Foundation Concepts

1-1   Introduction

The study of management information systems (MIS) arose to focus on the use of computer-based information systems in business firms and government agencies. MIS combines the work of computer science, management science, and operations research with a practical orientation toward developing system solutions to real-world problems and managing information technology resources. It is also concerned with behavioural issues surrounding the development, use, and impact of *information systems*.

We are in the midst of a swiftly moving river of technology and business innovations that is transforming the global business landscape. An entirely new Internet business culture is emerging with profound implications for the conduct of business. You can see this every day by observing how business people work using high-speed Internet connections for e-mail and information gathering, portable computers connected to wireless networks, cellular telephones connected to the Internet, and hybrid handheld devices delivering phone, Internet, and computing power to an increasingly mobile and global workforce.

The emerging Internet business culture is a set of expectations that we all share. We have all come to expect online services for purchasing goods and services, we expect our business colleagues to be available by e-mail and cell phone, and we expect to be able to communicate with our vendors, customers, and employees any time of day or night over the Internet. We even expect our business partners around the world to be "fully connected." Internet culture is global. Information technologies and systems are revolutionizing the operation of firms, industries, and markets.

What makes management information systems the most exciting topic in business is the continual change in technology, management use of the technology, and the impact on business success. New businesses and industries appear, old ones decline, and successful firms are those that learn how to use the new technologies.

New businesses and industries appear, old ones decline, and successful firms are those that learn how to use the new technologies. Table 1.1 summarizes the major new themes in business uses of information systems. There are three interrelated changes in the technology area: (1) the emerging mobile digital platform, (2) the growing business use of "big data," and (3) the growth in "cloud computing," where more and more business software runs over the Internet.

More and more business computing is moving from PCs and desktop machines to these mobile devices. Managers are increasingly using these devices to coordinate work, communicate with employees, and provide information for decision making. We call these developments the "emerging mobile digital platform."

Managers routinely use online collaboration and social technologies in order to make better, faster decisions. As management behaviour changes, how work gets organized, coordinated, and measured also changes. By connecting employees working on teams and projects, the social network is where

works gets done, where plans are executed, and where managers manage. Collaboration spaces are where employees meet one another – even when they are separated by continents and time zones.

CHANGE	BUSINESS IMPACT
TECHNOLOGY	
Cloud computing platform emerges as a major business area of innovation	A flexible collection of computers on the Internet begins to perform tasks traditionally performed on corporate computers. Major business applications are delivered online as an Internet service (Software as a Service, or SaaS).
Big Data	Businesses look for insights from huge volumes of data from Web traffic, e-mail messages, social media content, and machines (sensors) that require new data management tools to capture, store, and analyse.
A mobile digital platform emerges to compete with the PC as a business system	The Apple iPhone and Android mobile devices are able to download hundreds of thousands of applications to support collaboration, location-based services, and communication with colleagues. Small tablet computers, including the iPad, Google Nexus, and Kindle Fire, challenge conventional laptops as platforms for consumer and corporate computing.
MANAGEMENT	
Managers adopt online collaboration and social networking software to improve coordination, collaboration, and knowledge sharing	Google Apps, Google Sites, Microsoft Windows SharePoint Services, and IBM Lotus Connections are used by over 100 million business professionals worldwide to support blogs, project management, online meetings, personal profiles, social bookmarks, and online communities.
Business intelligence applications accelerate	More powerful data analytics and interactive dashboards provide real-time performance information to managers to enhance decision making.
Virtual meetings proliferate	Managers adopt telepresence videoconferencing and Web conferencing technologies to reduce travel time, and cost, while improving collaboration and decision making.
ORGANIZATIONS	
Social business	Businesses use social networking platforms, including Facebook, Twitter, and internal corporate social tools, to deepen interactions with employees, customers, and suppliers. Employees use blogs, wikis, e-mail texting, and messaging to interact in online communities.
Telework gains momentum in the workplace	The Internet, wireless laptops, smartphones, and tablet computers make it possible for growing numbers of people to work away from the traditional office. Fifty-five percent of U.S. businesses have some form of remote work program.
Co-creation of business value	Sources of business value shift from products to solutions and experiences, and from internal sources to networks of suppliers and collaboration with customers. Supply chains and product development become more global and collaborative; customer interactions help firms define new products and services.

