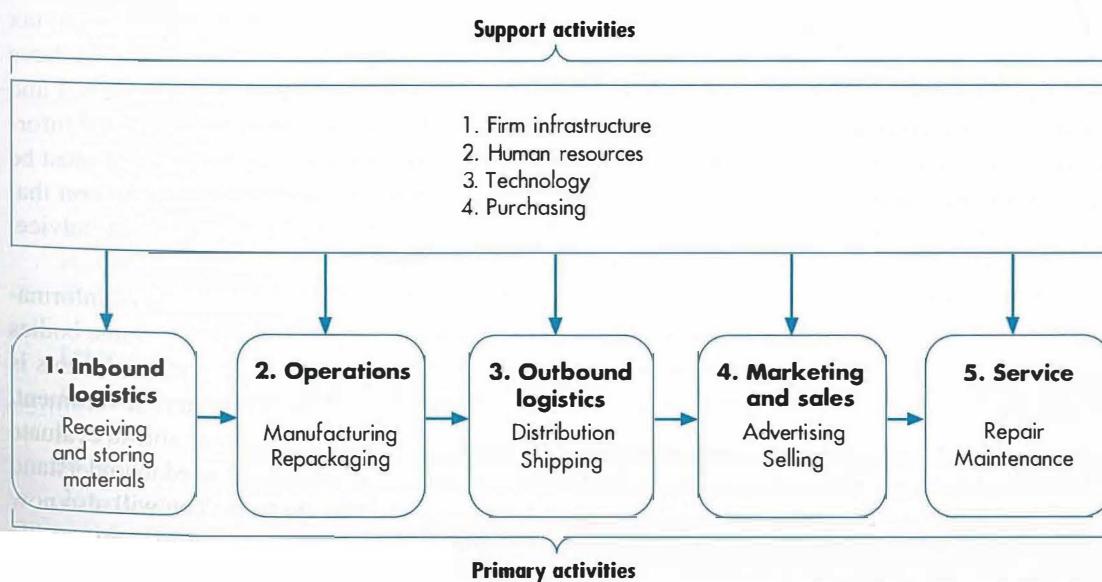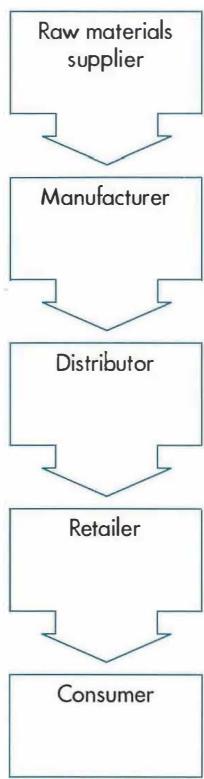
FIGURE 1.11
Supply chain

Using IT to redesign supply chain systems yields tremendous benefits and cost savings. For example, a power generator reengineered its supply chain and created an enterprise-wide system that provides up-to-the-minute information, rather than the 'current once a day' system that it replaced. The new system replaced 20 smaller and incompatible systems, reduced head count by 89 people, and saved $270 million in its first five years.[19]

An organisation's value chain is a part of a larger system called a *supply chain*. As shown in Figure 1.11, a manufacturing organisation interacts with its suppliers and distributors. By paying attention to its supply chain, a company can improve its performance by helping others in a supply chain to improve their performance. For example, S&S can improve its purchasing and inbound logistics activities by implementing a more efficient just-in-time inventory management system that reduces its costs and minimises the capital tied up in inventory. S&S can reap additional benefits if it links its new systems with its suppliers so they can perform their primary value chain activities more efficiently. For example, by providing more detailed and timely information about its inventory needs, S&S suppliers can more efficiently plan their production schedules. Part of the resultant cost reduction can be passed on to S&S in the form of lower product costs.

The problems created by an ineffective supply chain are illustrated by USA retail giant Limited Brands. Limited experienced explosive growth, including acquisitions of other retail companies such as Victoria's Secret and Abercrombie & Fitch. These acquisitions left Limited with a tangled web of over 60 incompatible information systems. The problems came to a head one night when 400 delivery trucks converged on a distribution centre car park that could fit only 150 vehicles. The trucks blocked traffic along all the highways around the distribution centre and caused countless traffic and community problems. No one in Limited knew where all the delivery trucks came from, what the merchandise was, or where it was to be sent. Chaos reigned for some time, until the merchandise could be routed to stores and other distribution centres. Limited solved many of its problems by installing a new, integrated system that greatly improved its supply chain processes and technologies. Developing the new system was not easy. Limited has over a thousand suppliers and sells its merchandise using various platforms, including retail stores, the internet, catalogues and third-party retailers.[20]

Why study accounting information systems?

Since accounting data comes from an AIS, AIS knowledge and skills are critical to an accountant's career success. Interacting with an AIS is one of the most important activities that accountants perform. Other important AIS-related activities include designing internal control systems and business process improvements, topics covered in detail in this text. Here are some other reasons why you need a knowledge of AIS if you are going to practice as an accountant, chief financial officer (CFO) or even a chief executive officer (CEO).

