MANAGEMENT INFORMATION SYSTEMS

A Contemporary Perspective

Second Edition

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PART ONE

Organizational Foundations of Information Systems

Contemporary information systems are both technical and social in nature. Managers must understand the relationship between information systems and the structure, functions, and politics of organizations. Information systems must be responsive to management interests and decision-making processes as well. Part One places information systems in the context of organizations and highlights their strategic role.

Chapter 1 introduces the concept of an information system and illustrates the role that information systems play in organizations. There are many different kinds of information systems, and they support different organizational levels and functions. Because information systems involve both technical and behavioral challenges, there are many relevant perspectives.

Chapter 2 provides realistic examples of the five major types of information systems in organizations: transaction processing systems; management information systems; knowledge work systems; decision support systems; and executive support systems. These systems serve different purposes and different constituencies in the organization.

Chapter 3 highlights the strategic role that can be played by information systems in organizations today. Strategic information systems have transformed organizations' products and services;

relationships with customers and suppliers; and internal operations. Leading U.S. corporations have used information technology for competitive advantage. To use information systems strategically, organizations may have to undergo extensive change.

Chapter 4 explores the relationship between organizations and information systems. Information systems are intimately tied to organizational structure, culture, political processes, management, and work. Organizations build information systems for a variety of reasons: sometimes to gain new efficiencies, other times to preserve market share or to match a competitor.

Chapter 5 examines how systems can support management decision making. An important first step is to understand how managers actually make decisions. As it turns out, this is not a simple matter. The chapter compares individual and organization models of decision making and shows how information systems should be designed to support managerial decision making and work.

Part One Case Study: "Chrysler and GM: A Tale of Two Architectures." This case illustrates how two giant American corporations, Chrysler and General Motors, have tried to use information technology for competitive advantage. The results for both corporations have been mixed. One key finding in both corporations is that organizations must change in order to effectively utilize new information technology. Technology alone is not the answer to productivity problems in America.

OUTLINE

CHAPTER 1

Introduction to Information Systems

MEDEX: Lab Testing on the Fast Track

MedExpress is a start-up company in Memphis, Tennessee, that provides express medical testing for hospitals around the country. MedExpress exploits a unique combination of Federal Express delivery capability, geography, and computer technology of its own in order to provide the most comprehensive and fastest medical testing in the world.

Here is how it works. A doctor in Kentucky orders a series of highly sophisticated tests on an elderly patient in intensive care at a small hospital in Lexington, Kentucky. Some of these tests can be done locally, but others require unusual equipment. Blood samples are sent by Federal Express overnight delivery to Baptist Memorial Hospital in Memphis, Tennessee, which has the required equipment. MedExpress arranges for the Fed Ex pickup and delivery and tracks the lab specimens at each point of testing.

In a few hours after the test is performed, MedExpress contacts the Lexington hospital via its own communications network with the results. The results are printed out on a PC printer either in the doctor's office or the hospital lab office. Within a day of taking the test, the doctor is using the results to form a diagnosis and design a therapy.

Because Federal Express is located in Memphis, Tennessee, getting blood samples into the Memphis area to some of the

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country's largest hospitals with thousands of lab technicians and unique equipment was relatively easy. Getting results back to hospitals and doctors around the country was more difficult. Moreover, MedExpress wanted to provide much better service than ordinary testing labs, which often take weeks to analyze samples. For these problems MedExpress turned to IBM to develop MedExpress workstations for each participating hospital based on IBM's powerful PS/2 desktop computers. To link these computers to the MedExpress mainframe computer in Memphis, MedExpress turned to Cyclix Telecommunications Company to develop a communications network that allows hospitals and doctors to trace the movement of their tests through the MEDEX system.

With these combined technologies, doctors can order tests via a personal computer in their office and receive results within a day or two. At any point in time, doctors can trace the samples through the testing facilities to obtain interim results or just to keep informed. Future expansion plans will permit MedExpress to plot historical dosages of drugs for individual patients and to develop national standards for cholesterol and other tests, which today vary greatly from lab to lab. For Dr. Robert Kisabeth, medical director of MedExpress, the success of MedExpress is based on a very human premise: "When you are in a hospital bed waiting for a test result, both the patient and doctor are in limbo. Our job is to get both the patient and the doctor out of limbo."