Table 1.1: What is new in MIS

The strength of cloud computing and the growth of the mobile digital platform allow organizations to rely more on telework, remote work, and distributed decision making. This same platform means firms can outsource more work, and rely on markets (rather than employees) to build value. It also means that firms can collaborate with suppliers and customers to create new products, or make existing products more efficiently.

Millions of managers rely heavily on the mobile digital platform to coordinate suppliers and shipments, satisfy customers, and manage their employees. A business day without these mobile devices or Internet access would be unthinkable. As you read this case, note how the emerging mobile platform greatly enhances the accuracy, speed, and richness of decision making.

Information Systems in Business

Information technologies, including Internet-based information systems, are playing vital and expanding roles in business. Information technology can help all kinds of businesses improve the efficiency and effectiveness of their business processes, managerial decision making, and workgroup collaboration, which strengthens their competitive positions in rapidly changing marketplaces. This benefit occurs irrespective of whether the information technology is used to support product development teams, customer support processes, e-commerce transactions, or any other business activity. Information technologies and systems are, quite simply, an essential ingredient for business success in today's dynamic global environment.

If we are to understand information systems and their functions, we first need to be clear on the concept of a system. In its simplest form, a **system** is *a set of interrelated components, with a clearly defined boundary, working together to achieve a common set of objectives* (Laudon & Laudon, 2014). Using this definition, it becomes easy to see that virtually everything you can think of is a system, and one system can be made up of other systems or be part of a bigger system. Systems have three basic functions:

- Input involves capturing and assembling elements that enter the system to be processed.
- Processing involves transformation processes that convert input into output.
- Output involves transferring elements that have been produced by a transformation process to their ultimate destination.

An *information system* (IS) can be any organized combination of *people* (end users and IS specialists), *hardware* (machines and media), *software* (programs), data (data and knowledge bases), *networks* (communications media and network support), and *policies* and *procedures* perform input, processing, output, storage, and control activities that transform data resources into information products. Although today's information systems are typically thought of as having something to do with computers, we have been using information systems since the dawn of civilization. Even today we make regular use of information systems that have nothing to do with a computer. Figure 1.1 illustrates an information system model that expresses a fundamental conceptual framework for the major components and activities of information systems.

People are the essential ingredient for the successful operation of all information systems. These people resources include end users and IS specialists.

The concept of *hardware resources* includes all physical devices and materials used in information processing. Specifically, it includes not only *machines*, such as computers and other equipment, but also all data *media*, that is, tangible objects on which data are recorded, from sheets of paper to magnetic or optical disks.

The concept of *software resources* includes all sets of information processing instructions. This generic concept of software includes not only the sets of operating instructions called *programs*, which direct and control computer hardware, but also the sets of information processing instructions or operating instructions called *procedures* that people need.

Data are more than the raw material of information systems. The concept of *data resources* has been broadened by managers and information systems professionals. They realize that data constitute valuable organizational resources. The data resources of information systems are typically organized, stored, and accessed by a variety of data resource management technologies into:

- Databases that hold processed and organized data.
- Knowledge bases that hold knowledge in a variety of forms, such as facts, rules, and case examples about successful business practices.

Telecommunications technologies and networks like the Internet, intranets, and extranets are essential to the successful e-business and e-commerce operations of all types of organizations and their computer-based information systems. Telecommunications networks consist of computers, communications processors, and other devices interconnected by communications media and controlled by communications software. The concept of *network resources* emphasizes that communications technologies and networks are fundamental resource components of all information systems. Network resources include:

