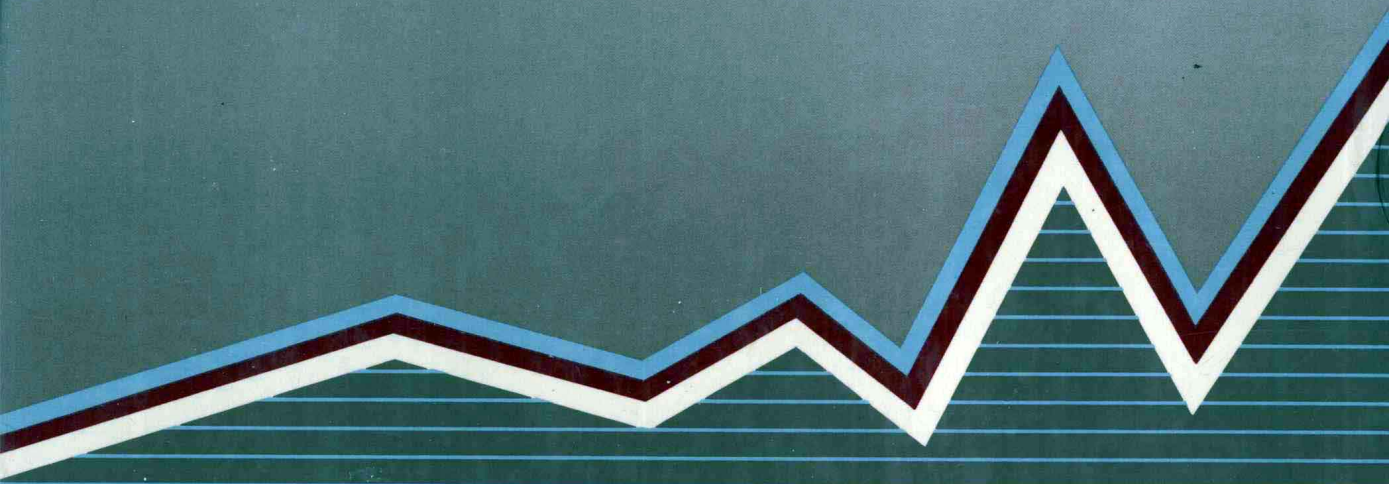
Raymond McLeod, Jr.



MANAGEMENT INFORMATION SYSTEMS

A STUDY OF COMPUTER-BASED INFORMATION SYSTEMS

FOURTH EDITION

Raymond McLeod, Jr.
Texas A & M University

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DEDICATION:

The dedication of a computer book to Thomas J. Watson, Jr., president of IBM during its early computer years, would be justified based on that fact alone. I have another, more personal reason. I was an IBM sales trainee in the San Antonio office when Mr. Watson paid a visit and addressed the employees. He was asked about the progress of a contest to sell punched card machines, and he replied that he "didn't know" about the contest, explaining his concern at the top level with problems of a longer-term nature. At first, I was surprised that this man I so admired didn't know everything. I later came to appreciate the courage that it took to admit a lack of knowledge when it would have been so easy to say "Oh, it's going quite well." That has been one of the important lessons of my life—that when you don't have the answer it is a sign of intelligence, not ignorance, to say "I don't know." I owe that lesson to Mr. Watson.

All this began to change in late 1988 when my former publisher, Science Research Associates, held receptions on my behalf at the ISECON conference in Dallas and the ICIS conference in Minneapolis. For the first time I was able to meet large numbers of instructors who had used my MIS book. At the ICIS conference I also participated in a focus group with users, who freely explained their likes and dislikes. Among them were Mehdi Khosrowpour of the Pennsylvania State University at Harrisburg, George Schell of the University of North Carolina at Wilmington, Terry Campbell of the Pennsylvania State University at University Park, and Steve Breslawski of Temple.

During the spring of 1989 I traveled the country under the sponsorship of my new publisher, Macmillan, giving seminars to management information systems (MIS) faculties. I am certain that I have benefited as much as my audience because these sessions gave me the opportunity to meet still more users. Like those users at the receptions and the focus group, these seminar attendees did not hesitate to express their views.

So now as I am making the final decisions about what material to include in the Fourth Edition and how to present it, I am more clearly aware of who will be using it. Although I feel more confident that I understand the users' needs, I also feel a greater responsibility than I had in the past, since I can now put faces and names with the many who have guided me.

