Pearson New International Edition

Information Systems Management

McNurlin Sprague Bui

Eighth Edition

ALWAYS LEARNING

PEARSON

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INFORMATION SYSTEMS MANAGEMENT IN THE GLOBAL ECONOMY

From Chapter 1 of *Information Systems Management in Practice*, Eighth Edition.

INTRODUCTION

Information technology (IT)—computers and telecommunications—continues to have the revolutionary, restructuring impact that has been expected and touted for years. The rapid advances in the speed and capacity of computing devices, coupled with the pervasive growth of the Internet, digital storage, wireless and portable devices, and multimedia content, are constantly changing the way we live and work.

Although IT affects nearly all aspects of human endeavor, we emphasize its use in managing and operating organizations, including business enterprises, public institutions, and social and charitable communities. Anytime people work together to jointly pursue objectives, IT is changing the way they work.

Managing and operating IT for these purposes has been a field of practice for some 50 years. First known as business data processing and later as management information systems (MIS), the field is now called information technology (IT). In this text, we distinguish between IT (the technology) and the organization that manages the technology, which we call the IS (information systems) organization. IS combines the technologies, people, data, and business processes for fostering the use of IT to improve organizational performance.

THEMES

Due to the growth and pervasiveness of IT, organizations are operating in a different environment from that of just a few years ago. The nature of this environment is explored in several themes in this edition of the book. The following three themes are woven through the text:

- ***Globalization.*** You may have heard this common wisdom. The world seems to be getting smaller or flatter. Events in a faraway land can impact others in another part of the globe. As a result, a major theme in today's world is globalization, whereby companies seek to offer or procure their goods and services around the world. However, the worldwide expansion of brands and the emergence of global institutions continue to encounter major protests from groups, and even nations, that want to maintain their local identity. Companies feel this backlash in their use of IT: locales and regions want systems that suit their culture, preferences, or lifestyles. In addition, they want jobs to stay put, and not move to a far-off country. In response, IS executives are seeking to achieve a balance between implementing a single, enterprisewide IT infrastructure and tailoring systems to fit local needs—and locating work where it is most cost effective.
- ***E-enablement.*** Doing business electronically has been fundamental since the 1950s, but now the Internet has transformed the way people conduct business. The before-Internet economy is evolving into an electronic economy where clicks and bricks exist side by side. The 2001 dot-com crash might have seemed a hiccup in the increasing use of the Internet for business and commerce. However, it has not deterred companies from e-enabling their businesses, that is, integrating the Internet into how they work. In fact, the term "e-business" has the broad connotation of doing business electronically. E-business has much to do with building e-enabled relationships with consumers and other enterprises,

not just executing transactions electronically. E-commerce, on the other hand, is being used in the more limited sense of buying and selling electronically, as in handling commerce transactions.

The vision is ubiquitous connectivity among everyone on earth, with the ability to communicate electronically, transfer multimedia files, and access information—anywhere and anytime—from around the world at the touch of a button on a wireless device.

- ***Business Intelligence Through Knowledge Sharing and Knowledge Management.*** The third major theme is how to deal with all the world's knowledge. One aspect of this is the transfer of knowledge between people (sharing), because the most important asset in enterprises is the people and the knowledge they possess. The other aspect is the transfer of knowledge from people's heads into lasting things, such as processes, products, best practices, databases, directories, software, and such. People walk out the door each night (or leave the company); these other artifacts do not, but they do grow stale and outdated. This second area is called knowledge management. Both aspects have to do with managing people and the knowledge they possess. IT can be used for both.

  Later in this chapter, we discuss two kinds of knowledge work: procedure based and goal based. Emphasis on knowledge work is shifting from the former to the latter. At the same time, a major shift is taking place from information access to content management, which includes searching, filtering, synthesizing, assimilating, and sharing knowledge resources. The importance of content management is reinforced by the fact that intellectual assets are considered by many to be the only source of sustainable competitive advantage for organizations. The ultimate goal is to devise an IT-enabled environment to promote creativity that would benefit all participating communities of practices.

MANAGEMENT OF IS

Although IT is used in space exploration, national defense, medicine, entertainment, and many other aspects of human activity, the majority of information technologies are used to manage organizations.

The process of managing IT in organizations is becoming increasingly complex as it becomes more important. To illustrate why, here are just three major trends that impact IT management:

- Governance of IT—that is, deciding who makes which IT decisions—is shifting from being handled exclusively by IS executives to being a collaborative effort between IS business and their constituencies.
- The role of IS is shifting focus from application delivery to system integration and infrastructure development.
- The constant struggle between outsourcing and insourcing is becoming a way of life for many IS organizations, to the extent that a major responsibility of IS is developing and managing relationships with external service providers (ESPs).

In a historical perspective, it is interesting to note that the use of computers has been elevated to a new level every decade. As illustrated in Figure 1, the first use of

Time Frame	Computer Use Trends	Emerging Applications	Some Leading Vendors
1950s	Calculator	Bookkeeping	Texas Instruments
1960s	Computer	Accounting, Payroll	IBM, Honeywell, CDC, Univac, Burrough, GE
1970s	Management Information Systems	Financial Applications, Inventory Management, Production, etc.	Digital, IBM, Unisys
1980s	Decision Support and Applied Artificial Intelligence	Portfolio Management, Project Management, Executive Information Systems	IBM, Lotus, Apple, Sun Micro Systems, Oracle, Microsoft
1990s	Communicator	Office Automation, E-mail, Instant Messaging, File Transfer	IBM, MCI, AT&T, AOL, Netscape
2000s	Partnership Promoter/Social Enabler	E-commerce, Supply Chain-Management, Social Networking, Mobile Computing	IBM, Oracle, SAP, Microsoft

FIGURE 1 Evolution of Business Computing

computer chips was the calculator, primarily for the many bookkeeping activities of business in the 1950s. Texas Instruments invented the first electronic handheld calculator and has since significantly contributed to the use of mathematical modeling in business. About a decade later, IBM offered to the world its first generation of business computers with sufficient processing power to run data-intensive business applications. Managers in the 1960s saw the introduction of computer applications for accounting and payroll. During this era, most IT activities emerged from the bookkeeping and accounting departments.

The next decade saw the development of mainframes, and many organizations create the department of Management Information Systems (MIS) or IS Department to keep these systems running. IBM consolidated its leadership position in the computer industry. However, it saw the birth of two potential competitors, SAP and Oracle, all inspired by IBM work. Oracle improved the relational database concept initially developed by IBM to launch the first commercial SQL (Structured Query Language) relational database management system. Oracle has become a major provider of computer-based business solutions. SAP, founded by five former IBM employees, focused on real-time, collaborative, inter-enterprise business solutions. Thus, the 1970s marked the debut of the most successful business software ever—Database Management Systems (DBMS). MIS applications have allowed managers to increase the efficiency of their daily operations.

The 1980s marked a new era for the computer. While scientists were busy fine-tuning computer networks, IBM released the first PC that ran on a 4.77-Mhz Intel 8088 processor with MS-DOS written by Microsoft in 1981. A quarter of a century later, it is estimated the world had produced more than one billion personal computers. The phenomenal adoption of the personal computer has facilitated the deployment of a new generation of business software, known as Decision Support Systems and Applied Artificial Intelligence. Computers are not only used for data processing of daily business operations (such as

payroll and accounting). They are embedded with decision algorithms that help managers make decisions ranging from cash-flow management to inventory decisions.