Source: Thom Elkjer, "MEDEX: The 'Federal Express' of Laboratory Testing," *Computerland Magazine*, September/October 1988

MedExpress illustrates the new role that information systems have come to play in organizations and industries. MedExpress also illustrates the critical role that information systems play in support of the knowledge and information sector of the American economy. Aside from keeping track of orders and bills, information systems today play a strategic role in business by defining new products and services, maintaining a competitive edge, and providing new opportunities for management control.

In this chapter the student will learn:

- How to define an information system.
- The difference between computer literacy and systems literacy.
- Why managers at all levels must understand information systems.
- The different kinds of information systems.
- The major trends in information systems.
- The major conceptual approaches to information systems.
- The major challenges to building effective information systems in organizations.

1.1 Introduction

What Is an Information System?

An *information system* can be defined as a set of procedures that collects (or retrieves), processes, stores, and disseminates information to support decision making and control (see Figure 1.1). In this book we are concerned exclusively with *formal, organizational, computer-based information systems (CBIS)*. Each of these terms will now be discussed.

Formal Systems

Formal systems rest on accepted and relatively fixed definitions of data and of procedures for collecting, storing, processing, disseminating, and using these data. The CBIS we describe here are structured—that is, they operate in conformity with predefined rules that are relatively fixed and not easily changed.

Informal information systems (such as office gossip networks), by contrast, rest on implicit agreements and unstated norms of behavior. These systems have open definitions of goals, opportunistic methods of data collection, and virtually unlimited channels of distribution and use. They are essential for the life of an organization, but they are beyond the scope of this text.

Computer-Based Information Systems (CBIS)

Most organizations have formal organizational information systems based entirely on paper-and-pencil technology. These *manual systems* serve important needs, but they are not the subject of this text.

We are concerned here with computer-based information systems (CBIS). From now on, when we use the term *information systems* we will be referring to formal organizational systems that rely on computer technology—both hardware and software.

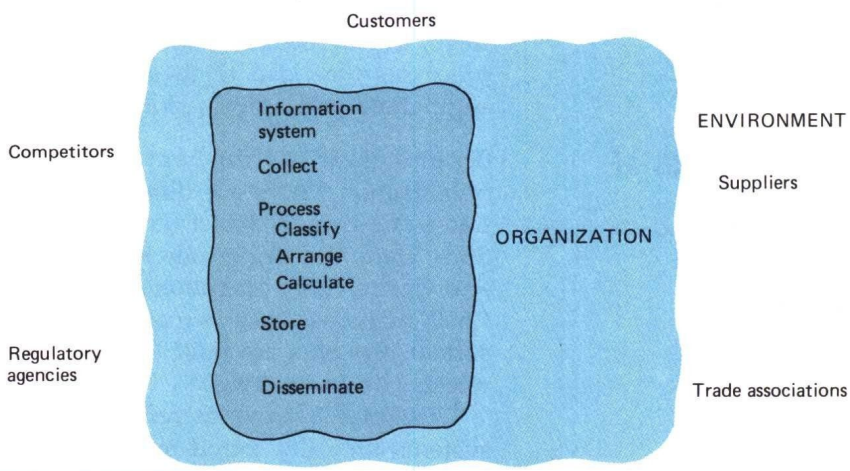

FIGURE 1.1
Basic operations of an information system. The basic operations of information systems are to collect, process, store, and disseminate information in an organization. Information may be collected from inside the organization or from the external environment and may be distributed to insiders and outsiders.

Organizations

A major theme of this text is that information systems are a part of organizations. Organizations are composed of different levels and specialties, which in turn produce different interests, often conflict, and certainly differences in perspective.

Information systems described in this book come out of this organizational cauldron of differing perspectives, conflicts, compromises, and agreements that is a natural part of all organizations.

There is no formula to be followed ritually when analyzing an organizational cauldron of differing perspectives, conflicts, compromstand and build information systems, students must first understand the structure, function, and politics of organizations. Then they must understand the capabilities and opportunities provided by contemporary information technology.

The Difference Between Computers and Information Systems

A sharp distinction must be drawn between a computer and a computer program, on the one hand, and an information system on the other. Electronic computers and related software programs are the technical foundation, the tools and materials, of modern information systems. Computers provide the equipment for storing and processing information. Computer programs, or software, are sets of operating instructions that direct and control computer processing. Knowing how they work is important in designing solutions to organizational problems. But the *raison d'être* of computers and computer programs comes from the information system of which computers are just a part.

Housing provides an appropriate analogy. Houses are built with hammers, nails, and wood, but these do not make a house. The architecture, design, setting, landscaping, and all of the decisions that lead to these features are part of the house and are crucial in finding a solution to the problem of putting a roof over one's head.

