



S I X T H E D I T I O N

INFORMATION  
**T**ECHNOLOGY  
FOR  
MANAGEMENT

HENRY C. LUCAS, JR.

# Information Technology for Management

SIXTH EDITION

**HENRY C. LUCAS, JR.**

Leonard N. Stern School of Business  
New York University

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To Scott and Jonathan

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# PREFACE

## TO THE STUDENT

Information technology surrounds you—on your campus and in local businesses. When you order merchandise over the telephone, chances are your sales representative is using an information system to check inventory and to trigger the shipment of your goods. Increasingly you will order products using a computer network called the Internet, dispensing with the telephone. When you use an automatic teller machine, make an airline reservation, or rent a car, information technology is working for you again.

Information technology is pervasive in modern organizations—from the largest manufacturing firms to your corner drugstore. The stakes are high as businesses confronted with global competition strive to succeed. Some organizations will flourish; others will fail. Those that succeed in the future will understand how to use and manage information technology to their advantage.

The purpose of *Information Technology for Management, Sixth Edition* is to help you learn enough about the technology to play an active role in the design, use, and management of information technology. You will learn how creative organizations have integrated technology with their corporate strategy, allowing them to surpass the competition to maintain an advantage. You will also see how to use information technology to transform the organization, to create new lines of business and new relationships with other firms. The text also stresses how you as a manager can use information technology-enabled organization design variables to create new organization structures, including the T-Form firm. This new structure takes advantage of electronic communications and linking, technological matrixing, technological leveling, virtual components, electronic workflows, production automation, and electronic customer/supplier relationships to create a flat organization closely linked to other organizations. It uses technology to reduce the number of administrative levels in the firm, to decentralize decision making, and generally to design a highly efficient and effective organization.

You will learn how to exploit the technology to enhance your professional and personal productivity. Information technology is a tool. It enables you to redesign the organization, change the firm's relationship with customers and suppliers, and alter communications patterns in the firm. Technology is a variable that you as a manager will be able to manipulate to effect significant improvements in what the organization and its employees can accomplish.



Once you have completed this course, look through a newspaper or business publication. You will be surprised at your understanding of many of the issues raised in articles dealing with information technology.

In sum, this text is designed to prepare you for the important managerial role of managing information technology, to give you and your company a competitive edge.

## TO THE INSTRUCTOR

This book is designed for business students with no particular background in information systems. The primary goal is to help prepare students to assume an active and significant role in the design, use, and management of information systems and technology. The approach evolved through extensive efforts to create a required course that would meet this goal for all M.B.A. candidates at the Leonard N. Stern School of Business at New York University. This approach has proven successful with the previous five editions of the text at other schools around the world.

### *The Objectives of This Text*

During the past five years computers and communications technologies have proliferated in offices and homes. Organizations distribute the responsibility for technology to all levels of management and to different geographic locations. As a result, managers from supervisor to CEO encounter information technology on a daily basis. Managers have to take advantage of the technology; they must make decisions about how to use the technology.

Organizations have the opportunity to become more efficient and competitive. Skilled and creative managers are required to accomplish these goals. Today's M.B.A.s need the knowledge and confidence to deal with issues related to technology. They must apply technology aggressively if they are to compete successfully in our global economy. They must take advantage of the ability that IT gives them to change the way work is done, communications patterns, and the very structure of the organization.

One of the most important parts of using the technology is the design of information systems. Much of the distribution of technology to end users results from the rapid diffusion of personal computers or workstations. Applications once considered personal are being shared across networks. Users now are likely to access a number of different applications on different computers through a LAN and probably the Internet as well.

Users may design systems for themselves alone, or they may be one of many users of a system designed by others. The design of multiuser applications is much more complex than the design of a personal computer system for an individual user. Many more people are involved in the process, each with unique and often conflicting needs and expectations.