Thanks to the rapid growth of the Internet, the 1990s saw an exponential use of computers for office automation and networking. As "the communicator," computers allow users to do e-mails, transfer files, and use instant messaging. A research estimated that in 2003, 65–72 percent of world's computing power was dedicated to supporting human needs for communications. In addition to e-mail, Microsoft's Word, PowerPoint, and Excel software have become the industry standards for sharing information. Later in the decade, the World Wide Web allowed billions of pages to be made available on the Internet.

The Internet economy has come of age in the 2000s, thanks to a number of significant developments in e-business software, and open source software such as Linux, Enterprise Resource Planning, and supply-chain management software. The first years of the 2000s can be characterized by the widespread adoption of computer networks as a means to promote business partnerships and implement strategic alliances and global cooperation.

As we prepare to move onto the 2010s, the Internet has firmly changed the social fabric. It is a platform where people do business, find entertainment, and enhance social life.

This brief historical review reminds us of the growing importance of IT. The purpose of this text is to describe how IT is being managed today in leading-edge enterprises. Thus, this text is appropriate for anyone who is using IT to improve organizational performance—IS executives, technical managers, top executives, business unit executives, line managers, and employees at all levels of an organization.

This chapter briefly reviews the recent history of IT and its management in organizations. Then it identifies a number of organizational and technical trends that are affecting IT management. Finally, it presents a framework for thinking about how IT is used and managed in organizations.

A LITTLE HISTORY

Most people are surprised to learn that the United States passed from the industrial era to the information era in 1957. In that year, the number of U.S. employees whose jobs were primarily to handle information (information workers) surpassed the number of industrial workers.

In the late 1950s and early 1960s, though, information technology to support information work hardly existed. Only the telephone was widespread, and did not reach every desk. Computers were just beginning to be used in data-processing applications, replacing electric accounting machines. Even where computers were in use, their impact was modest.

Most other information work in general offices was done without much support from technology. Xerographic office copiers were introduced in 1959. Electric typewriters were commonplace, but the first word processor would not arrive until 1964. Facsimile machines were used only in specialized applications and would not be in general office use until the 1970s. However, the future of technology support for information workers was extremely bright. Many of the foundations of IT had been invented, and costs were starting their steady long-term fall.

Another milestone was reached in about 1980, when the number of U.S. information workers surpassed the number of U.S. workers in all other sectors combined. In other words, information workers exceeded 50 percent of the U.S. workforce. However, the technology to support these information workers remained slow, expensive, and segmented into special-purpose categories.

IT was initially used to perform manual information work more quickly and more efficiently. Then it was used to manage work better. Now we are well into the third stage of technology assimilation, in which IT makes pervasive changes in the structure and the operation of work, business practices, organizations, industries, and the global economy.

Today, the information and communications technologies (ICT) sectors continue to grow strongly, with significant and rapid growth in developing nations. As the ICT global market is constantly exploring new technologies (such as mobile computing), emerging Asian and eastern European countries are rapidly becoming both leading producers and adopters of disruptive technologies. According to a study by OECD ("Information Technology Outlook 2006 Highlights," 2006, Geneva, OECD), the ICT section is expected to grow at 6 percent in 2006 and the market is accelerating its global restructuring of ICT production and services.

In its 2007 IT salary and skills survey, Global Knowledge reported that salaries are rising again, and the increase is proportional to the level of education and training of IT workers.

The next two sections explore the changes in the work environment and the technical environment.

THE ORGANIZATIONAL ENVIRONMENT

How IT is used depends on the environment surrounding the organization that uses it. This environment includes economic conditions, characteristics of principal resources (especially labor), management philosophies, societal mores, and other factors. This environment changes constantly. Simultaneously, technological advances affect the way IT is used. An ongoing debate centers around whether technology drives change in organizations or merely supports it. This "chicken or egg" debate is giving way to the realization that IT and its use and management co-evolve, each influencing the other.

This section explores two aspects of the organizational environment: the external forces that are causing executives to reexamine how their firms compete, and the internal structural forces that affect how organizations operate or are managed. It then considers how these environmental trends have led to a new set of goals for the new work environment.

The External Business Environment

Today, the turbulent business world includes shorter and shorter product cycles, a U.S. telecommunications industry in constant turmoil, investor doubts about corporate truthfulness, computer security, and terrorism. For better or worse, IT contributes to this turbulence because it allows information to move faster, increasing the pace at which individuals and organizations can respond to events. One result is higher peaks and lower valleys, caused by an IT-charged herd instinct. The following are the main changes taking place in our global marketplace.

The Internet Economy

The *new* economy has been much publicized by the outgrowth of business-to-consumer (B2C) retailing and selling over the World Wide Web (Web). The pioneer of the Web-only business model was Amazon.com, with its ability to use the Internet to sell and ship books to consumers at substantially lower costs. However, the overwhelming bulk of e-business belongs to business-to-business (B2B), with buyers and sellers using Internet exchanges (or e-marketplaces) to find and consummate business deals. eBay is the most well-known exchange, but there are other industry-specific exchanges, such as business procurement along the value-chain network. The main point is that today's economy is encompassing both old and new ways of operating, and IT is a major underpinning of the way these two worlds interface with each other.

Global Marketplace

The entire world has become a conglomeration of electronic marketplaces. To succeed, large companies believe they need to be global, meaning huge and everywhere. Merger mania is occurring across industries as companies aim for this goal. Mergers even cross national boundaries. It is not unusual for a British food company to own U.S., French, and other food and beverage companies; for a Swiss pharmaceutical company to buy out its American and Japanese counterparts; or for a Chinese computer manufacturer to buy a laptop division of a major American IT company. "Think globally, act locally" has become a popular adage among multinational corporations.

In addition, the Internet enables companies to work globally—with three main operating arenas, Asia/Pacific, the Americas, Europe and the Middle East and Africa (EMEA)—and work around the clock by passing work from one region to the next, following the sun.

The global marketplace has become a two-way street. Firmly entrenched companies find unexpected competitors from halfway around the world bidding on work via the Internet. Parts and subassemblies are being manufactured in many countries to cut overall labor costs and then shipped to other countries for final assembly.

The Internet also allows small firms to have a global reach. Norwegians can order extra-hot chili sauce from Texas. Europeans can order books over the Internet from U.S. companies before those books become available in their own country's bookstores, at a more advantageous currency exchange rate. And so on. The business environment is now global, but local tastes still matter. As noted earlier, local backlashes against globalization are a factor that global enterprises need to include in their planning.

Micro-markets

The Internet has created new markets for new kinds of goods and services: digital micro-products. Digital micro-products—such as Apple's 99-cent I-tunes songs, Amazon.com's 49-cent short books, Disney's $4.99 short videos, or freeware—are products in digital forms that can be delivered anywhere, at any time, at a low or zero acquisition cost and no delivery costs. These products illustrate two emerging trends that have been identified in electronic commerce as micro-commoditization and micro-consumption, which are expected to significantly impact the market for digital goods. Unlike other products, digital micro-products often have a selling price that is very low, fixed, and identical for all products. With these product characteristics, the impact of price on sales (quantity) is trivial and thus mitigated and channeled into

quality perception, so price is no longer the primary demand factor. Alternatively, quality signal is likely to become a key demand factor.