A Management Orientation

The Fourth Edition, like its predecessors, views the computer through the eyes of the manager. The objective of this text is to prepare students to use the computer in solving problems when they become managers. The emphasis is not on computer technology, although that subject is not ignored; rather, it is on how to use information to solve problems. The computer is but *one* means to provide the information. Because of the movement toward end-user computing I feel even strongly today that the management orientation is the right way.

The management orientation means that the primary audience is business students who are *not* planning to become information specialists—majors in accounting, finance, management, marketing, real estate, and so on. In most schools these students have had an introductory computer course but one that does not specifically address management use. The MIS course, using this text, fulfills this need.

I certainly do not mean to say that students who major in information systems should not take the MIS course or cannot benefit from using this text. On the contrary, they will benefit as much as the future managers. When IS students become information specialists, they will be working *with*

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Preface

One of the problems that has always plagued persons trying to explain computer use in business, and persons trying to understand it is the organization of the material. This problem becomes more serious each year as new topics are added.

The organization of this text has always been one of its strong features, and for that reason the basic structure of this Fourth Edition is the same as that used in the previous ones. The text begins with a theoretical foundation followed by explanations of computing technology, the approaches to computer use in business, the system life cycle, system control, and an integrated look into the future. So, if you are familiar with any of the earlier versions of *Management Information Systems,* I believe you will feel comfortable with this Fourth Edition.

Suggestions from Users

Like all textbook authors, I have always received critical feedback from a small number of reviewers who examine the manuscript, make recommendations concerning the topics that are covered, and verify technical accuracy. Occasionally, I have also received letters from users (mostly instructors but sometimes students), who have made suggestions for improvement. I have heeded this advice, but, having little actual face-to-face contact with users, I have continued to plug away, comfortable in the knowledge that my books were being well received.

This new way of thinking meant that I had to come up with a name for the overall "box" that contains data processing, MIS, DSS, OA, and expert systems. I have decided to use the term *computer-based information system*, or *CBIS*. It is not my term, nor is it new.

I have used this new framework in my *Introduction to Information Systems: A Problem-Solving Approach*, published by Macmillan in 1989, and taught from this text during the spring and fall semesters of 1989. Based on this experience, I am confident that the new structure correctly frames the relationships that currently exist among business computer applications.

Chapter Organization

I have retained the same internal chapter organization. Each begins with learning objectives and an introduction, and ends with key terms, key concepts, questions, problems, a case, and a selected bibliography. With the exception of most of the key terms and concepts, all of this material is new to this edition.

Overview of the Chapters

The text is organized into six parts of nineteen chapters, followed by seven appendices, a glossary, and an index.

Part One is the first chapter. It presents the new *CBIS framework* and introduces the student to the key topics of the text.

Part Two is basically unchanged, presenting the *fundamental principles* in the form of chapters on management and organization theory, the general systems model of the firm, and the systems approach. The book has a definite systems flavor and is often used in systems analysis courses.

Part Three covers computing technology. One chapter is devoted to *computer concepts*, addressing issues such as the justification of computer expenditures and ethics, in addition to descriptions of hardware and software. A separate chapter on the *database* includes a new description of DB2, and a chapter on *data communications* includes coverage of new topics such as ISDN.

Part Four develops the CBIS framework introduced earlier. Separate chapters discuss each of the five subsystems. The *data processing* chapter still describes the distribution system, but the data flow diagrams have been redrawn using the Yourdon methodology. The *MIS* chapter reverts back to an approach taken in the first and second editions—an introductory MIS chapter for users who only want an overview. The *DSS* chapter continues to be perhaps the strongest in the text, since this is the area where so much development is taking place. Henry Mintzberg's framework allows me to

managers to develop complex systems. The specialists must understand the users and their needs.

A Change in How MIS Is Perceived

The biggest change in the Fourth Edition is in how I perceive the MIS. Previously I regarded the MIS as including *all* business computing—data processing, decision support systems (DSS), and office automation (OA). When expert systems began making a name for themselves, it became clear that they deserve a place in this group of applications. At the time, however, I had difficulty regarding expert systems as a type of MIS, considering how that term was originally conceived. I have gradually come around to the thinking of others who regard the MIS as a special type of information system. After giving the matter much thought, I have come to the conclusion that an MIS is itself an *organizational* information system, rather than a collection of *individual* systems, such as DSSs and expert systems.