- *Communications media.* Examples include twisted-pair wire, coaxial and fiber-optic cables, and microwave, cellular, and satellite wireless technologies.
- *Network infrastructure*. This generic category emphasizes that many hardware, software, and data technologies are needed to support the operation and use of a communications network. Examples include communications processors, such as modems and internetwork processors, and communications control software, such as network operating systems and Internet browser packages.
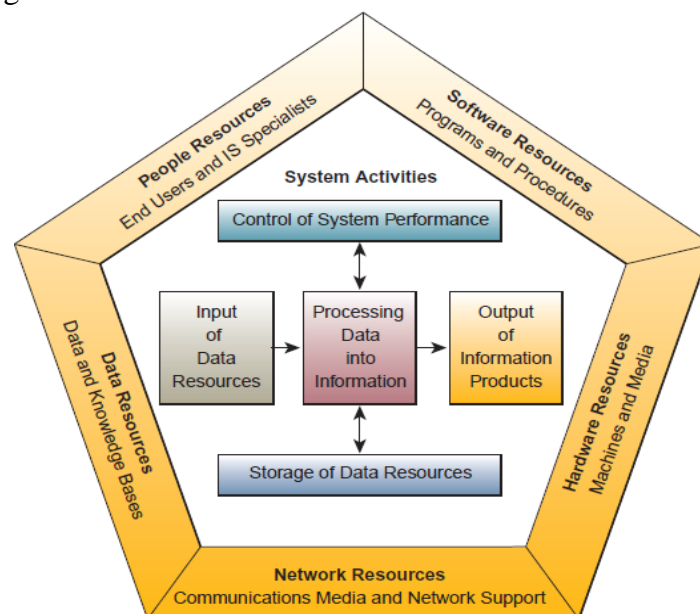

Figure 1.1: The components of an information system.

Figure 1.2 illustrates a useful conceptual framework that organizes the knowledge areas one needs about information systems. It emphasizes that you should concentrate your efforts in the following five areas of IS knowledge:

- *Foundation Concepts*. Fundamental behavioural, technical, business, and managerial concepts about the components and roles of information systems. Examples include basic information system concepts derived from general systems theory or competitive strategy concepts used to develop business applications of information technology for competitive advantage.
- *Information Technologies*. Major concepts, developments, and management issues in information technology—that is, hardware, software, networks, data management, and many Internet-based technologies.
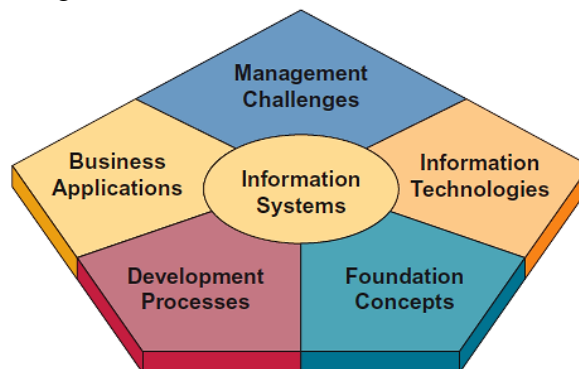

Figure 1.2: A framework that outlines the major areas of information systems knowledge

- *Business Applications*. The major uses of information systems for the operations, management, and competitive advantage of a business.
- *Development Processes*. How business professionals and information specialists plan, develop, and implement information systems to meet business opportunities.
- *Management Challenges*. The challenges of effectively and ethically managing information technology at the end-user, enterprise, and global levels of a business.

The Fundamental Roles of IS in Business

While there are a seemingly endless number of software applications, there are three fundamental reasons for all business applications of information technology. They are found in the three vital roles that information systems can perform for a business enterprise:
- Support of business processes and operations.
- Support of decision making by employees and managers.
- Support of strategies for competitive advantage.

Figure 1.3 illustrates how the fundamental roles interact in a typical organization. At any moment, information systems designed to support business processes and operations may also be providing data to, or accepting data from, systems focused on business decision making or achieving competitive advantage. The same is true for the other two fundamental roles of IS. Today's organizations are constantly striving to achieve integration of their systems to allow information to

flow freely through them, which adds even greater flexibility and business support than any of the individual system roles could provide.
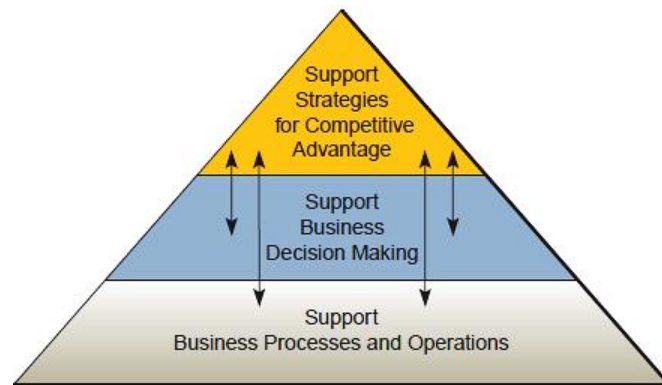

Figure 1.3: The three fundamental roles of the business applications of information systems.