Many of the courses you study in your accounting program focus on your role as a user or provider of information (e.g. preparing financial statements), such as financial, managerial, tax and auditing. Most of these courses assume that data has been collected and stored and you have access to that data. But these courses do not describe or discuss how the data is collected and protected. The information system is treated as a 'black box' into which data is poured and information comes out. Some people assume that if a computer has produced information 'it must be right'. Even at this stage of your reading this text, you must have gathered the impression that this assumption is not valid; things can go wrong. As an accountant you need to provide advice, if not a full solution, to issues that arise from an AIS.

All accounting bodies in Australia, New Zealand and Asia require the inclusion of information systems design, development and applications in accredited accounting degrees. Some bodies make it compulsory where others recommend the AIS area to be included. The reason for this is that it is important if you are going to pursue a career in public accounting, industry, government, not-for-profit organisation or management consulting. As an auditor you need to be able to evaluate the accuracy and reliability of information produced from an AIS. To do so you need to understand how a system is developed, how it operates and how you can instigate controls. You will also now need to understand that an organisation's AIS may be vulnerable to attack from inside and outside of the firm you audit as companies become more virtual due to the effects of globalisation and

competition. You or your peers may become an accountant in the private or public sector where you could eventually become involved in development of strategy. We showed in Figure 1.9 on page 18 the factors that influence the design of an AIS, one of which was IT. With continuous change in the IT sector, you need to keep up with future trends so that as the main advisor on accounting and finance matters, you can make suggestions and recommendations that do not lock your firm into outdated technologies in the medium to long term.

The other important reason that you need to understand accounting information systems is that as IT pervades all organisations, it makes it easier and easier for employees to act unethically by committing fraud, misappropriating assets, accepting bribes and misstating a company's financial position. Ethics is a major issue for the accounting and auditing professions as they have been found to collude with management to sign-off statements that do not show a 'true and fair' view of a company's position. In the next section we provide a framework for analysing an ethical issue to help you make an appropriate decision should you uncover unethical behaviours.

Ethics in accounting and information systems

As you will discover when you read Chapters 5 and 12, fraud and corruption is mainly perpetrated by employees, 'knowledgeable insiders' who know the systems and controls in their organisation and see an opportunity to embezzle assets of their company. Some have manipulated the accounts to mislead shareholders and other stakeholders such as the share market, banks and governments. This latter form of unethical behaviour is called *earnings management*. Many notorious cases have been publicised of companies that produced financial statements that do not reflect actual profits and asset values. On a global scale, Enron and WorldCom in the USA are among the best known.

In Australia, HIH and One.Tel raised the consciousness of the accounting profession and the public to issues of ethical misconduct. More recently, Clive Peeters[21] and the Queensland Health[22] fraud cases have shown that employees are still misappropriating assets of their organisations.

Stories relating to 'golden handshakes', 'golden parachutes' and share option schemes for senior management have exposed the ethical behaviour of managers to a high level of scrutiny and comment. Accountants can help to prevent unfair practices or corruption by presenting a complete and accurate record of business transactions. Ultimately, however, good practice depends upon people in business following acceptable standards of conduct.

Corporate and professional codes of ethics

Most large businesses and governments have a code of ethics embodied in a set of principles of good corporate governance or code of conduct designed to encourage employees to behave ethically and responsibly. However, a set of general guidelines may not be specific enough to identify misbehaviour, and a list of dos and don'ts can lead to the false view that anything is okay if it isn't specifically forbidden.

Accountants have incentives to behave ethically. As professionals, they are expected to maintain higher standards than society in general. Their ability to attract business depends entirely on their reputation. Codes of Conduct have been developed by the CPAA <www.cpaaustralia. com.au>, ICAA, <www.charteredaccountants.com.au>, IPA <www.publicaccountants.org.au> and CIMA <www.cimaglobal.com/Our-locations/Australia>. These documents set minimum standards of conduct for members. Unacceptable actions can result in expulsion from the organisation, which makes it difficult for the person to remain in the accounting profession.

Ethical issues in accounting

In many situations, the ethical choice is easy. For example, stealing cash is obviously unethical as well as illegal. If cashiers steal money from an employer, that action can land them in prison. In other cases, choices are more difficult. However, in every instance, ethical judgments boil down to a personal decision: What should I do in a given situation?

Let's consider three ethical issues in accounting. The first two are easy to resolve. The third issue is more difficult.

Situation 1   Gavin Finlay is preparing the income tax return of a client who has earned more income than expected. On 2 July, the client pays for advertising and asks Finlay to backdate the expense to the preceding financial year, which ends on 30 June. Backdating the deduction would lower the client's immediate tax payments. After all, there is a difference of only two days between 2 July and 30 June. This client is important to Finlay. What should he do?

> Finlay should refuse the request because the transaction took place in July of the new tax year.

Situation 2   Kim Ho's software company owes $40 000 to the ANZ Bank. The loan agreement requires Kim's company to maintain a current ratio (current assets divided by current liabilities) of 1.50 or higher. At present, the company's current ratio is 1.40. At this level, Kim is in violation of her loan agreement. She can increase the current ratio to 1.53 by paying off some current liabilities right before year-end. Is it ethical to do so?

> Yes, because the action is a real business transaction. Kim should be aware that paying off the liabilities is only a delaying tactic. It will hold off the bank for now, but the business must improve in order to keep from violating the agreement in the future.