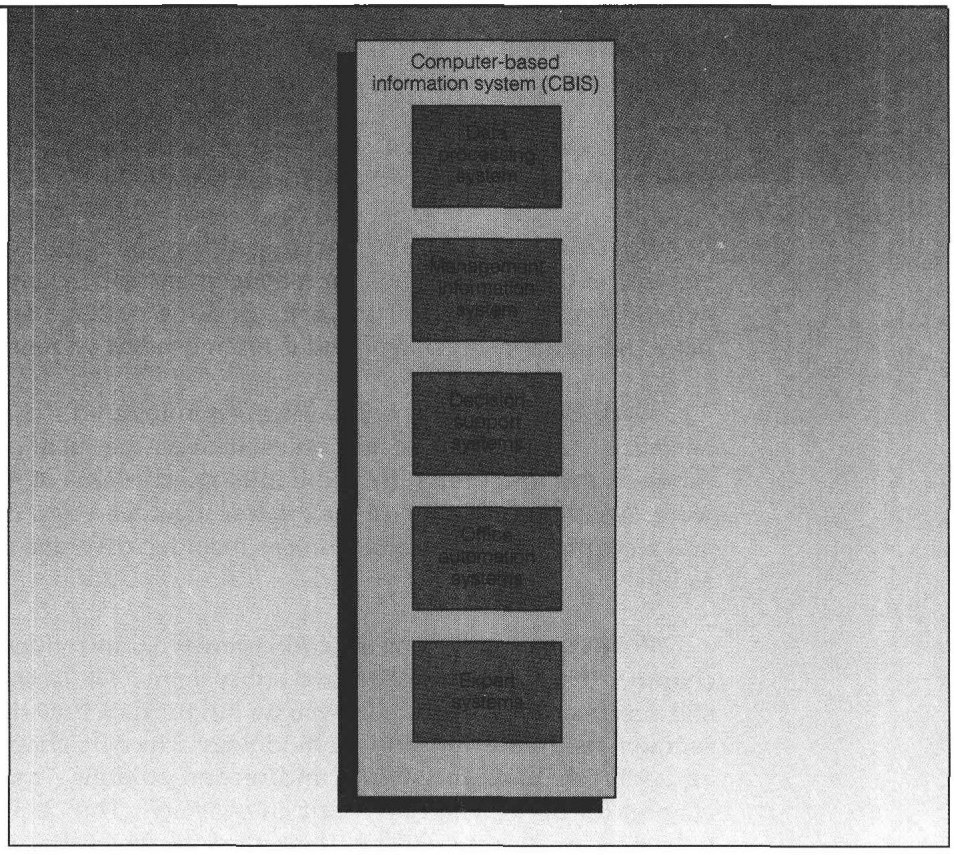

FIGURE P.1 The Computer-Based Information System (CIBS)

or her particular approach. One comment that I have heard repeatedly from users is that the text "lends itself to instructor enrichment." I take this as a compliment and believe that whatever the approach—technology, systems, behavioral, or management—the Fourth Edition will provide a good foundation upon which to build.

An Extensive Glossary

For the first time I am including a glossary. It is not a complete dictionary of computer terms since it does not contain the computer literacy terms, such as bit and byte. However, it includes descriptions of *all* of the key terms at the end of the chapters, plus other terms that I believe to be a part of a CBIS vocabulary. Altogether, there are definitions of more than five hundred terms. These definitions are not simply repetitions of the wording used in the chapters and appendices. They provide the student with an additional opportunity to achieve a clear understanding of the terms.

Expanded Bibliographic References

I have substantially increased the number and broadened the scope of the resources listed in the bibliographies at the end of the chapters and in the footnotes. I have tried *not* to include sources simply because they are recent; the collection includes the classics as well as more contemporary works. Together, these varied resources provide a good sketch of how our field has evolved. My problem has not been where to find references but which ones to use. I perform a wall-to-wall research effort every few years and am thus able to see how dramatically the literature base in information systems is improving. Some excellent research is being conducted, and this text brings the more important findings into the classroom.

A Complete Package

A complete set of materials is available to instructors and students to facilitate use of the text.