Types of information systems and main purposes

Conceptually, the applications of information systems that are implemented in today's business world can be classified in several different ways. For example, several types of information systems can be classified as either operations or management information systems. Figure 1.4 illustrates this conceptual classification of information systems applications. Information systems are categorized this way to spotlight the major roles each plays in the operations and management of a business.
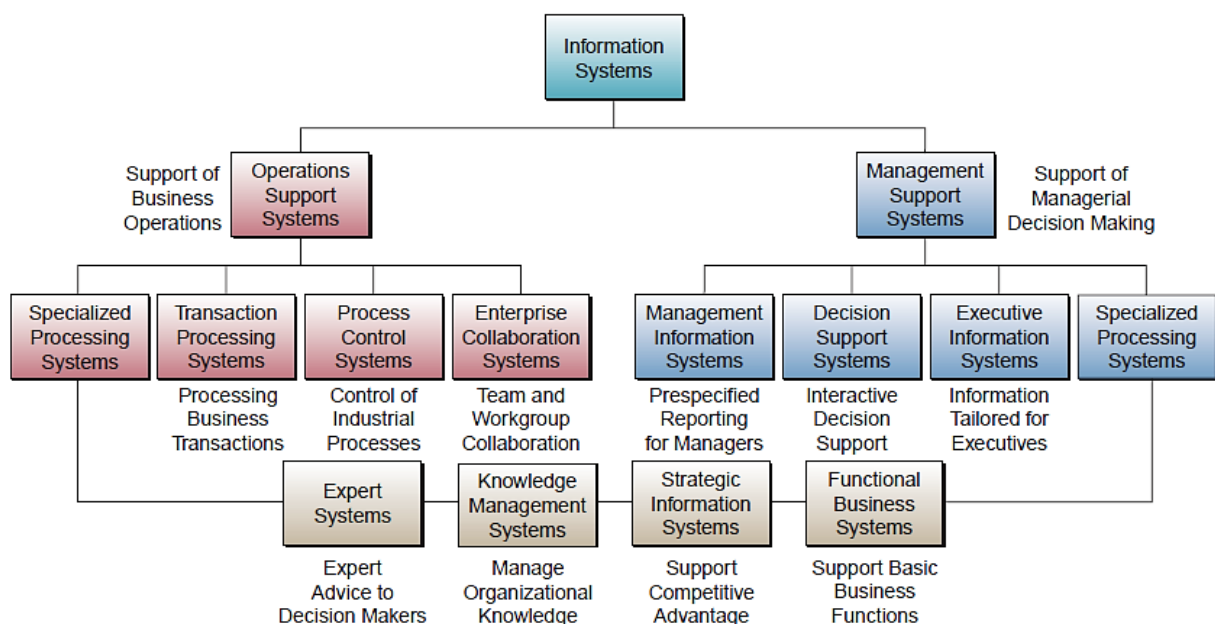

Figure 1.4: Operations and management classifications of information systems

Operations Support Systems

- **Transaction processing systems.** Process data resulting from business transactions, update operational databases, and produce business documents. Examples: sales and inventory processing and accounting systems.
- **Process control systems.** Monitor and control industrial processes. Examples: petroleum refining, power generation, and steel production systems.
- **Enterprise collaboration systems.** Support team, workgroup, and enterprise communications and collaborations. Examples: e-mail, chat, and videoconferencing groupware systems.

Management Support Systems

- **Management information systems.** Provide information in the form of prespecified reports and displays to support business decision making. Examples: sales analysis, production performance, and cost trend reporting systems.
- **Decision support systems.** Provide interactive ad hoc support for the decision-making processes of managers and other business professionals. Examples: product pricing, profitability forecasting, and risk analysis systems.
- **Executive information systems.** Provide critical information from MIS, DSS, and other sources tailored to the information needs of executives. Examples: systems for easy access to analyses of business performance, actions of competitors, and economic developments to support strategic planning.