Situation 3   David Duncan, the lead auditor of Enron Corporation, thinks Enron may be understating the liabilities on its balance sheet. Enron's transactions are very complex, and outsiders may never figure this out. Duncan asks his firm's Standards Committee how he should handle the situation. They reply, 'Require Enron to report all its liabilities'. Enron is Duncan's most important client, and Enron is pressuring him to certify liabilities. Duncan can rationalise that Enron's reported amounts are okay. What should he do?

> To make his decision, Duncan could follow the following outlined stakeholder analysis framework.[23]

Stakeholder analysis framework

Weighing tough ethical judgments requires a decision framework, such as a *stakeholder analysis framework*. One way to do it is to follow a decision framework that takes all stakeholders' effects into account before arriving at the most ethical action to take. Answering these four questions will guide you through tough decisions. Let's apply them to David Duncan's situation.

You can use this framework to analyse other ethical decisions, including those that have been presented throughout this text. See Exhibit 1.1 for an extract from the Code of Conduct for the Queensland Public Service.

Ethical issues in information systems

As we indicated earlier, computer technologies are revolutionising how organisations do business and disseminate information. But this proliferation of computers and information systems are creating ethical dilemmas. New issues need to be faced in relation to rights and responsibilities in the use of information. However, the law seems to lag behind the speed at which technologies are implemented and information is disseminated. This makes it difficult to capture, in standards and codes of conduct, what the right thing to do is. Thus employees may not have good guidelines on what is appropriate behaviour in their use of company computer resources.

There are moral choices to be made by staff in relation to data that is gathered from customers and suppliers as well as employees. These revolve around issues of control and access to private and confidential data, and misuse of data stored in large databases and data warehouses. These concerns are heightened when that type of data leaves an organisation across networks and when people other than employees have access to data, such as suppliers. With the use of the internet and cloud-based storage of data, accountants are faced with new challenges about control and access.

Another issue that produces ethical dilemmas is the proliferation of computers within an organisation. Everyone in a firm has a PC or terminal on their desk. Most business activities and processes are conducted through a digital device whether hand-held or on a desktop. This may mean that sometimes staff may use the technology for other than business purposes.

Exhibit 1.1   Extract from Queensland Public Service Code of Conduct

Principle and values
Integrity and impartiality
The *Public Sector Ethics Act 1994* states:

In recognition that public office involves a public trust, public service agencies, public sector entities and public officials seek to promote public confidence in the integrity of the public sector and –

a. are committed to the highest ethical standards;
b. accept and value their duty to provide advice which is objective, independent, apolitical and impartial;
c. show respect towards all persons, including employees, clients and the general public;
d. acknowledge the primacy of the public interest and undertake that any conflict of interest issue will be resolved or appropriately managed in favour of the public interest; and
e. are committed to honest, fair and respectful engagement with the community.

Standards of conduct
1.1 Commit to the highest ethical standards
As public service employees we are required to ensure that our conduct meets the highest ethical standards when we are fulfilling our responsibilities.
We will:

a. ensure any advice that we provide is objective, independent, apolitical and impartial
b. ensure our decision-making is ethical
c. engage with the community in a manner that is consultative, respectful and fair, and
d. meet our obligations to report suspected wrongdoing, including conduct not consistent with this Code.

1.2 Manage conflicts of interest
A conflict of interest involves a conflict between our duty, as public service employees, to serve the public interest and our personal interests. The conflict may arise from a range of factors including our personal relationships, our employment outside the public service, our membership of special interest groups, or our ownership of shares, companies, or property.

As public service employees we may also experience conflicts of interest between our public service ethics and our professional codes of ethics (for example, as health care professionals or as lawyers), or with our personal beliefs or opinions.

Having a conflict of interest is not unusual and it is not wrongdoing in itself. However, failing to disclose and manage the conflict appropriately is likely to be wrongdoing.

As public service employees we are committed to demonstrating our impartiality and integrity in fulfilling our responsibilities and as such we will:

a. always disclose a personal interest that could, now or in the future, be seen as influencing the performance of our duties. This will be done in accordance with our agency policies and procedures,
b. actively participate with our agency in developing and implementing resolution strategies for any conflict of interest, and
c. ensure that any conflict of interest is resolved in the public interest.

Source: Queensland Government (2010). *Code of Conduct for the Queensland Public Service*, Public Service Commission. © The State of Queensland (Public Service Commission) 2010.

The question is what is acceptable use? The way to disseminate acceptable behaviour is to have a written policy outlining what is permitted and any restrictions. Thus a policy may include that during breaks (e.g. lunch time), firm computers can be used for private matters, provided that no illegal, disruptive or obscene activities or communications are undertaken. At the same time, companies have the ability to track staff's activities on firms' computers as well as tracking how much work is actually done to measure productivity. This throws up privacy issues and employees' rights to know what is being tracked and accessed. Although many people don't know it, all emails are stored on a company's server and they can be read by anyone who has access to the mail server, such as IT staff. What is tracked needs to be included in the policy and all staff need to be reminded regularly about what is acceptable.

Some companies have a log-on screen which requires an employee to tick that they have read and understood the policy before they get access to the company's network and information resources. In Part 3 we will discuss some of the controls required in accounting information systems to guard against misuse of system and technology resources.