Likewise with computers and programs: They are the hammer, nails, and lumber of CBIS. Understanding information systems, however, requires one to understand the problems they are designed to solve, the architectural and design solutions, and the organizational processes that lead to these solutions. Computer literacy must be augmented with information system literacy.

Different Kinds of Systems

Because there are different interests, specialties, and levels in an organization, there are different kinds of systems. Figure 1.2 illustrates one way to depict the kinds of systems found in an organization. Here the organization is divided into strategic, managerial, knowledge, and operational levels and then further divided into functional areas such as marketing, manufacturing, finance, and personnel. Systems are built to serve these different organizational interests (Anthony, 1965).

Chapter 2 provides real-world examples of the major kinds of systems typically found in organizations. Here we provide a brief overview of systems at each level.

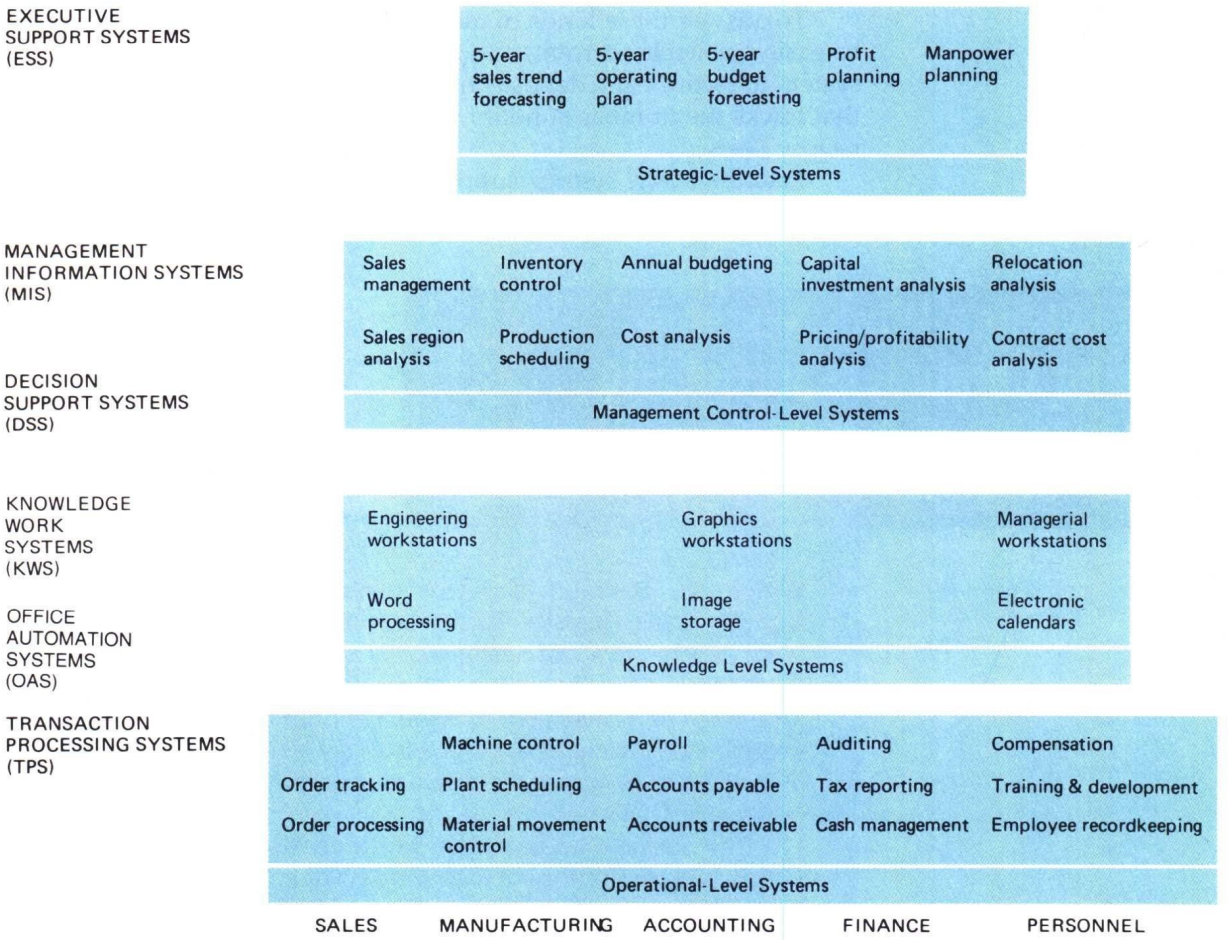

FIGURE 1.2
The hierarchy of information systems. Organizations and information systems can be divided into operational, knowledge, managerial and strategic levels. Information systems are built to serve each of these levels. Organizations also contain specialized subunits or divisions. In large organizations, each division has its own information systems.