Figure 1.5a: A summary of management support and operations support systems with examples

Other Categories of Information Systems

- **Expert systems.** Knowledge-based systems that provide expert advice and act as expert consultants to users. Examples: credit application advisor, process monitor, and diagnostic maintenance systems.
- **Knowledge management systems.** Knowledge-based systems that support the creation, organization, and dissemination of business knowledge within the enterprise. Examples: intranet access to best business practices, sales proposal strategies, and customer problem resolution systems.
- **Strategic information systems.** Support operations or management processes that provide a firm with strategic products, services, and capabilities for competitive advantage. Examples: online stock trading, shipment tracking, and e-commerce Web systems.
- **Functional business systems.** Support a variety of operational and managerial applications of the basic business functions of a company. Examples: information systems that support applications in accounting, finance, marketing, operations management, and human resource management.

Figure 1.5b: A summary of other categories of information systems with examples

Information Technology

This strategic role of information systems involves using information technology to develop products, services, and capabilities that give a company major advantages over the competitive forces it faces in the global marketplace. Information technology is a subset of information systems and consists of *hardware*, *software*, *data*, *networks*, *policies* and *procedures.*

Managerial Challenges of Information Technology

Figure 1.6 illustrates the scope of the challenges and opportunities facing business managers and professionals in effectively managing information systems and technologies. Success in today's dynamic business environment depends heavily on maximizing the use of Internet-based technologies and Web-enabled information systems to meet the competitive requirements of customers, suppliers, and other business partners in a global marketplace. Figure 1.6 also emphasizes that information systems and their technologies must be managed to support the business strategies, business processes, and organizational structures and culture of a business enterprise. That is because computer-based information systems, though heavily dependent on information technologies, are designed, operated, and used by people in a variety of organizational settings and business environments. The goal of many companies today is to maximize their customer and business value by using information technology to help their employees implement cooperative business processes with customers, suppliers, and others.

Business / IT Challenges

■ Speed and flexibility requirements of product development, manufacturing, and delivery cycles.
■ Reengineering and cross-functional integration of business processes using Internet technologies.
■ Integration of e-business and e-commerce into the organization's strategies, processes, structure, and culture.

Business / IT Developments

■ Use of the Internet, intranets, extranets, and the Web as the primary IT infrastructure.
■ Diffusion of Web technology to internetwork employees, customers, and suppliers.
■ Global networked computing, collaboration, and decision support systems.

Business / IT Goals

■ Give customers what they want, when and how they want it, at the lowest cost.
■ Coordination of manufacturing and business processes with suppliers and customers.
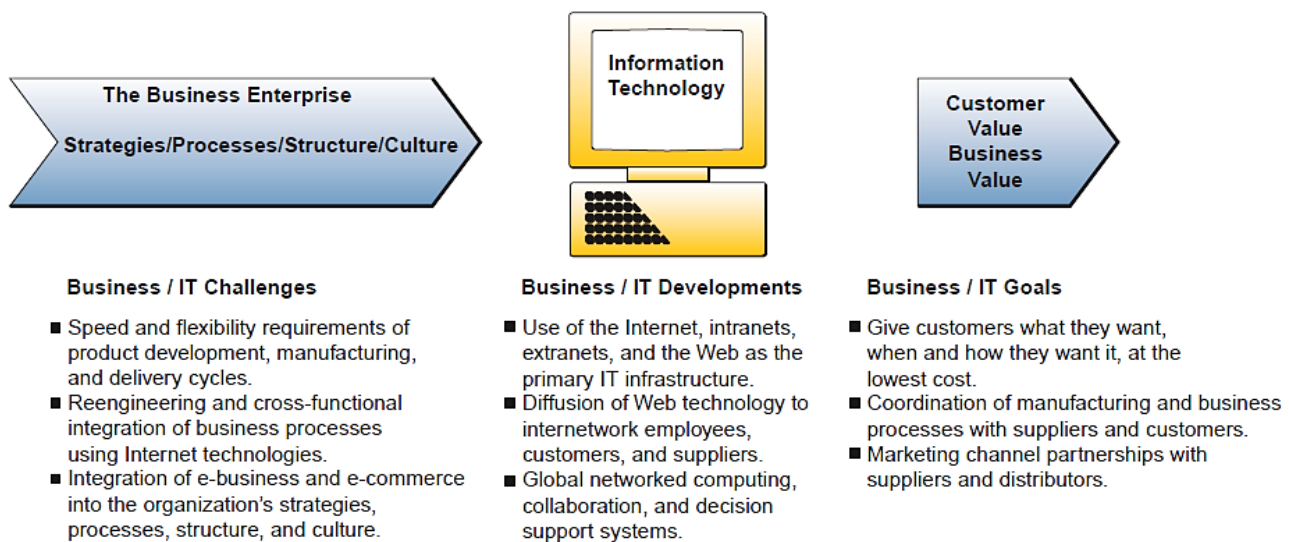■ Marketing channel partnerships with suppliers and distributors.