Summary and case conclusion

Susan and Scott reflected on what they did to try and understand what decisions S&S would need to make and the information needed to make them. They began by obtaining an understanding of S&S's basic business processes and of the key decisions that must be made to operate the

TABLE 1.3 Template to use when confronting an ethical issue

Question	Decision guidelines
1. *What is the ethical issue?*	1. *Recognise the ethical issue or dilemma.* The root word of ethical is *ethics*, which the *Oxford Dictionary* defines as 'a set of moral principles, especially ones relating to or affirming a specified group, field or form of conduct'. Duncan's ethical dilemma is to decide what he should do with the information he has uncovered.
2. *What are the principle elements in this situation?*	2. *Move towards an ethical resolution by answering these questions in sequence.*
a. What parties (stakeholders) may be harmed?	a. Investor, financiers such as banks, creditor; in the long-run, employees
b. Whose rights or claims may be violated?	b. Investor, financiers, creditor
c. Which specific interests are in conflict?	c. To deliberately understate liabilities on the balance sheet is dishonest, possibly fraudulent and unethical. It contravenes most of the fundamental principles of the APES 110 Code of Ethics for Professional Accountants: Integrity, Objectivity, Professional Competence and Due Care, and Professional Behaviour.[24]
d. What are Duncan's (my) responsibilities and obligations?	d. Auditors are bound by their profession's Code of Ethics and they have a duty of care that extends beyond the firm, colleagues and shareholders and includes other stakeholder groups who may not have a financial interest in the firm, including the community
3. *What are Duncan's options and what are the consequences?*	3. *Specify alternatives and weigh up impacts of each on various stakeholders.* For David Duncan, the alternatives include: a. go along with Enron's liabilities as reported, or b. force Enron to report higher amounts of liabilities. Impact of alternatives on stakeholders include: a. If Duncan certifies Enron's present level of liabilities—and if no one ever objects—Duncan will keep this valuable client. But if Enron's actual liabilities turn out to be higher than reported, Enron investors may lose money and take Duncan to court. That would damage his reputation as an auditor and hurt his firm. b. If Duncan follows his company policy, he must force Enron to increase its reported liabilities. That will anger the company, and Enron may fire Duncan as its auditor. In that case, Duncan will save his reputation, but it will cost him some business in the short run.
4. *What shall I do?*	4. *Select the best or most ethical alternative considering all the circumstances and consequences.* In fact, Duncan went along with Enron and certified the company's liabilities. He acted against his firm's policies. Enron later admitted understating its liabilities, Duncan had to retract his audit opinion and Duncan's firm, Arthur Andersen, was closed down. Duncan should have followed ethical principles as well as firm policy. Not doing so cost him and many others dearly.

Source: C.T. Horngren, P. Best, D. Fraser & R. Willett (2009). *Financial Accounting* 6th edition, Pearson Australia, Sydney.

business effectively. They followed that with an analysis of the internal and external parties that the AIS would have to interact with and the information the AIS would have to provide them.

Since S&S is a retail merchandising company, its business processes could be described in terms of four basic transaction cycles:

1. The *revenue cycle* encompasses all transactions involving sales to customers and collections of cash receipts for those sales.
2. The *expenditure cycle* encompasses all transactions involving purchase of and payment for merchandise sold by S&S, as well as other services it consumes, such as rent and utilities.
3. The *HRM cycle/payroll subcycle* encompasses all transactions involving hiring, training and payment of employees.
4. The *financing cycle* encompasses all transactions involving investment of capital in the company, borrowing money, payment of interest and loan repayments.

These four cycles interface with the *general ledger and reporting cycle,* which consists of all activities related to preparation of financial statements and other managerial reports.

Scott and Susan will need a well-designed AIS to provide information they need to effectively plan, manage and control their business. Their AIS must be able to process data about sales and cash receipts, purchasing and paying for merchandise and services, payroll and tax-related

transactions as well as acquiring and paying for fixed assets. The company's AIS must also provide information needed to prepare financial statements.

Fortunately, there are many computer-based accounting packages available for the retail industry. As they begin looking at various software packages, however, Scott and Susan quickly learn that considerable accounting knowledge is required to choose the one that will best fit their business. Because neither has an accounting background, Scott and Susan decide that their next task will be to hire an accountant.

Key terms

accounting information system (AIS) (5)
Agency Theory (5)
business process (11)
data (8)
data overload (8)
earnings management (21)
enterprise resource planning (ERP) system (7)
expenditure cycle (11)
firm infrastructure (18)
financing cycle (11)
general ledger and reporting cycle (11)
'give-get' exchange (11)

goal conflict (7)
goal congruence (7)
human resources management (HRM) cycle/payroll subcycle (11)
inbound logistics (18)
information (8)
information technology (IT) (6)
Metcalfe's Law (7)
Moore's Law (7)
outbound logistics (18)
predictive analysis (18)
price mechanism (4)

primary activities (18)
production (conversion) cycle (11)
revenue cycle (11)
stakeholder analysis framework (22)
supply chain (20)
support activities (18)
system (7)
Theory of the Firm (4)
transaction (11)
transaction cycle (11)
transaction processing (11)
value chain (18)
value of information (8)