Operational-level systems keep track of the elementary activities and transactions of the organization, such as sales, receipts, cash deposits, payroll, credit decisions, and the flow of materials in a factory. Systems serving this level of the organization are typically called *transaction processing systems* (*TPS*). The principal purpose of systems at this level is to answer routine questions and to track the flow of transactions through the organization. How many parts are in inventory? What happened to Mr. Williams's payment? What is the size of the payroll this month?

To answer these kinds of questions, information generally must be easily available, current, and accurate. Examples of TPS include a system to record bank deposits from automatic teller machines or one that tracks the number of hours worked each day by employees on a factory floor.

Knowledge level systems support knowledge and data workers in an organization. Examples of knowledge workers are engineers,

Knowledge Work Systems: Using Computers to Get Rid of Screws at National Cash Register

William R. Sprague is senior manufacturing engineer at National Cash Register Corporation (NCR). In charge of the team of engineers that designed and built NCR's new low-end 2760 electronic cash register, Sprague can snap together the new machine in less than two minutes from fifteen parts! This economy of parts and ease of assembly were made possible by a new philosophy of manufacturing called design for manufacturability (DFM).

The design process began with a computer-aided design (CAD) program that permitted the engineering team to build three-dimensional models of the machine on a computer screen. The CAD program also analyzed different designs for performance, durability, and parts complexity. Specialized DFM software was used to simplify the final design from 234 parts down to 15 parts.

The designers were so confident about the new design that they skipped the prototyping stage and transferred the data for the parts directly to the computer-aided manufacturing systems of NCR parts suppliers. The resulting product has 85 percent fewer parts, 65 percent fewer suppliers, and takes only 25 percent as much assembly time as its predecessor NCR machine. The creator of the DFM software, Professor Geoffrey Boothroyd of the University of Rhode Island, comments that "Almost anything made in Japan can be improved upon with DFM—often impressively."

Source: "The Best Engineered Part Is No Part at All," *Business Week*, May 8, 1989.

architects, scientists, researchers, and other professionals. Examples of data workers are secretaries, accountants, file clerks, salespersons, and other persons whose job largely involves the processing of information. There are several kinds of systems that serve these groups. *Office automation systems* (*OAS*) of many kinds primarily serve data workers. *Knowledge work systems* (*KWS*) serve engineers, graphics artists, medical technicians and many other kinds of professional knowledge workers.

The central purpose of knowledge work systems is to help the business firm integrate new knowledge into the business and to help it control information for its own purpose. Knowledge systems, especially in the form of workstations and office systems, are the fastest-growing applications in business today.

Management-level systems are designed to serve the monitoring, controlling, decision-making, and administrative activities of an organization. *Management information systems* (*MIS*) focus on daily, weekly, and monthly summaries of transactions that are useful for monitoring and controlling operational-level activities (Gorry and Morton, 1971). The principal question addressed by such systems is: Are things working well? Today's output will be compared with that of a month or a year ago. There is less need for instant information, but periodic reports are required. An example is a relocation control system that reports on the total moving, house-hunting, and home financing costs for employees in all company divisions, noting wherever actual costs exceed budgets.

Decision support systems (*DSS*) are customized management systems that support nonroutine decision making (Keen and Morton, 1978). They tend to focus on less structured decisions for which information requirements are not always clear, especially "what if" questions: What would be the impact on production schedules if we doubled sales in the month of December? What would happen to our return on investment if a factory schedule were delayed for six months? Answers to these questions frequently require new data from outside the organization, as well as data from inside that cannot be drawn from existing operational-level systems. An example is a financial planning system such as that used by the Xerox Corporation for profit planning.

Strategic-level systems address strategic issues and long-term trends, both in the firm and in the external environment, that are of interest to senior management. The principal concern is to match changes in the external environment with existing organizational capability. What will employment levels be in five years? What are the long-term industry cost trends, and where do we fit in? What products should we be making in five years?

The kinds of information found in most transaction and management systems may not be sufficient to answer these questions. Special senior management systems called *executive support systems* (*ESS*)

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