Figure 1.6: Examples of the challenges and opportunities that business managers face in managing information systems and technologies to meet business goals.

Success and Failure with IT

The success of an information system should not be measured only by its *efficiency* in terms of minimizing costs, time, and the use of information resources. Success should also be measured by the *effectiveness* of the information technology in supporting an organization's business strategies, enabling its business processes, enhancing its organizational structures and culture, and increasing the customer and business value of the enterprise. It is important to realize, however, that information technology and information systems can be mismanaged and misapplied in such a way that IS performance problems create both technological and business failures.

Developing IS Solutions

Developing successful information system solutions to business problems is a major challenge for business managers and professionals today. As a business professional, you will be responsible for proposing or developing new or improved uses of information technologies for your company. As a business manager, you will frequently manage the development efforts of information systems specialists and other business end users.

Most computer-based information systems are conceived, designed, and implemented using some form of systematic development process. Figure 1.7 shows that several major activities must be accomplished and managed in a complete IS development cycle. In this development process, end users and information specialists *design* information system applications on the basis of an *analysis* of the business requirements of an organization. Examples of other activities include *investigating* the economic or technical feasibility of a proposed application, acquiring and learning how to use any software necessary to *implement* the new system, and making improvements to *maintain* the business value of a system. We discuss the details of the information systems development process in a subsequent chapter.
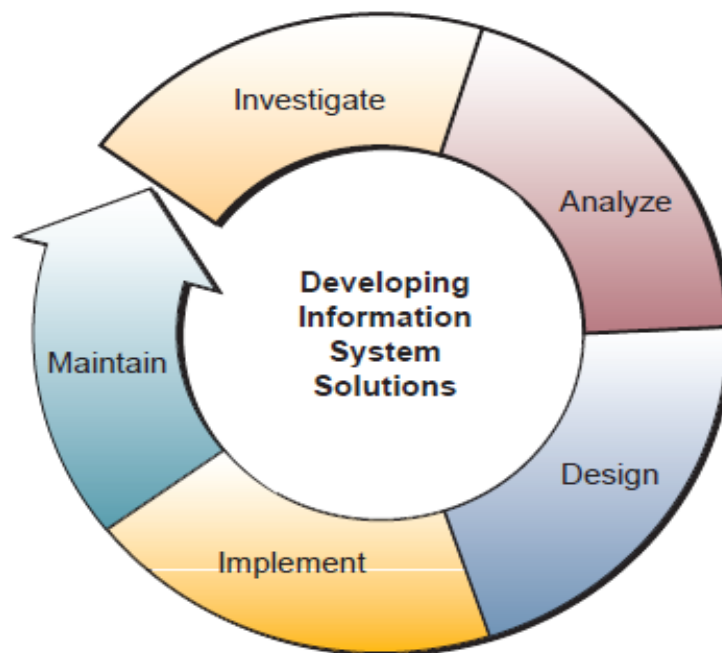
Figure 1.7: Cycle of developing information systems solutions

Challenges and Ethics of IT

As a prospective manager, business professional, or knowledge worker, you will be challenged by the **ethical responsibilities** generated by the use of information technology. For example, what uses of information technology might be considered improper, irresponsible, or harmful to other people or to society? What is the proper business use of the Internet and an organization's IT resources? What does it take to be a **responsible end user** of information technology? How can you protect yourself from computer crime and other risks of information technology? These are some of the questions that outline the ethical dimensions of information systems.

The IS Function

The information systems function represents:

- A major functional area of business equally as important to business success as the functions of accounting, finance, operations management, marketing, and human resource management.
- An important contributor to operational efficiency, employee productivity and morale, and customer service and satisfaction.
- A recognized source of value to the firm.
- A major source of information and support needed to promote effective decision making by managers and business professionals.
- A vital ingredient in developing competitive products and services that give an organization a strategic advantage in the global marketplace.
- A dynamic, rewarding, and challenging career opportunity for millions of men and women.
- A key component of the resources, infrastructure, and capabilities of today's networked business enterprises.
- A strategic resource.