AIS IN ACTION

Chapter quiz

Q1.1 Data differ from information in which way?
    a. data are output and information is input
    b. information is output and data are input
    c. data are meaningful bits of information
    d. there is no difference

Q1.2. Which of the following is NOT a characteristic that makes information useful?
    a. it is reliable   c. it is inexpensive
    b. it is timely   d. it is relevant

Q1.3. Which of the following is a primary activity in the value chain?
    a. purchasing   c. post-sales service
    b. accounting   d. HRM

Q1.4. Which transaction cycle includes interactions between an organisation and its suppliers?
    a. revenue cycle   c. HRM cycle/payroll subcycle
    b. expenditure cycle   d. general ledger and reporting cycle

Q1.5. Which of the following is NOT a means by which information improves decision-making?
    a. increases information overload
    b. reduces uncertainty

    c. provides feedback about the effectiveness of prior decisions
    d. identifies situations requiring management action

Q1.6. In the value chain concept, upgrading IT is considered to be what kind of activity?
    a. primary activity
    b. support activity
    c. service activity
    d. structured activity

Q1.7. In which cycle does a company ship goods to customers?
    a. production cycle
    b. financing cycle
    c. revenue cycle
    d. expenditure cycle

Q1.8. Which of the following is a function of an AIS?
    a. reducing the need to identify a strategy and strategic position
    b. transforming data into useful information
    c. allocating organisational resources
    d. automating all decision-making

Q1.9. A firm, its suppliers, and its customers collectively form which of the following?
    a. supply chain
    b. value chain
    c. ERP system
    d. AIS

Q1.10. A report telling how well all approved vendors have performed in the prior 12 months is information that is MOST needed in which business process?
    a. paying vendors
    b. acquiring inventory
    c. selling merchandise
    d. paying employees

Ethical issue

Gavin Finlay is preparing the income tax return of a client who has earned more income than expected. On 2 July, the client pays for advertising and asks Finlay to backdate the expense to the preceding financial year, which ends on 30 June. Backdating the deduction would lower the client's immediate tax payments. After all, there is a difference of only two days between 2 July and 30 June. This client is important to Finlay. What should he do?[25]

Required

Use the stakeholder analysis framework described in this chapter to analyse the ethical dilemma you identify and arrive at an ethical decision.

Discussion questions

D1.1. The value of information is the difference between benefits realised from using that information and costs of producing it. Would you, or any organisation, ever produce information if its expected costs exceeded its benefits? If so, provide some examples. If not, why not?

D1.2. Can the characteristics of useful information listed in Table 1.1 on page 9 be met simultaneously? Or does achieving one mean sacrificing another?

D1.3. You and a few of your classmates decided to become entrepreneurs. You come up with a great idea for a new mobile phone application that you think will make lots of money. Your business plan wins second place in a local competition, and you are using the $10 000 prize to support yourselves as you start your company.
    a. Identify the key decisions you need to make to be successful entrepreneurs, the information you need to make them, and the business processes you will need to engage in.
    b. Your company will need to exchange information with various external parties. Identify the external parties and specify the information received from and sent to each of them.

D1.4. How do an organisation's business processes and lines of business affect the design of its AIS? Give several examples of how differences among organisations are reflected in their AIS.

D1.5. Figure 1.9 on page 18 shows that organisational culture and the design of an AIS influence one another. What does this imply about the degree to which an innovative system developed by one company can be transferred to another company?

D1.6. Figure 1.9 on page 18 shows that developments in IT affect both an organisation's strategy and the design of its AIS. How can a company determine whether it is spending too much, too little, or just enough on IT?

D1.7. Apply the value chain concept to S&S. Explain how it would perform the various primary and support activities.

D1.8. IT enables organisations to easily collect large amounts of information about employees. Discuss the following ethical issues.
   a. To what extent should management monitor employees' emails?
   b. To what extent should management monitor which websites employees visit?
   c. To what extent should management monitor employee performance by, for example, using software to track keystrokes per hour or some other unit of time? If such information is collected, how should it be used?
   d. Should companies use software to electronically 'shred' all traces of email?
   e. Under what circumstances and to whom is it appropriate for a company to distribute information it collects about the people who visit its website?

D1.9. Apply the relevant concepts explained in the theoretical framework to S&S. Do they explain why S&S want to develop an AIS for its various primary and support activities? Discuss and validate your response.

D1.10. How relevant is Coase's 1937 Theory of the Firm to modern organisations?

Problems

P1.1. IT is continually changing the nature of accounting and the role of accountants. Write a two page report describing what you think the nature of the accounting function and the accounting information system in a large company will be like in the year 2020.

P1.2. The annual report is considered by some to be the single most important printed document that companies produce. In recent years, annual reports have become large documents. They now include such sections as letters to the shareholders, descriptions of the business, operating highlights, financial review, management discussion and analysis, a discussion of company internal controls, segment reporting, inflation data and the basic financial statements. The expansion has been due in part to a general increase in the degree of sophistication and complexity in accounting standards and disclosure requirements for financial reporting.