Business Ecosystems

A new term is creeping into the business lexicon: ecosystem. An ecosystem is a web of self-sustaining relationships surrounding one or a few companies. For example, Microsoft and Intel are the center of the Wintel ecosystem that has dominated the PC world. And, the new generation of Intel-based Apple's iMac computers is expected to consolidate this ecosystem, further enabling participating members to move toward shared visions, securing their investment strategies through strategic partnership. Yet, although they dominate the PC ecosystem, they are far less dominant in other ecosystems, such as the Internet ecosystem and the wireless communications ecosystem. The point about ecosystems is that they appear to follow biological rules rather than industrial-age, machine-like rules. They require flexibility because relationships change more frequently; they are more organic. Relationships and co-evolution require a different corporate mind-set from the command-and-control mind-set of the past.

Decapitalization

Tangible items, such as capital, equipment, and buildings, were the tenets of power in the industrial age. Today, intangible items, such as ideas, intellectual capital, and knowledge, have become the scarce, desirable items. Many argue that the business world is moving from tangible to intangible; it is decapitalizing. In many situations, knowledge is more important than capital. For this reason, managing talent has become as important as managing finances. Without talent, ideas dwindle, the new-product pipeline shrivels up, and the company becomes less competitive.

Faster Business Cycles

The tempo of business has accelerated appreciably; companies do not have as much time to develop new products or services and move them into the marketplace. Once on the market, their useful lives tend to be shorter as well, so speed has become of the essence. Efforts to accelerate time to market or to reduce cycle time often depend on innovative uses of IT to transform creative ideas into profitable products.

Instant Gratification

The Internet is about instant gratification. One of the successes of YouTube is due to the use of the Flash technology that allows instant viewing of video clips without the need to download large video files. The need of instant coffee, lottery tickets with instant-win notification, and instant pain relievers is extended to the need for instant access to digital products and services. Google builds one of its successes on the ability of its search engines to instantly deliver relevant information to its surfers, and its new Web-based uploader that allows users to share their break-up stories. The desire to satisfy society's demand for instant gratification could, however, lead to quality problems as products are hastily brought to the markets.

Accountability and Transparency

The rise and fall of dot-coms probably should have been expected; some of their business plans truly could not make money. However, the ensuing debacle in the overbuilt telecommunications industry and the corporate financial shenanigans in several indus-

tries around the world have shaken investor confidence and led to calls for greater transparency of corporate operations and greater accountability of corporate officers. These events have increased the pressure for corporate ethics, and the expensive-to-comply-with Sarbanes-Oxley Act in the United States was passed in 2002 to reinforce investment confidence and protect investors by improving the accuracy and reliability of corporate disclosure. IT will surely play a role in implementing the ensuing regulations and fostering transparency. Discussions of IT ethics might also increase.

Rising Societal Risks of IT

In spite of the unequivocal benefits that IT has brought to the world, it has also negatively affected millions of people—through network shutdowns, computer viruses, identity thefts, e-mail scams, movement of white-collar jobs to lower-cost countries, and such—which has led to increasing calls for government regulation and for vendors and corporations to take action. This edition includes more discussion of the societal risks that accompany the benefits of IT.

Now, more than in the past, CIOs need to address the dark side of IT, which includes protecting the privacy of individuals whose information they store and securing their networks, databases, and computers from cybercrime, computer viruses, and such. They also need to consider the societal effects of outsourcing, and ease, as much as possible, the human misery that comes from employees losing their jobs or having to oversee work performed in distant places.

The Internal Organizational Environment

The work environment is also changing, and the art of managing people is undergoing significant shifts. These changes are profound enough to change organizational structures. Frances Cairncross,[1] management editor at the *Economist*, writes in her book, *The Company of the Future,* that the relationship between IT and enterprise structure is growing more widespread and deeper. She believes that the company of the future will look much like the Japanese keiretsu (the associations of independent and interdependent businesses working in concert). Here are some of the changes we see affecting how people work and how organizations operate. Some support Cairncross's belief.

From Supply-Push to Demand-Pull

In the industrial age, companies did their best to figure out what customers wanted. Firms were organized to build a supply of products or services and then "push" them out to end customers on store shelves, in catalogs, and such. The Internet, which allows much closer and one-to-one contact between customer and seller, is moving the business model to demand-pull. In this model, companies offer customers the components of a service or product, and the customers create their own personalized versions, creating the demand that pulls the specific product or service they want through the supply chain, or rather, the demand chain.

To move to this consumer-pull mass customization business model, companies need to essentially reverse their business processes to be customer driven. In fact, this model can lead to suppliers and customers co-creating or negotiating products and services. For example, book buyers who put their critiques of books through online reviews and useful votes on Amazon.com's Web site are, in a sense, co-creating part of Amazon's service to other book buyers.

Here's another bookseller example. Borders is the second-largest book retailer in the United States. Its president has decided to replace the industry's supply-push approach with a new demand-pull approach. Traditionally, and still today, booksellers push those books that publishers pay them to promote in their bookstore windows, on near-the-door tables, and in other high-traffic areas.

Borders' president thinks these short-term incentives might actually hurt overall sales in categories, so he is shifting Borders to "category management," which means publishers will help co-manage 250 book categories, reports Trachtenberg.[2] In return for being part of the decision-making process by recommending titles to Borders, the publishers will help pay for the market research Borders will do to find out what book buyers want. For instance, Borders wants to find out which books are bought on impulse, which ones sell better when the cover is showing, which types should be grouped together, where sections should be located, and even how to price books.

Borders' competitors are watching this demand-pull experiment with great interest. Some doubt that it will work, reports Trachtenberg, arguing that selling books is not like selling screwdrivers or prescription drugs. One thing Borders has already learned through its market research, though, is that one-fourth of its cookbooks are bought as gifts.

"Customer-centricity" is another term for this trend. It means replacing product-centric thinking with customer-centric thinking. The result: Organizational structures shift from product groups to customer groups. One way to view this shift is to see it as turning traditional thinking inside-out. When companies focus on products, they are thinking inside-out. When they think about customers and customer groups, they think outside-in.

Although you might think this shift means keeping customers happy, it can actually have the opposite effect for some customers. When companies create customer clusters using data-warehousing and data-mining techniques, they find out which clusters are profitable and which are not. They may then institute policies that cater to the profitable customers and charge or let go the unprofitable ones.

Self-Service

Bank automated teller machines (ATMs) were an early and successful example of customer self-service. The 1990s saw an increase in systems that let consumers access corporate computer systems to purchase products, inquire about the state of an order, and, in general, do business with the firm online on their own. FedEx was one of the first companies to leverage the Web by allowing customers to directly access its package-tracking system via its homepage. Today, companies that ship products via FedEx have links to the same homepage, providing that service to their customers. When customers serve themselves, employees can concentrate on services that customers cannot help themselves and other kinds of work. More importantly, self-service has shown to be an effective means for customer empowerment, extending the value from the business to the customer.

Real-Time Working

The genesis of the notion of real-time enterprise, we believe, was the military, whose personnel fly planes and drive tanks using instrument panels. These panels show the pilots and soldiers the surrounding terrain as it exists at the moment, so that they can

respond to changes and threats in real time. The term has been adopted in business and means operating a business in as close to real time as possible, using computer systems to indicate the state of the "business terrain" as it exists at the moment.

