



MANAGEMENT INFORMATION SYSTEMS

Raymond McLeod, Jr.

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MANAGEMENT INFORMATION SYSTEMS

Second Edition

RAYMOND McLEOD, Jr.

Texas A&M University



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To Francis Cox, band director, 1935–1968

C. H. Yoe High School, Cameron, Texas

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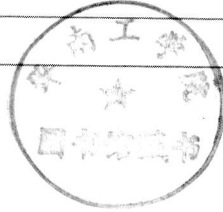
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Preface



Although the subject of management information systems (MIS) is usually offered in schools of business, it is difficult to conceive of a career path that will not eventually involve use of the computer as a management tool. All people who have managerial responsibilities—including those in organizations such as churches, military branches, museums, and hospitals as well as business firms—need more than a computer literacy. They need an MIS literacy. These people are the users of the MIS.

In addition to managers are information specialists—systems analysts, programmers, data base administrators, and EDP auditors—who support them. Such specialists help managers recognize problems that can be solved with the aid of the MIS, formulate computer-based solutions, and implement workable information systems. These specialists also need to understand the managerial role and the importance of information to that role.

Future managers and future information specialists travel different routes during their collegiate programs. But at some point the two bodies of material—the managerial and the technical—must merge. That point is the MIS course. Both groups of students study the same material in the same setting of managerial problem solving. This is a good approach, because the two groups eventually will work together in designing and implementing information systems. It is important that cooperation and understanding develop as soon as possible, and the MIS course is the perfect place. This textbook is written especially for such a course.

Realizing that little course standardization exists from campus to campus, every effort has been made to provide instructional flexibility. Material has been included to observe curricula suggestions provided by the Association for Computing Machinery in their course IS3 and by the Data Processing Management Association in their course CIS-10.

Further flexibility is provided by an updated case book and a software package. These items permit the student to become personally involved in

solving MIS-related problems and using the computer as a decision support system. In addition, an instructor's guide includes a range of items designed to support the various activities of the instructor in presenting the course material.

Like the first edition, this book has a management orientation. Emphasis is on the problem to be solved and the information needed. It is both possible and preferable for the manager to obtain information without getting wrapped up in the technical details of the computer, so those details are omitted here. A set of schematic models, many new as well as many carried over from the first edition, provide the framework that holds all of the pieces together. Each chapter now concludes with a short case to further illustrate and apply chapter concepts in realistic settings.

The narrative of the text fills out and explains the framework of the models. All terms are explained and all processes described—each part and each step. The intent is to provide a solid foundation of the MIS material on which instructors in this and following courses can build in explaining the subject and describing its specific application to particular career areas.

Although the first edition was well accepted and widely adopted, it needed to reflect the rapidly changing computer field. A survey of faculty users suggested added topics, expanded coverage, different approaches, and other improvements. These suggestions have been incorporated into this second edition, along with valuable feedback from my students at Texas Christian University and Texas A&M University. Final improvements came from reviewers who read all or part of the manuscript and recommended changes. Users of the first edition will find three new chapters, covering data base, mini/micro systems, and the future of MIS. Such additional concepts as decision support systems, informal information systems, contingency management theory, word processing, and computer security have been added, along with many more examples of how firms are actually using MIS.

Organization

This edition has the same basic organization as the first. Part One consists of a single chapter introducing the entire topic. It is an overview that describes what an MIS is and why you should be studying it.

Part Two is devoted to theory and its application to problem solving. A process that can be followed in solving problems is explained, using the computer as a decision support system. A mastery of this process, called the systems approach, is a valuable skill for every person entering an organization.

Part Three deals with the computer. Chapter 5 provides an overview, and separate chapters focus on input/output devices, storage devices, the data base, data communications, mini/micro systems, and the computer as a decision support system. Each chapter is related to the theory presented earlier.

Part Four answers the question "What does an MIS do?" Chapter 12 is an overview of functional information systems. A functional system is one tailored to fit the needs of a functional area of business—marketing, manufacturing, and finance. Each area is described in a separate chapter that provides

a wide range of examples of MIS use. These examples are presented both to explain the material and to whet the appetites of future managers and information specialists for what can be accomplished with MIS. The examples are realistic in that firms are performing the tasks every day, but they are also creative, insightful uses of the computer, representing effective targets at which the designers of future information systems might aim.

Finally, Part Five describes the life cycle of an MIS, detailing the step-by-step process that the manager and the information specialist follow in developing an MIS. As with the discussion of hardware and software, this explanation of the MIS life cycle is presented in the context of the computer as a decision support system. The role of the manager is emphasized because manager involvement is the key to successful computer installations. The involvement of the user is more important today than ever. We are in the midst of an evolution from an era of user dependency on the information specialist to one of user self-sufficiency. New user-friendly natural languages and design tools are making it easier for managers to build and use their own systems.

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Raymond McLeod, Jr.

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Part One

INFORMATION MANAGEMENT

Managers have always used information to perform their tasks, so the subject of management information is nothing new. What *is* new is the recent availability of better information. The innovation that makes this possible is the electronic computer.

The computer is a relatively new tool, since it became popular only about twenty-five years ago. It was first applied to business tasks mainly as an accounting tool. More recently, the value of the computer as a producer of management information has been recognized. The term *management information system (MIS)* is by now quite popular, and all firms have some type of MIS.

The information systems of some firms are better than those of others. And some systems are computer-based, whereas others use keydriven machines, punched card machines, or manual methods. These two differences do not necessarily relate to each other; the better systems are not always the computer-based ones. The quality of the MIS is determined by the people who design it—the managers and computer professionals—not by the type of equipment.