- The *Management Information Systems Case Book,* Fourth Edition, coauthored with George Schell, provides case problems in addition to those in the text. The text cases are ideal for classroom discussion. The cases in the *Case Book* are better suited for use as assignments that give the students an opportunity to apply the systems approach.
- The *Instructor's Guide* includes suggestions for designing the course and for presenting each chapter and appendix. It also includes teaching tips for substitute instructors and teaching associates, and special "emergency" lectures.

present *office automation* in a problem-solving context, including more recently developed tools, such as electronic image management and desktop publishing. New to this edition is the concluding chapter on *expert systems*. When the Third Edition was written expert systems were still unproven in business and were mentioned only briefly in the chapter on the future of MIS. Today, the situation has changed greatly, and there are many examples of successful applications.

Part Five slices the CBIS pie yet a different way—according to where the users are located in the organization. A chapter is still devoted to *executive information systems* (*EIS*) and includes descriptions of prewritten EIS systems that have become popular only since the Third Edition was published. Filling out this Part are chapters on *marketing*, *manufacturing*, and *financial information systems*. Over the years these functional information system chapters have consistently been the favorites.

Part Six is packaged a little differently than before. The overall emphasis is on management of the firm's information resources—not so much how they are managed by the chief information officer, or CIO, but how they are managed by users. The *system life cycle* is covered in one chapter, *security and control* in another, and a **new** topic—*information resources management* (*IRM*)—in the final one. This chapter is less a crystal-ball effort at projecting the future and more a synthesis of the major topics, so that the student finishes this text with an organized view. The vehicle for the synthesis is the IRM concept. When I was discussing the outline of this edition with users, some expressed the view that delaying the important IRM topic until the last chapter was a mistake. Instead, I have chosen to introduce IRM in Chapter 1 and continually reinforce the concept throughout the book. The concluding discussion simply ties the bow on the package.

I have substantially upgraded the appendices. They deal with systems analysis and design methodologies and tools. If you want to give your MIS course a strong systems flavor (and many schools use the MIS course to also teach systems analysis), you will find complete descriptions of *flowcharting*, *data flow diagramming*, the *data dictionary*, *structured English*, *Warnier-Orr*, and the most popular CASE tool—*EXCELERATOR*. The first appendix presents a case problem that can be solved with each of the tools presented in the later appendices, enabling the student to see how they document a system in different ways. These appendices provide an opportunity for experiential activity, which is not found in other MIS texts.

Modular Format

The modular format of the chapters and appendices allows use of the text to be tailored to a variety of course approaches. The material is presented in a logical sequence, with later chapters building on what was covered previously, but the instructor is free to pick and choose in order to fit his

and the detailed outline, and made major suggestions concerning content: Robert L. Ashenhurst, Graduate School of Business at the University of Chicago; Therold E. Bailey, University of Central Arkansas; Harold Bettencourt, Rutgers University; Thomas Black, San Jose State University; David Bryant, Pepperdine University; Chandler M. Bush, University of North Carolina at Charlotte; Stephen A. Floyd, University of Alabama at Huntsville; Randolph H. Forsstrom, Farleigh Dickinson University; Tom Hilton, Utah State University; Meg Kletke, Oklahoma State University; Guy L. Langsford, California State University at Northridge; Irving P. Leif, Montclair State College; Sal March, University of Minnesota; Gary C. Pickett, Tennessee Technological University; John V. Quigley, East Tennessee State University; Timothy Shea, University of Lowell; E. Ray Smith, Western Illinois University; Ken Sochats, University of Pittsburgh; Kathy B. White, University of North Carolina at Greensboro; and Ahmed S. Zaki, College of William and Mary.

Other reviewers addressed specific portions of the manuscript: Michael Carrigg and Dave McEttrick of Science Research Associates (DB2), David Dietzel of Federal Express (SUPER TRACKER), Norman Gaither of Texas A & M University (manufacturing information systems), Cary Hughes of Middle Tennessee State University (EXCELERATOR), Venkat Srinivasan of Northeastern University (financial expert systems), and Mark Wood of Execucom Systems Corporation (executive information systems).

I also have received much help from my colleagues at Texas A & M. One of the advantages of teaching at a school with a large MIS faculty is the benefit of being able to walk down the hall and find someone with just the right type of expert knowledge. I have made the trip many times, receiving help from Joobin Choobineh; James Courtney, Jr.; George Fowler; William Fuerst; David Paradice; Joe L. Poitevent; Arun Sen; and Ajay Vinze.