For example, members of a sales team about to talk to a potential global customer can have up-to-the-minute information about that customer—late-breaking news about the company, recent management changes, latest orders to the company (if any), sales tips from other employees—all gathered for them from many sources.

Other examples of real-time working are knowing inventories as of right now (not one week or one month ago), knowing cash on hand right now (not at the end of last month), and being able to reach someone when you need them, perhaps via instant messaging. With accurate, up-to-date information on company operations, customer orders, inventory stocks, and on-demand access to others, people have better information to make decisions. Thus, businesses are making a major push to have real-time information in hand and real-time access to people, which are not easy feats, especially for enterprises with global operations.

Real-time working is more than just providing instant up-to-date information. According to (Gartner), a respected research firm in I.T. and Business, it is a quest for strategic gain. Firms will have to implement new collaborative business rules and roles before event-driven actions. IT can help implement real-time working with computer-based content management and Internet portals.

Team-Based Working

The trend is toward people working together on projects. Rather than depending on chains of command and the authority of the boss, many organizations emphasize teams to accomplish major tasks and projects. Peter Drucker's classic article in the *Harvard Business Review*[3] uses the analogy of a symphony, where each member of the team has a unique contribution to make to the overall result. Task-oriented teams form and work together long enough to accomplish the task, then disband. This project-based working, where people sometimes work simultaneously on several projects with different teams across different organizations, is generating major interest in the information systems called "groupware." Groupware provides IT support for meetings, collaborative work, and communications among far-flung team members. Cairncross[1] believes the increased ability to collaborate in new ways using IT is one of the forces driving the changes in organizational structures, and that enterprises that use the technology to work in new collaborative ways will be the winners.

Anytime, Anyplace Information Work

Information workers are increasingly mobile, so computers and networks are needed not just for accessing information, but also for communicating with others. One of the hallmarks of IT today is that the communication capabilities of computers are seen as more important than their computing capabilities. Communication technology has developed to the point where information work can be done anywhere with a laptop computer, cell phone, or PDA. Electronic mail, voice mail, and instant messaging (IM) cross time zones to allow work to be conducted anytime, anywhere. People sporadically work from home, rather than commute every day, and they work in their preferred geographical location, even if it is remote from the main office. The advances in wireless technology enable people to work in an airport, at a customer site, while walking, and so on.

Outsourcing and Strategic Alliances

To become more competitive, organizations are examining which work they should perform internally and which they should give to others. Outsourcing, having a third party perform information work for you, may be a simple contract for services or a long-term strategic alliance. Between these two extremes are a variety of relationships that are redefining the way organizations work together. The thinking is: We should focus on what we do best and outsource the other functions to people who specialize in them, to make us more world-class in all our functions. The result is becoming known as the extended enterprise. IT is providing the information and communication means to manage complex sets of workflows.

Demise of Hierarchy

In the traditional hierarchy, people performing the same type of work are grouped together and overseen by a supervisor. The supervisor allocates the work, handles problems, enforces discipline, issues rewards, provides training, and so on. Management principles such as division of labor and chain of command define this traditional work environment.

This structure is no longer best in many instances. Self-managed groups, whether working on an assembly line or in an insurance company, provide much of their own management. In these quality circles, they have lower absenteeism, yield higher productivity, produce higher-quality work, and are more motivated than workers in traditional settings.

A major reason for the demise of hierarchy is that the more turbulent business environment—represented by the changes just noted—challenges the premises of a hierarchical structure because it cannot cope with rapid change. Hierarchies require a vertical chain of command, where lines of responsibility do not cross and approval to proceed on major initiatives is granted from above. This communication up and down the chain of command can take too much time in today's environment. IT enables team-based organizational structures by facilitating rapid and far-flung communication.

Business Strategies in the New Work Environment

Thomas Friedman's bestseller, *The World Is Flat*, is another forceful essay on unfolding the new structure of the global economy. As a result of these changes in the internal and external organizational environment, enterprises around the world are redefining their work environment—a tumultuous proposition, at best—without any true guidance. We see the following overarching goals for thriving in the new work environment:

- Leverage knowledge globally
- Organize for complexity
- Work electronically
- Handle continuous and discontinuous change

Leverage Knowledge Globally

Knowledge is now being called intellectual capital to signify its importance. This is not the knowledge in an expert system or a Lotus Notes database, but rather the knowledge in people's heads. Knowledge that people know but cannot really explain to others is called tacit knowledge, as opposed to explicit, explainable knowledge. Companies that

are able to leverage tacit knowledge globally will be successful—provided, of course, its use is directed by a sound strategy.

Brook Manville and Nathaniel Foote of McKinsey & Company[4] point out that knowledge-based strategies begin with strategy, not knowledge. Intellectual capital is meaningless unless companies have the corporate fundamentals in place, such as knowing what kind of value they want to provide and to whom.

They also point out that executing a knowledge-based strategy is not about managing knowledge but about nurturing people who have the knowledge, tapping into the knowledge that is locked in their experience. Although companies have numerous systems in place to share explicit knowledge, the key to unlocking tacit knowledge is a work environment in which people want to share. A manufacturer that tried to foster greater knowledge transfer while downsizing discovered that the combination was impossible. Why would employees share what they know when the bosses were looking for ways to consolidate expertise?

The means to tap tacit knowledge is to foster sharing and to support the sharing with technology. E-mail and groupware can provide the interconnection, but the driving force is the culture. When people want to share, they form worknets—informal groups whose collective knowledge is used to accomplish a specific task. The sharing and leveraging of knowledge happens through organizational "pull"—people needing help from others to solve a problem—rather than organizational "push," which overloads people with information. Therefore, leveraging knowledge is all about raising the aspirations of each individual, say Manville and Foote.

Organize for Complexity

A second overarching goal of companies, whether they recognize it or not, is to be able to handle complexity. Why? One reason is that the world has become so interconnected that simple solutions no longer solve a problem. Another reason is that issues are systemic. Corporate decisions can have an environmental impact, a human resources impact, an economic impact, and even an ethical impact. Furthermore, capturing market share oftentimes requires allying with others who have complementary expertise. Alliances increase complexity; so does specialization. Have you bought shampoo, crackers, or tires lately? These used to be fairly straightforward decisions. Today, the choices are so numerous that consumers can spend an inordinate amount of time making a selection. To thrive in such an age, companies need to be organized to be able to handle complexity.

Work Electronically

Just as the marketplace is moving to the marketspace, the workplace is moving to the workspace. Taking advantage of the Internet, and networks in general, is a third major goal of enterprises these days. But just as the move from horse and buggy to train to automobile to jet plane was not simply a change in speed, but a change in kind, so, too, is the move to working in a space rather than a place a change in kind. It requires different organizing principles, management tenets, compensation schemes, organizational structures, and such. It also changes how organizations interact with others, such as their customers.

George Gilder,[5] columnist and author, noted that business eras are defined by the plummeting price of the key factor of production. During the industrial era, this key factor was horsepower, as defined in kilowatt hours. It dropped from many dollars to

7.5 cents. For the past 40 years, the driving force of economic growth has been transistors, translated into millions of instructions per second (MIPS) and bits of semiconductor memory. The latter has fallen 68 percent a year, from $7 per bit to a millionth of a cent. Likewise, the cost of storage has become almost trivial, less than 50 cents per gigabyte.