The control over information that MIS designers have is called *information management*. The manager can use information as another resource. A body of knowledge has been assembled that describes how information can, and should, be managed. The objective of Part One is to introduce the topic of information management.

Chapter 1

Introduction to Information Management

Learning Objectives

After studying this chapter, you should:

- Understand why there is so much interest in the use of computers for management support
- Know what is meant by a physical system, supersystem, and subsystem, and how they relate to a business organization
- Appreciate the importance of a conceptual information system as it relates to the physical system
- Know the difference between data and information, and the basic processes for transforming data into information
- Understand one definition of the MIS, and know the necessary components and how they are integrated
- Be familiar with how the MIS concept has evolved and how MIS relates to the DSS (decision support system) concept
- Appreciate the difficulty of economically justifying the MIS
- Understand how the MIS evolves through a series of phases, and recognize the primary roles played by the manager and the information specialist

Overview

This book regards information as one of the basic resources available to the manager—just as valuable as human, material, or financial resources. Information is especially valuable because it *represents* the other, tangible, resources. This representation becomes more important as the scale of business increases.

The manager of a small newsstand in the lobby of a hotel can manage by observing the tangible ingredients—himself or herself, the merchandise, the cash

register, the room, and the customer flow. As the scale increases to a firm with several hundred or several thousand employees, with operations scattered over a wide area, the manager relies less on observation of the physical operation and more on information representing that operation. He or she uses many reports or information displays to reflect the firm's condition. It is easy to imagine the almost complete reliance that the chairman of the board of General Motors or IBM or Sears must place on information. These executives probably regard information as their most valuable resource.

If information is recognized as a resource, then it follows that information, like other resources, can be managed. The other resources (personnel, money, material, and machines) are acquired and assembled to be available for use when needed. Very often the assembly process entails converting an essentially raw material into a refined form, such as training an employee or constructing a piece of special machinery. Once these resources are assembled, the manager is responsible for using them in the most efficient way. The manager attempts to minimize the amount of time during which resources are idle and to keep them functioning at their highest efficiency. Finally, the manager must replace these resources at a critical time—before inefficiency or obsolescence affects the entire organization.

The management of information as a resource follows the same pattern. The manager is responsible for gathering raw data and processing it into usable information. He or she must assure that appropriate individuals within the organization receive the information in the proper form at the proper time so that it can assist in the management process. And finally, the manager must discard out-of-date, incomplete, or erroneous information and replace it with information that is usable.

Importance of Information Management

Interest in information management has increased during recent years—both in the college classroom and in the world of business. Two main reasons account for this: the increasing complexity of the management task and improved decision-making tools.

Increasing complexity of the management task

Management has always been a difficult task, but it is more so today than ever before. One reason is the sheer *size of organizations*. In addition to an increase in the number of organizations (especially the very small ones) in the past decade, the large ones have grown larger. For example, the number of employees in the nation's 500 largest industrial firms increased from 11.3 million in 1965 to 16.2 million in 1979, and assets increased from \$252 to \$1,035 billion.¹

¹ *Statistical Abstract of the United States 1980* (Washington, D.C.: U.S. Department of Commerce, Bureau of the Census, 1980), p. 570.

Another factor is the *increasing complexity of technology* employed within the organization. The effort to keep pace with technology must be continuous. And the computer is not the only example of increasing complexity. Increasing mechanization is occurring in almost every part of the firm; examples include factory robots, automated merchandise storage and movement, electronic inspection and quality control, and even automated vending machines in the lunchroom.

In addition to this increase in the scale and complexity of operations, the manager's *time frame* for action is shrinking. Managers must act quickly in response to pressures from customers, competition, and stockholders. The entire span of business operations is moving more rapidly today than ever before; sales representatives cover their territories by jet, sales orders arrive at headquarters by telephone or satellite transmission, and filled orders are shipped the same day.

Not all environmental pressures favor production; some, ironically, favor *nonproduction*. This is true in the case of products and services that society, or some part of it, finds undesirable. Thus, *social pressure* adds another dimension to the task of business decision making. Decisions must be based on economic factors, but social costs and payoffs must be considered as well. Plant expansion, new products, new sales outlets, and similar actions affecting the local and national community must all be weighed in terms of their short- and long-term impact.

Each of these factors—the scale and complexity of operation, the demands of time, and social pressure—influences the management task at all levels.

Availability of decision-making tools

Even as the manager's task has become more complex, there has been a movement under way to develop means to improve the effectiveness of decision making. Some means involve quantitative techniques; others involve the application of electronic devices such as computers. During the 1950s, efforts to solve business problems with advanced mathematics were called *operations research* (OR). These efforts were usually designed to prevent or solve manufacturing problems. During the 1960s, the term *management science* became popular, as quantitative methods were applied on a broader scale—in finance and marketing, for example. The increasing popularity of the computer in the late sixties and seventies led to attempts to harness the power of this electronic giant for mathematical computations. Terms such as *management information system* (MIS) and *decision support system* (DSS) represent currently popular means of assisting the manager with computer-produced information. MIS refers to the overall application of the computer in a firm, with the emphasis on supporting management's information needs. DSS refers to a subset of the MIS, intended to provide information relating to specific problems.

Increasing computer literacy

Of course, in order to use operations research, management science, MIS, or DSS, a manager must understand them. More harm than good can come from unin-