The expansion is also reflective of the change in the composition and level of sophistication of users. Current users include not only shareholders but also financial and securities analysts, potential investors, lending institutions, stockbrokers, customers, employees and—whether the reporting company likes it or not—competitors. Thus, a report that was originally designed as a device for communicating basic financial information now attempts to meet the diverse needs of an ever-expanding audience.

Users hold conflicting views on the value of annual reports. Some argue that they fail to provide enough information, whereas others believe that disclosures in annual reports have expanded to the point where they create information overload. Others argue that the future of most companies depends on acceptance by the investing public and by its customers; therefore, companies should take this opportunity to communicate well-defined corporate strategies.

Required

a. Identify and discuss the basic factors of communication that must be considered in the presentation of the annual report.
b. Discuss the communication problems a company faces in preparing the annual report as a result of the diversity of users being addressed.
c. Select two types of information found in an annual report, other than the financial statements and accompanying footnotes, and describe how they are helpful to users of annual reports.
d. Discuss at least two advantages and two disadvantages of stating well-defined corporate strategies in an annual report.
e. Evaluate the effectiveness of annual reports in fulfilling information needs of the following current and potential users: shareholders, creditors, employees, customers and financial analysts.
f. Annual reports are public and accessible to anyone, including competitors. Discuss how this affects decisions about what information should be provided in annual reports. (*CMA Examination, adapted*)

P1.3. Unlimited Financial Services Australia and Asia (UFSAA) is one of the largest diversified financial services companies in the world, with close to $75 billion in assets under management. One reason for its success is the use of IT to lower costs and improve customer service. UFSAA operates one of the most advanced and successful information systems in the world. It communicates with its widely scattered customers, mostly military officers and their families, primarily by email, phone, and its website.

Early on, UFSAA made a strategic choice to become one of the more technology-intensive companies in the world. It views IT as a strategic weapon and uses it in several ways, including the following:

- When customers call from their homes, offices or mobile phones, UFSAA personnel greet them personally by name. Unlike many diversified companies, a customer representative can handle enquires and transactions about all of UFSAAs products using a highly integrated database.
- UFSAA uses its extensive database to keep track of minute details, such as which auto parts are fixed most frequently. It also uses its database to find ways to reduce claims costs. For example, UFSAA discovered that repair shops would rather charge up to $300 to replace a windshield with punctures than to charge $40 to repair it. UFSAA began offering to waive the excess if the owners would repair the windshield rather than replace it.
- UFSAA spent extensively to develop an image-processing system that digitises all paper documents sent in by claimants (over 25 million a year). It takes only a few keystrokes for a policy service representative to retrieve pictures of all the documents in a customer's file. The system can sort and prioritise documents so that employees are always working on the most important and urgent tasks.
- UFSAA offers its customers remote deposit capture using scanning technology. It was the first bank to implement a remote deposit capture application for the iPhone. The iPhone application allows customers to take pictures of the front and back of each cheque and submit them electronically for deposit.
- UFSAA is a world leader in mobile banking. Customers can use their mobile phones and other mobile devices to access and execute banking, investment, share trading and insurance applications such as filing claims. Customers can also use UFSAAs two-way text messaging system to send messages and receive text alerts and real-time information. They can also access person-to-person payment applications as well as social networking and personal financial management tools connected to bank accounts. Over 70% of UFSAAs logins are from mobile phone users.

Required

a. Why should UFSAA collect data on which auto parts are fixed most frequently? What could it do with this data?

b. Even though UFSAA offered to waive the excess, the repair shops still managed to convince 95% of owners to replace rather than repair their damaged windshields. How could UFSAA use its AIS to persuade more shop owners to repair rather than replace their windows?

c. How does the image-processing system at UFSAA add value to the organisation?

d. How do the remote deposit capture and mobile banking system at UFSAA add value to the organisation?

P1.4. Match the description listed in the right column with the information characteristic listed in the left column.

_____ 1. Relevant	a. The report was carefully designed so that the data contained in the report became information to the reader.
_____ 2. Reliable	b. The manager was working one weekend and needed to find some information about production requests for a certain customer. He was able to find the report on the company's network.
_____ 3. Complete	c. The data in a report was checked by two clerks working independently.
_____ 4. Timely	d. An accounts receivable ageing report included all customer accounts.
_____ 5. Understandable	e. A report was checked by three different people for accuracy.
_____ 6. Verify	f. An accounts receivable ageing report is used in credit-granting decisions.
_____ 7. Accessible	g. An accounts receivable ageing report was received before the credit manager had to make a decision whether to extend credit to a customer.

P1.5. The Howard Leasing Company is a privately held, medium-sized business that purchases school buses and leases them to school districts, churches, charitable organisations, and other businesses. To better serve its customers and, more importantly, to protect its investment in the buses, Howard operates a large maintenance facility to maintain and repair leased vehicles. Howard's annual sales for last year were $37 million, with a net income of $2.9 million. Howard employs approximately 150 people.

You were recently hired by Howard, and you are eager to prove your worth to the company. Your supervisor just called you into her office and asked you to prepare an accounts receivable ageing report as of the end of the year for use in the upcoming audit of the company's financial statements.