MIPS and bits have been used to compensate for the limited availability of bandwidth. The microchip moved power within companies, allowing people to vastly increase their ability to master bodies of specialized learning. Microchips both flattened corporations and launched new corporations. Bandwidth, on the other hand, moves power all the way to consumers. That is the big revolution of the Internet, Gilder contends, and the reason behind the move to relationship marketing with consumers.

The use of bandwidth is becoming more available as the economy changes. For example, TV is based on a top-down hierarchical model with a few broadcast stations (transmitters) and millions of passive broadcast receivers (televisions). The result is "lowest-common-denominator" entertainment from Hollywood. The Internet, on the other hand, is a "first-choice" culture, much like a bookstore. You walk in and get your first-choice book. First-choice culture is vastly different from lowest-common-denominator culture. As the Internet spreads, the culture will move from what we have in common to one in which our aspirations, hobbies, and interests are manifested.

Handle Continuous and Discontinuous Change

Finally, to remain competitive, companies will need to innovate continually—something most have generally not been organized to do. Continual innovation, however, does not mean continuously steady innovation. Innovation occurs in fits and starts. Change takes two forms: continuous change (the kind espoused by total quality management techniques) or discontinuous change (the kind espoused by reengineering). When a product or process is just fine, but needs some tuning, continuous change improves its efficiency. However, when it is not fine, discontinuous change is needed to move to an entirely new way of working. The two often form a cycle. Companies need to be able to handle both for their products and processes.

These four major goals underlie the new work environment. This organizational environment sets the backdrop for exploring the emerging technology environment.

THE TECHNOLOGY ENVIRONMENT

The technology environment enables advances in organizational performance. The two have a symbiotic relationship; IT and organizational improvements co-evolve. IT evolution can be described using the four traditional areas of hardware, software, data, and communication.

Hardware Trends

In the 1950s and 1960s, the main hardware concerns of data-processing managers were machine efficiency and tracking new technological developments. Batch processing was predominant; online systems emerged later. At that time, hardware was centralized, often in large, showcase data centers behind glass walls.

In the mid-1970s, processing power began to move out of the central site, but only at the insistence of users who bought their own departmental minicomputers and word processors. In the 1980s, mainly due to the advent of personal computers (PCs), this trend accelerated far beyond the expectations of most people, especially IS managers. In the 1990s, the IT world was focused on networks, ranging from local area networks (LAN) to high-speed wide-area networks to support client-server computing. In this underlying structure, a client machine on the desktop, a laptop, or a handheld provides the user interface, and a server on the network holds the data and applications. This same client-server model is used for interacting with the Web.

The major development in hardware toward mobile and handheld devices is led by two factions: telecommunications companies (and the cell phone manufacturers that serve them) and handheld computer manufacturers, such as Palm and Microsoft. Functionality is expanding with devices handling both voice and data. Use of wireless hardware has become the norm for the anytime-anyplace workforce.

These hardware trends are further distributing processing beyond organizational boundaries to suppliers and customers. The result is the movement of enterprise-wide hardware and processing power out of the control—although perhaps still under the guidance—of the IS organization. Many futurists predict that hardware will evolve from the desktop to embedded devices. These are self-contained special-purpose applications with a dedicated computer installed in the devices, such as Personal Digital Assistants (PDAs) and handheld computers.

Software Trends

The dominant issue in software and programming in the 1960s was how to improve the productivity of in-house programmers—those who created mainly transaction-processing systems. Occasionally, IS management discussed using outside services, such as time-sharing services, application packages, and contract programming from independent software houses. The software industry was still underdeveloped, though, so application development remained the purview of IS managers.

Later, programming issues centered first around modular and structured programming techniques. Then the topic expanded to life cycle development methodologies and software engineering, with the goals of introducing more rigorous project management techniques and getting users more involved in early stages of development. Eventually, prototyping (quick development of a mock-up) became popular.

Then two other software trends appeared. One, purchased software, became a viable alternative to in-house development for many traditional, well-defined systems. Two, IS managers began to pay attention to applications other than transaction processing. Software to support decision support systems (DSS), report generation, and database inquiry shifted some programming from professional programmers to end users.

During the 1990s, the push for open systems was driven primarily by software purchasers who were tired of being locked in to proprietary software (or hardware). The open systems movement continues to demand that different products work together, that is, interoperate. Vendors initially accommodated this demand with hardware and software black boxes that performed the necessary interface conversions, but the cost of this approach is lower efficiency.

Another major trend in the 1990s was toward Enterprise Resource Planning (ERP) systems, which tightly integrate various functions of an enterprise so that management

can see cross-enterprise financial figures and order and manufacturing volumes. Some firms implemented ERP to replace legacy systems that were not Y2K compliant (i.e., the systems would think that an "02" would mean 1902 rather than 2002). Implementing ERP involves integrating components, which is called systems integration, rather than application development. Implementation has been expensive and troublesome, especially for companies wanting to modify the ERP software to fit their unique processes. However, for many large corporations, their ERP system has become their foundation information system, in essence, defining their IT architecture.

Like hardware, software is becoming more network-centric. Rather than replacing legacy systems, many companies are adding Web front ends to broaden access to the systems to employees, customers, and suppliers. Companies are establishing corporate portals where employees log into their company intranet to use software housed at that site. This approach moves the software from being decentralized (on PCs) to being centralized (on a server somewhere).

Another change in software is the move to Web Services. Web Services are packages of code that each perform a specific function and have a URL (Uniform Resource Locator; an address on the Internet) so that they can be located via the Internet to fulfill a request. For example, if you have accessed FedEx's Web site to track a package, you have used a Web Service. MacAfee's virus protection also is delivered to PCs using a Web Services approach. The software industry is morphing into a Web Services industry.

The significance of Web Services is that it moves software and programming to being truly network-centric. As SUN Microsystems claimed more than a decade ago, the network becomes the heart of the system, linking all Web Services. Packages of code can be concatenated to produce highly tailored and quickly changed processes. In the past, once software was programmed to handle a process in a specific way, it essentially cast that process in electronic concrete because the process could not change until the software was modified. The tenet of Web Services is that a process is defined at the time it is executed, because each Web Service decides at that time which of its many options to use to answer the current request. The world of Web Services entails its own jargon, standards, and products. Importantly, it builds on the past—functions in legacy systems can be packaged to become Web Services. The last two years have witnessed the widespread adoption of service-oriented architecture (SOA). Service orientation refers to an architecture that uses loosely coupled applications or services to support the requirements of business processes.

As discussed in the hardware trends, embedded applications will eventually become a major task for software developers. With an estimation of more than 10 to 15 billion connected devices in the next few years—from PDAs to mobile phones—networking and security remain key priorities.

Another emerging trend is the increasing recognition that Web-based interface alone is not sufficient. With the proliferation of ubiquitous computing, Web-based interfaces should be supplemented with complementary "anywhere accessible" applications that require a new type of interface rich in interactivity and intuitiveness.