Other academic sources of information are Richard D. Arvey, Gerardine DeSanctis, and Detmar Straub of the University of Minnesota, Joseph Munn of Baylor, and Fletcher Crowe of Brenau College. Texas A & M graduate student Nadalyn Miller Reiff was my chief research assistant, and Penny Woodcock, now a student at Texas Christian University, was my library researcher.

Help also has been provided by persons in industry—Donald H. Bender of Government Personnel Mutual Life (San Antonio); Dwain R. Boelter of Personnel Decisions, Inc. (Minneapolis); Dick Guenther of Argee Oil Company (Midland, Texas); Tim Hadley of Pilot Executive Software; Ricia Hughes of Comshare; P. R. Jeanneret of Jeanneret & Associates (Houston); Helen D. Kendrick of Software Publishing Corporation (Mountain View, California); Nan Myers of Arbitron Ratings; Samuel Panarello of BRS Information Technologies; Michael Sena of Alvin B. Zeller, Inc. (New York); Everett Southerland, Kevin Collins, and Lynn Smith of Infodata Systems; Katherine S. Mulvey of Dialog Information Services; and the Charles Bearden Drilling Company.

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- *Transparency Masters* facilitate the classroom display of the more important diagrams and illustrations from the text. I have always paid special attention to the diagrams. In fact, the book simply explains a set of diagrams that I believe provide the structure for the MIS field. The diagrams are the *stickum* that holds all of the topics together.
- The *Test Bank* consists of true-false and multiple-choice questions, plus a 10-point "pop" quiz for each chapter and appendix. This material exists in both a hard copy and a diskette form.
- Diskette-based materials include:
  - *Software Package II,* a set of prewritten mathematical models, which affords students the opportunity to gain hands-on experience with computer-based decision making without writing programs. Detailed documentation gives background information for the models and includes problem scenarios and data for assignments. For more information, *see* the *Instructor's Guide.*
  - The *Macmillan Test Generation System,* which automatically assembles questions from the test bank. It also allows instructors to add their own questions.

This set of materials provides a variety of course options in terms of what is presented, how it is presented, and the ways that students actively engage in the learning process.

A Team Effort

Although I am the sole author, I use *we* throughout the text. The writing and publishing process has been a group effort. Playing key roles have been the people at Macmillan—my editor, Charles Stewart; Bob Pirrung and Ann Berlin in production; and MIS specialist, Kevin Flanagan. I would also like to recognize the support that I always receive from Hank Kennedy, president of the Macmillan College Division. Another organization, Graphic Typesetting Service of Los Angeles, has also played a key role, providing valuable editorial assistance, creatively drawn art, and skillful typesetting.

At other times when I say *we,* I am including the student. If the material is accurate and hangs together well, it is in a large part due to earlier use in the classroom. I am always amazed at how students can come up with insightful interpretations of the material, which I would never have imagined. I have not hesitated to incorporate these improvements into the text.

Acknowledgments

I also want to thank others who have provided support. Valuable suggestions have been provided by the following persons, who reviewed the text

Finally, I would like to recognize the support from my wife, Martha, and children, Sharlotte and Glenn. Because of Martha's inspiration during the past fifteen years I have discovered some research skills that I didn't even know I had. As for Shar and Glenn, they would have much preferred that I had spent the summer of '89 building a clubhouse in the backyard. Now that this edition is completed, I can give my attention to that more important job.

Even though I have received much help along the way, I alone am responsible for the manner in which the material is presented. In some cases I have been advised to do one thing but elected to do otherwise. Therefore, any shortcomings are my own doing.

Before closing, permit me to return one last time to the users with whom this preface began and express my appreciation to the many MIS professors around the world, who not only have adopted *Management Information Systems* but also have embraced it and made it a part of their own particular teaching styles. I am blessed to have such a following and feel a deep sense of responsibility to you. I hope that this Fourth Edition lives up to your expectations.

One final note—I am keeping the dedication to Mr. Watson, which I used in the Third Edition. I recall one instructor telling me that he requires his students to read it. When a student asked why, he replied, "Because it is an important lesson." We had better leave it in.

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