Required

a. What is an accounts receivable ageing report?

b. Why is an accounts receivable ageing report needed for an audit?

c. What is an accounts receivable ageing report used for in normal company operations?

d. What data will you need to prepare the report?

e. Where will you collect the data you need to prepare the report?

f. How will you collect the necessary data for the report?

g. What will the report look like (i.e., How will you organise the data collected to create the information your supervisor needs for the audit)? Prepare an accounts receivable ageing report in Excel or another spreadsheet package.

h. How will you distribute the report? How many copies will you make? Who should receive the copies? What security features will you implement?

P1.6. Based on Wal-Mart's success in the United States, many expected the company to quickly dominate the British market after it bought the Asda grocery chain in 1999. That has not happened; Wal-Mart's market share in groceries is a little more than half that of its biggest competitor, Tesco. Initially, Tesco's sales and net income rose significantly while Wal-Mart's sales and net income increased at a much slower rate. More recently, Wal-Mart has made small gains in market share, and Tesco has had small decreases.

Wal-Mart found out that Tesco is a formidable worldwide competitor. Tesco operates almost 2400 stores in Britain in four different formats. It has a very successful operation in Central Europe, and it has expanded to the United States with Fresh & Easy stores. In Korea, Tesco's 174 stores are thriving while Wal-Mart gave up after an eight-year effort to succeed and sold its 16 stores.

One of the biggest reasons for Tesco's success is its use of technology. In 1995, Tesco started a loyalty card program, called Clubcard, and over 80% of its shoppers are members. Shoppers fill out an application in the store and receive a plastic card and a key fob in the mail that is scanned before they make a purchase. Tesco gathers massive amounts of data about its customers' 15 million purchases each week. Sales data are analysed and turned into information that provides Tesco with a significant competitive advantage.

As traditional advertising loses effectiveness, these large stores of data allow Tesco to find new and creative ways to market its products.

Required

a. What kind of information do you think Tesco gathers?
b. How do you think Tesco has motivated over 22 million customers to sign up for its Clubcard program?
c. What can Tesco accomplish with the Clubcard data it collects? Think in terms of strategy and competitive advantage.
d. What are some of the disadvantages to the Clubcard program?

P1.7. Have you ever imagined having one electronic device that does everything you would ever need? Smart phone makers in Japan have gone beyond the imagining phase. Mobile phones in Japan are becoming more versatile than ever. Newer models of mobile phones contain myriad applications and can do many of the things that a personal computer (PC) can do. PCs are also able to function as phones. A small but growing number of professionals are trading in their laptops for handheld computers, tablets and iPads. Mobile phone manufacturers around the world are quickly catching up to their Japanese counterparts.

Required

a. What commercial activities can be done with a smart phone? With a mobile phone/PC combination device? What work activities do you do when you're on your mobile phone? What do you expect to be doing on your phone in five years?
b. How can businesses utilise this technology to attract more customers, sell more products, advertise their products, facilitate the sale of products, and conduct and manage their businesses more efficiently and effectively?
c. What are some problems or drawbacks you can see with using these devices in business?

P1.8. Classify each of the following items as belonging in the revenue, expenditure, human resources/payroll, production, or financing cycle:
a. purchase raw materials
b. pay off mortgage on a factory
c. hire a new assistant controller
d. establish a $10 000 credit limit for a new customer
e. pay for raw materials
f. disburse payroll cheques to factory workers
g. record goods received from a vendor
h. update the allowance for doubtful accounts
i. decide how many units to make next month

  j. complete a picking ticket for a customer order
  k. record factory employee timecards
  l. sell concert tickets
  m. draw on line of credit
  n. send new employees to a business ethics course
  o. pay utility bills
  p. pay property taxes on an office building
  q. pay state payroll taxes
  r. sell a DVD player
  s. collect payments on customer accounts
  t. obtain a bank loan
  u. pay sales commissions
  v. send an order to a vendor
  w. put purchased goods into a warehouse.

P1.9. In Chapter 1 we present a theoretical framework to better understand the growth and use of AIS. Two main theories are identified 'Theory of the Firm' and 'Agency Theory'. Search the accounting and information systems (IS) research literature to see if you can identify any other theories that may be applicable. Write a report making sure to back up your findings with references to articles and websites.

P1.10. Metcalf's Law and Moore's Law capture the rapid growth in computer power. Collect some statistics from the literature and the web to validate these laws. In today's fast advances in networks, does the equation $n(n-1)/2$ or n^2 still hold? What about chip density? Is it doubling every 18 months or less? Write a report on your findings including graphs of statistics for both laws and citing reference to back up your findings.

Case 1.1 Ackoff's 'Management Misinformation Systems'

Read Russell L. Ackoff's classic article 'Management Misinformation Systems', first published in *Management Science*, Vol. 14, No. 4, Dec. 1967, available online at <www.acasa.upenn.edu/ackoff67.pdf.>. In the article, Ackoff identified five common assumptions about information systems and then explained why he disagreed with them.

Required

Read the five assumptions, contentions and Ackoff's explanations. For each of the five assumptions, decide whether you agree or disagree with Ackoff's contentions. Prepare a report in which you defend your stand and explain your defence.