Data Trends

The evolution of the third core information technology area—data—has been particularly interesting. At first, discussions centered around file management and techniques for organizing files to serve individual applications. Then generalized file management

systems emerged for managing corporate data files. This more generalized approach led to the concept of corporate databases to serve several applications, followed a few years later by the concept of establishing a data administration function to manage these databases.

As discussed earlier, in the 1970s, the interest in data turned to technical solutions for managing data—database management systems (DBMS). As work progressed, it became evident that a key element of these products was their data dictionary. Dictionaries now store far more than data definitions; they store information about relationships between systems, sources and uses of data, time cycle requirements, and so on.

For the first 20 years of information processing, discussions about data concerned techniques to manage data in a centralized environment. It was not until the advent of fourth-generation languages and PCs that interest in letting employees directly access corporate data began. Then users demanded it. If data across systems are defined the same way, they can be more easily exchanged.

In addition to distributing data, the major trend in the early 1990s was expanding the focus from data resources to information resources, both internal and external to the firm. Data management organizes internal facts into data record format. Information management, on the other hand, focuses on concepts (such as ideas found in documents, especially digital documents such as Web pages) from both internal and external sources. Thus, information resources encompass digitized media, including voice, video, graphics, animation, and photographs.

Managing this expanded array of information resources requires new technologies. Data warehousing has arisen to store huge amounts of historical data from such systems as retailers' point-of-sale systems. Data mining uses advanced statistical techniques to explore data warehouses to look for previously unknown relationships in the data, such as which clusters of customers are most profitable. Similarly, massive amounts of document-based information are organized into document repositories and analyzed with document mining techniques. In addition, as noted earlier, businesses now emphasize intellectual capital management. Some believe knowledge can reside in machines; others believe it only resides in people's heads. Either way, knowledge management is of major importance in the new economy because intangibles hold competitive value.

The Web has, of course, broadened the term "data" to mean "content," which encompasses text, graphics, animation, maps, photos, film clips, and such. Initially, Web content was managed by the content creators, such as marketing departments. However, with the huge proliferation of sites, enterprises realized they needed to rein in all the exuberance in order to standardize formats, promote their brands in a common manner, establish refresh cycles for their content, and create approval and archival processes. Content management has become very important, and as one manager observed, it is a lot like running a newspaper.

Three major data issues now facing CIOs are security (protecting data from those who should not see it) and privacy (safeguarding the personal data of employees and customers). Furthermore, regulations (such as the 2002 Sarbanes-Oxley Act in the United States) now require company officers to verify their financial data. Because the processes that handle financial data are undoubtedly automated, CIOs need to document and ensure the accuracy of these processes. Thus, numerous aspects of data

safeguarding have become important. In the coming years, content management solutions, thanks to the ease in which they can manage unstructured data, will likely constitute a software foundation for other applications to build, retrieve, and store data.

Communications Trends

The final core information technology is telecommunications and technology convergence. This area has experienced enormous change and has now taken center stage. Early use of data communications dealt with online and time-sharing systems. Then interest in both public and private (intracompany) data networks blossomed.

Telecommunications opened up new uses of information systems, and thus it became an integral component of IS management. Communications-based information systems were used to link organizations with their suppliers and customers. In the early 1980s, a groundswell of interest surrounded interorganizational systems, because some provided strategic advantage. Also during the 1980s, the use of local area networks (LANs) to interconnect PCs began. PCs started out as stand-alone devices, but that only took advantage of their computing capabilities. It soon became clear that they had communication capabilities as well, so companies jammed even more wires in their wiring ducts to connect desktops to each other and then to the corporate data center.

Until the Internet appeared, enterprises leased lines from telecommunications carriers to create wide area networks (WANs) that linked their offices and factories. The only publicly available telecommunication system was the voice telephone system. Transmitting data from PCs in small offices that did not have leased lines generally entailed using a modem to dial up a computer at another site.

The Internet changed all that. Internet Service Providers (ISPs) appeared seemingly overnight to provide PC users with a local number for dialing into the Internet to search the Web, converse in a chat room, play text-based games, send e-mail, and transfer files. The Internet provided for data the equivalent of the worldwide voice network. Today, the Internet's protocol has become the worldwide standard for LANs and WANs. In fact, it will soon be the standard for voice as well.

Perhaps the most exciting developments in telecommunications technology is wireless—wireless long distance, wireless local loops (the last-mile connection of a home or office), wireless LANs (increasingly handled by Wi-Fi technology), and even wireless personal area networks (PANs). Wireless does not just enable mobility; it changes why people communicate, how they live, and how they work. It is a paradigm shift, and we are in the early days of wireless. VoiP (Voice over Internet Protocol) has become popular in many organizations or countries, with greater penetration in developing countries such as China and India. Many industry analysts predict that by 2009, over 70 percent of worldwide voice connection will be wireless.

While the Internet continues to be the key networking technology, alternate technologies such as peer-to-peer technology, Bluetooth, or wireless mesh network, make it possible to deploy communications or collaborative applications without the reliance on Internet servers. Examples include local messaging systems, or RFID-based inventory management.

A number of unresolved issues remain salient. Reliability and security of networks, development and migration to new communications standards, and uneven access to networks (digital divide) are among a few but critical issues that management needs to strategize.

THE MISSION OF IS ORGANIZATIONS

With the organizational and IT environments as backdrops, we now turn to the mission of the IS organization. In the early days, transaction processing systems (TPS) acted as "paperwork factories" to pay employees, bill customers, ship products, and so on. During that era, the performance of the IS organization was defined by efficiency (or productivity) measures such as the percentage of uptime for the computer, throughput (number of transactions processed per day), and the number of lines of program code written per week.

Later, during the MIS era, the focus of IS departments shifted to producing reports for "management by exception" or summary reports for all levels of management. This era gave us the classic IS objective to "get the right information to the right person at the right time." In this era, IS was judged on effectiveness measures (in addition to the efficiency measures of the previous era).

For today's environment, the mission of IS organizations has broadened to the following:

> *To improve the performance and innovativeness of people in organizations through the use of IT.*

The objective is improvement of the enterprise, not IS; so, ideally, IS performance is based on business outcomes and business results. IT is but one contributor to improving enterprise performance and competitiveness. This text focuses on the resources used by IS organizations.

A SIMPLE MODEL

We propose a simple model to describe the IS function in organizations. Figure 2 represents the process of applying IT to accomplish useful work. On the left is the technology, and on the right are the users who put it to work. The arrow represents the process of translating users' needs into systems that fill that need. In the early days of IT, this translation was performed almost entirely by systems analysts.