AIS IN ACTION SOLUTIONS

Quiz key

Q1.1. Data differs from information in which way?
  a. data are output and information is input [Incorrect. Data are facts and figures that, once organised, can become information. Therefore, data are inputs and information is output.]
 ▶ **b.** information is output and data are input [Correct.]
  c. data are meaningful bits of information [Incorrect. Information is organised and processed data that provide meaning.]
  d. there is no difference [Incorrect. There is a difference. Data are unorganised facts and figures. Information is meaningful, organised, and processed data.]

Q1.2. Which of the following is NOT a characteristic that makes information useful?
  a. It is reliable. [Incorrect. This is one of the information characteristics listed in Table 1.1 on page 9.]

    b. it is timely [Incorrect. This is one of the information characteristics listed in Table 1.1 on page 9.]

▶ **c.** it is inexpensive [Correct. This is NOT one of the information characteristics listed in Table 1.1 on page 9.]

    d. it is relevant [Incorrect. This is one of the information characteristics listed in Table 1.1 on page 9.]

Q1.3. Which of the following is a primary activity in the value chain?

    a. purchasing [Incorrect. This is a support activity.]

    b. accounting [Incorrect. This is a firm infrastructure support activity.]

▶ **c.** post-sales service [Correct. Service is a primary activity.]

    d. HRM [Incorrect. This is a support activity.]

Q1.4. Which transaction cycle includes interactions between an organisation and its suppliers?

    a. revenue cycle [Incorrect. The revenue cycle involves interactions between an organisation and its customers.]

▶ **b.** expenditure [Correct.]

    c. HRM cycle/payroll subcycle [Incorrect. The human resources management cycle/ payroll subcycle involves interactions between an organisation and its employees, government, and potential hires.]

    d. general ledger and reporting cycle [Incorrect. The general ledger and reporting system receives summary information from all cycles.]

Q1.5. Which of the following is NOT a means by which information improves decision-making?

▶ **a.** increases information overload [Correct. Decision makers receiving too much information have difficulty incorporating all of the information into their decision framework, and, as a result, decision quality can be reduced rather than improved.]

    b. reduces uncertainty [Incorrect. More reliable information leads to less uncertainty and thus better decisions.]

    c. provides feedback about the effectiveness of prior decisions [Incorrect. Knowledge of effective and ineffective decisions can lead to better decisions in the future.]

    d. identifies situations requiring management action [Incorrect. Identifying the need for management action can lead to improved decision-making.]

Q1.6. In the value chain concept, upgrading IT is considered what kind of activity?

    a. primary activity [Incorrect. Investing in IT is a support activity.]

▶ **b.** support activity [Correct. Technology activities, including investing in IT, are considered a support activity.]

    c. service activity [Incorrect. The value chain includes only primary and support activities. A service activity is a type of primary activity.]

    d. structured activity [Incorrect. The value chain includes only primary and support activities. A structured activity is neither a primary nor a secondary activity.]

Q1.7. In which cycle does a company ship goods to customers?

    a. production cycle [Incorrect. The production cycle involves the transformation of raw materials into finished goods.]

    b. financing cycle [Incorrect. The financing cycle deals with interactions between an organisation and its lenders and owners.]

▶ **c.** revenue cycle [Correct. The revenue cycle involves interactions between an organisation and its customers, such as shipping them goods.]

    d. expenditure cycle [Incorrect. The expenditure cycle involves interactions between an organisation and its suppliers.]

Q1.8. Which of the following is a function of an AIS?

    a. reducing the need to identify a strategy and strategic position [Incorrect. An AIS does not reduce the need to identify a strategy. It provides information to executives for the purpose of making strategic decisions.]

▶ **b.** transforming data into useful information [Correct. This is one of the primary functions of an AIS.]

c. allocating organisational resources [Incorrect. Decision-makers allocate resources, and the purpose of the AIS is to provide information to the decision-makers so that they can make the allocation.]

d. automating all decision-making [Incorrect. The AIS provides information to decision-makers; it is not designed to automate all decision-making.]

Q1.9. A firm, its suppliers, and its customers collectively form which of the following?

▶ **a.** supply chain [Correct. The supply chain is made up of the firm, its suppliers, and customers.]

b. value chain [Incorrect. The value chain is made up of primary and support activities within the firm.]

c. ERP system [Incorrect. An ERP system integrates all aspects of an organisation's activities into one system.]

d. AIS [Incorrect. The AIS is made up of the human and capital resources within an organisation that are responsible for collecting and processing transactions and preparing financial information.]

Q1.10. A report telling how well all approved vendors have performed in the prior 12 months is information that is MOST needed in which business process?

a. paying vendors [Incorrect. To pay a vendor, a company needs to know whether merchandise ordered was received in good condition. They do not need a 12-month history of vendor performance.]

▶ **b.** acquiring inventory [Correct. Companies want to acquire inventory from companies that have performed well in the past. A vendor performance report would disclose whether the vendor shipped inventory on time, whether the inventory was of the requested quality, whether the prices were as agreed upon, etc.]

c. selling merchandise [Incorrect. A 12-month history of vendor performance is usually not very helpful in trying to sell products to customers. More important would be customer tastes and preferences, customer credit status, etc.]

d. paying employees [Incorrect. It is very rare for an employee's pay to be based on a 12-month history of vendor performance. More important are hours worked, annual salary, sales figures to calculate commissions, etc.]

Endnotes

Website addresses are correct at time of printing.

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