Figure 3 is a simple representation of what has happened over the past 50 years. Technology has become increasingly complex and powerful; uses have become increasingly sophisticated. Information systems are now viewed as system products and users

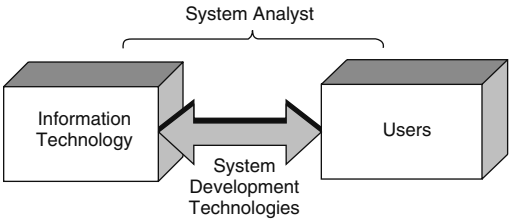

FIGURE 2 A Simple Model of Technology Use

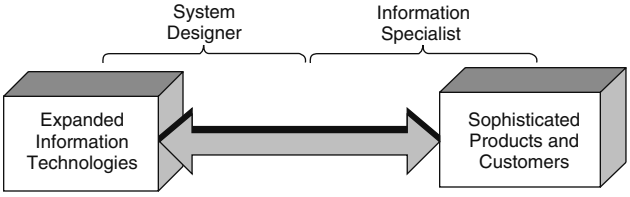

FIGURE 3 Systems Professionals Bridging the Technology Gap

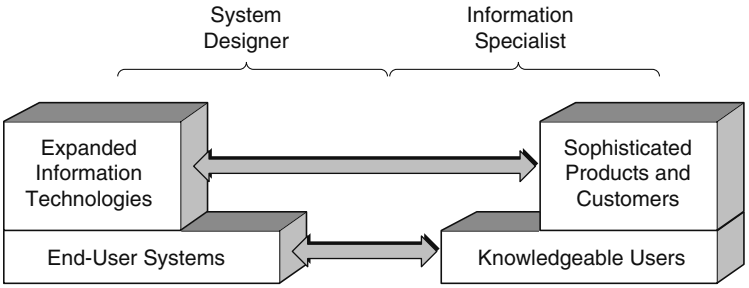

FIGURE 4 Users Bridging the Technology Gap

have become customers. The increased distance between the two boxes represents the increasingly complex process of specifying, developing, and delivering these system products. It is no longer feasible for one system analyst to understand the fine points of all the technologies needed in an application as well as the nuances of the application. More specialization is required of systems professionals to bridge this wider gap.

Systems professionals are not the only ones who can help bridge this gap between the technology and its users. Technology has become sophisticated enough to be used by many employees and consumers. At the same time, they are becoming increasingly computer literate; many employees even develop their own applications; hence, the notion of end-user computing. Figure 4 depicts this trend. Today, some of the technology is truly user-friendly, and some applications, such as Web page development, database mining, and spreadsheet manipulation, are handled by non-IT staff. Transaction systems, however, are still developed and maintained by professional developers, either inside or outside the firm.

The main point of this discussion is that technology is getting more complex, applications are becoming more sophisticated, and users are participating more heavily in the development of applications. The net result is that management of the process is becoming more complex and difficult as its importance increases.

A BETTER MODEL

Expanding the simple model gives us more guidance into managerial principles and tasks. We suggest a model with four principal elements:

1. A set of technologies that represent the IT infrastructure installed and managed by the IS department
2. A set of users who need to use IT to improve their job performance
3. A delivery mechanism for developing, delivering, and installing applications
4. Executive leadership to manage the entire process of applying the technology to achieve organizational objectives and goals

Let us look more carefully at each of these elements.

The Technologies

Several forces contribute to the increased importance and complexity of IT. One, of course, is the inexorable growth in computing and communications capacity accompanied

by significant reductions in cost and size of computers and telecommunications components. Another is the convergence of the previously separate technologies of computers, telephones/telecom/cable TV, office equipment, and consumer electronics. Still a third contributor is the ability to store and handle multiple forms of data—including voice, image, and graphics—and integrate them, resulting in multimedia. Here is a brief list of some rapidly growing technology areas:

- Handheld wireless devices and multifunction cell phones
- Web Services
- Wireless networks
- Integration of voice, data, and video
- Integration of consumer electronics and IT
- Green technologies

These technologies form products that are useful to employees, customers, suppliers, and consumers. No longer relegated primarily to automating transactions, information systems now fill major roles in management reporting, problem solving and analysis, distributed office support, customer service, and communications. In fact, most activities of information workers are supported in some way by IT; the same is becoming true of suppliers, customers, business trading partners, and consumers.

The Users

As IT becomes pervasive, user categories expand. The users of electronic data processing and MIS once were relatively easy to identify; they were inside the company. These systems performed clear-cut processes in specific ways. Now, though, many people want open-ended systems that allow them to create their own processes on the fly. They want systems that act as a tool, not dictate how to perform a task.

If we concentrate only on business use of IT, one helpful dichotomy divides the activities of information workers into two: procedure-based activities and knowledge-based (or goal-based) activities. The value of this model is that it focuses on the important characteristics of information workers—their job procedures and knowledge—rather than on the type of data (e.g., numbers versus text) or the business function (production versus sales), or even job title (managerial versus professional).

Procedure-based activities are large-volume transactions, where each transaction has a relatively low cost or value. The activities are well defined; therefore, the principal performance measure is efficiency (units processed per unit of resource spent). For a procedure-based task, the information worker is told what to accomplish and the steps to follow. Procedure-based activities mainly handle data.

Knowledge-based activities, on the other hand, handle fewer transactions, and each one has higher value. These activities, which can be accomplished in various ways, must therefore be measured by results, that is, attainment of objectives or goals. Therefore, the information worker must understand the goals because part of the job is figuring out how to attain them. Knowledge-based activities are based on handling concepts, not data. Figure 5 summarizes these two kinds of information-based work, giving several examples from banking.

Some authors use the words "clerical" and "managerial" to refer to these two types of activities. Looking at the attributes, however, it is clear that managers often do procedure-based work, and many former procedure-based jobs now have knowledge-based components. Furthermore, the distinction between manager and worker is blurring.

PROCEDURE BASED	KNOWLEDGE BASED
• High volume of transactions	• Low volume of transactions
• Low cost (value) per transaction	• High value (cost) per transaction
• Well-structured procedures	• Ill-structured procedures
• Output measures defined	• Output measures less defined
• Focus on process	• Focus on problems and goals
• Focus on efficiency	• Focus on effectiveness
• Handling of data	• Handling of concepts
• Predominantly clerical workers	• Managers and professionals
• Examples	• Examples
Back office	Asset/liability management
Mortgage servicing	Planning department
Payroll processing	Corporate banking
Check processing	

FIGURE 5 A Dichotomy of Information Work

The most important benefit of this dichotomy is that it reveals how much of a firm's information processing efforts have been devoted to procedure-based activities, which is understandable because computers are process engines that naturally support process-driven activities. As important as they are, though, it is clear that procedure-based activities are no longer sufficient to sustain competitiveness. The wave of the future is applying IT to knowledge-based activities. For the task "pay employees" or "bill customers," the system analyst can identify the best sequence of steps. On the other hand, the task "improve sales in the Asian market" has no best process. People handling the latter work need a variety of support systems to leverage their knowledge, contacts, plans, and efforts.

System Development and Delivery

In our model, system development and delivery bridge the gap between technology and users, but systems for procedure-based activities differ from systems for knowledge-based information work.

The left side of Figure 6 shows the set of technologies that form the IT infrastructure. Organizations build systems on these technology resources to support both procedure-based and knowledge-based activities. The three main categories, called essential technologies, are computer hardware and software, communication networks, and information resources. We call the management of them infrastructure management, which includes operations, that is, keeping the systems that use these technologies up and running.

The right side of Figure 6 shows the two kinds of information work: procedure based and knowledge based. These two categories are not distinct or separate, of course, but it is helpful to keep their major differences in mind because they lead to different approaches, and frequently different teams, in the bridging of systems development and delivery.

In between the technologies and the information workers is the work of developing and delivering both procedure-based systems and support systems.

IS Management

The fourth component of this text model is executive leadership. IT leadership comes from a chief information officer (CIO) who must be high enough in the enterprise to influence organizational goals and have enough credibility to lead the harnessing of the

technology to pursue those goals. However, the CIO, as the top technology executive, does not perform the leadership role alone, because IT has become too important to enterprise success to be left to one individual. Thus, CIOs work with their business peers, C-level executives—CEO, COO, CFO—and the heads of major functional areas and business units. The technology is becoming so fundamental and enabling that this executive team must work together to govern and leverage it well.

To summarize, this model of the IS function has four major components:

1. The technology, which provides the enabling electronic and information infrastructure for the enterprise
2. Information workers in organizations, who use IT to accomplish their work goals
3. The system development and delivery function, which brings the technology and users together
4. The management of the IS function, with the overall responsibility of harnessing IT to improve the performance of the people and the organization

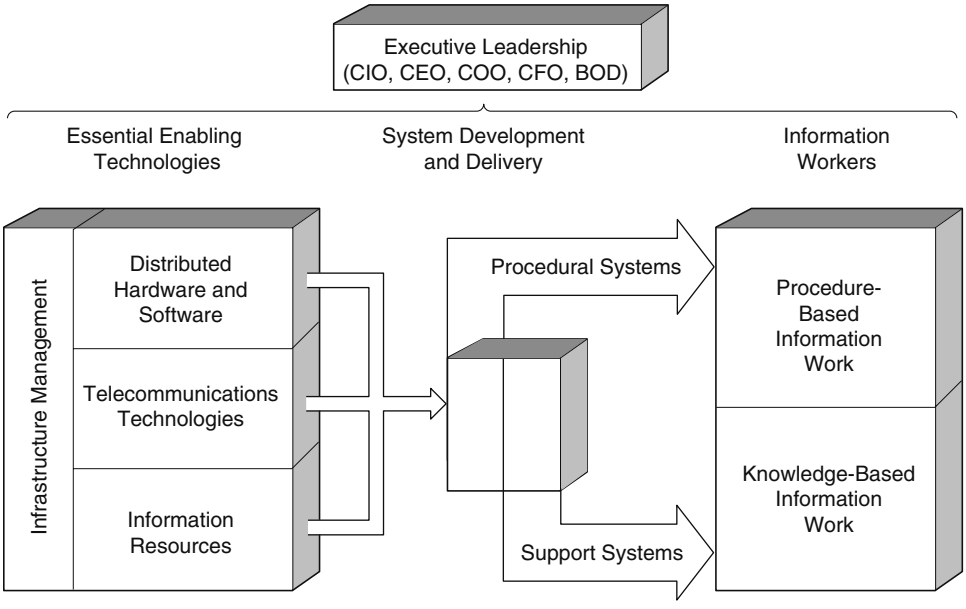

FIGURE 6 A Framework for IS Management

Following is the case of MeadWestvaco. The evolution of the case study, first published in 1985, mirrors the changes that have taken place in many IS organizations over the past 20 years.

CASE EXAMPLE

MEADWESTVACO CORPORATION

www.meadwestvaco.com

MeadWestvaco, with headquarters in Stamford, Connecticut, is a $7-billion global company that produces specialty and coated paper, packages specialty chemicals, and manufactures consumer and office products. It owns and manages some 3 million acres of forest using sustainable forestry practices. The company operates in more than 29 countries, has about 24,000 employees around the world, and serves customers in approximately 100 nations.

Mead Corporation and Westvaco, two comparably sized forest products companies, merged in early 2002 to form MeadWestvaco Corporation. This case study begins in 1985 and follows the evolution of Mead's IT function up to the present time, in its merged form. In 2001, *InformationWeek* magazine listed Mead No. 193 in its top 500 of the most innovative users of information technology. The IT organization has remained in Dayton, Ohio, the former headquarters of Mead Corporation.

The 1960s and 1970s: Reorganization of Information Services

In the 1960s, Mead's corporate information services (CIS) department provided all divisions with data processing services. By 1967, the department's budget had grown so large that management decided to spin off some of the functions to the divisions. Divisions could establish their own data processing and process engineering groups or they could continue to purchase data-processing services from CIS. Many of the divisions did establish their own IS departments, but all continued to use the corporate data center for their corporate applications. In the late 1970s, the CIS department had six groups. The director reported to the vice president of operations services. The six groups under the director were:

- *Computer Operations* to manage the corporate data center
- *Telecommunications* to design the telecommunications network and establish standards
- *Technical Services* to provide and maintain systems software
- *Developmental Systems* to handle traditional system development
- *Operational Systems* to maintain systems after they become operational
- *Operations Research* to perform management science analysis

The 1980s: Focus on End-User Computing

In 1980, management realized that its CIS organizational structure would not serve the needs of the rapidly growing end-user community. Furthermore, to become an "electronic-based" organization, Mead needed a corporate-wide network. Therefore, the department reorganized so that the director of corporate information resources (CIR) reported directly to the company president. This change signaled the increased importance of information resources to Mead.

CIR was responsible for creating hardware, software, and communication standards for the entire corporation; it ran the corporate data center; and it operated the network. All the divisions used the network and corporate data center, and they followed the corporate standards; some operated their own small, distributed systems as well, which linked into the corporate network. The three departments within the new group were as follows.

Information Resources Planning and Control was responsible for planning future information systems and technology. This department grew out of the company's strong planning culture. The decentralization in the 1970s highlighted the need for a coordinating IT body. Although it was small, it had two important roles. First, it took the corporate perspective for IT planning to ensure that Mead's IT plans meshed with its business plans. Second, it acted

(*Case Continued*)

as planning coordinator, helping various groups and divisions coordinate their plans with corporate and CIR plans.

Information Services was responsible for most of the traditional IS functions from the old information services department—company-wide telecommunications support, data center operations, development of corporate-wide systems, database administration, system software support, and technical support for end-user computing.

Most divisions developed their own applications, following the guidelines created by this department. The IS steering committee—composed of the president and group vice presidents—established a policy that applications should be transportable among the various computing centers and accessible from any Mead terminal. The company's telecommunications network established the guidelines for making this interconnection possible.

Decision Support Applications (DSA) provided all end-user computing support for the company. At the time of the reorganization, DSA had no users, no products, no common applications among multiple locations, and only five staff members in operations research and two in office systems support. By 1985, they were serving 1,500 users in some 30 Mead locations with 10 staff members. DSA offered 14 products and 8 corporate-wide applications through the following 4 groups:

- *Interactive help center* provided hotline support and evaluated new end-user computing products.
- *Office systems* supported the dedicated word-processing systems and IBM's Professional Office System (PROFS), which Mead used as the gateway to end-user computing. Divisions were free to select any office system, but most followed the recommendations of this group to ensure corporate-wide interconnection.
- *Decision analysis* built a number of company-wide decision support systems, such as a corporate budgeting model and a graphics software system. It also used operations research tools to develop linear programming models and simulations for users needing such sophisticated analysis tools.
- *Financial modeling coordination and EIS* was in charge of Mead's integrated financial system. It also supported executive computing through IBM PCs used by corporate executives and an executive information system (EIS) accessed through PROFS.

Late 1980s: Structure Adjustment

The 1980 reorganization separated the more people-oriented activities under DSA from the more technical activities under the information services department. The technology was better managed, and relations with users improved. However, this split caused two problems. The first was that traditional programmers and systems analysts felt that DSA received all the new and exciting development work. The second problem was coordinating the two departments. A matrix arrangement evolved to handle both problems, with both information