Recent graduates are likely to find themselves on design teams for multiuser systems. *Thus, it is critical that a course in information systems prepare*

*students to play an active role in the development of new applications that will affect their productivity and their company's competitiveness.*

Based on the discussion above, this book is designed to help students meet these three major objectives:

1. To understand the emerging technological issues facing management so students can effectively manage information systems in organizations
2. To play an active role in applying technology through the analysis, design, and implementation of multiuser systems that will meet the information needs of the organization
3. To learn how to use technology to transform the organization, creating new relationships, structures, and entirely new organizations

## ORGANIZATION

The text is organized into six major parts to help students meet these objectives:

**Part I** **The Role of Managers in Information Systems** The purpose of Part One is to emphasize to students the value of information as a corporate asset and illustrate the myriad information systems applications they will face as graduates.

**Part II** **Organizational Issues** Here we deal with the impact of information technology on the organization. The book stresses the use of IT design variables in creating new kinds of organization structures. In particular, I advocate developing T-Form organizations in order to be successful in the highly competitive environment of the twenty-first century. This section also discusses how the firm can use technology as part of its strategy to gain a competitive advantage. This discussion of key managerial issues surrounding the technology and its application help motivate student learning.

**Part III** **Information Technology** Important managerial decisions increasingly require an understanding of the technology. Therefore, graduates need to have knowledge of the hardware and software fundamentals. I have included in Part Three the technical information I consider most important and relevant to future managers.

**Part IV** **Systems Analysis and Design** Poorly designed systems are responsible for many information system problems. When information needs are not met, users are alienated and the value of the system diminishes. Part Four prepares graduates to participate in the development of multiuser systems and make an immediate contribution to their employer.

**Part V Exciting Directions in Systems** Part Five deals with alternatives to traditional transactions processing applications, such as decision support systems, expert systems, groupware, multimedia, and artificial intelligence. An understanding of these emerging applications offers students great potential to enhance their organizations' competitiveness.

**Part VI Senior Management Concerns** At the end of the text, we return to the issues facing management today. Managers need to be concerned with security and control and how to achieve the maximum benefits possible for the firm's investment in technology. Part Six encourages students to evaluate the problems—and opportunities—that changing societal conditions and technological advances will create for their businesses. The table below arrays our three objectives against the six major parts of the text.

Part	Managing Technology	Applying Technology	Transform the Organization
I The role of managers in IT	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
II Organizational issues	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
III Information technology	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
IV Systems analysis and design	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
V Exciting directions in systems	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
VI Management control of IS	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Note that the first objective—managing information technology—is a theme woven throughout every chapter in the text. In order to manage the technology effectively, students must understand its strategic significance and potential impact on the organization. In addition to these underlying organizational issues, managers must understand the related technical issues.

The second objective—learning to apply technology through a systems analysis and design team—is supported by parts Two, Three, Four, and Five. These parts of the book cover the fundamentals of systems development from a managerial perspective. Using the Simon Marshall case, which is integrated throughout the book, students complete the logical design of a system. This exercise encourages students to confront the myriad decisions and trade-offs that constitute the design of a multi-user system and gain a “real world” understanding of what otherwise would remain abstract.

The third and final objective—transforming the organization—is a theme throughout the text. It is a significant component of parts One, Two, Four, and Five. In one sense, the entire text is devoted to preparing students to use technology to change the way in which organizations are structured and operate.



## Learning Tools for Your Students

The text has a number of features designed to facilitate student learning, including the following:

- *Management Problems and Applications Briefs* Most chapters contain Management Problems and Applications Briefs. Management Problems are “minicases” for students to ponder alone or in groups; some instructors use the problems to stimulate class discussion. Applications Briefs illustrate the many different ways information technology is used today. They are intended to help the student become more creative in discovering how to benefit from information systems.
- *Chapter Summary* New to this edition is a summary of each chapter in the form of a numbered list containing the most important points in the chapter.
- *Implications for Management* Another new feature is a paragraph after the Chapter Summary which contains my thoughts on the implications of the material in the chapter for a manager. This personal statement explains the importance of the material the student has just read.
- *Chapter Projects* Most chapters contain a Chapter Project. The projects are designed to help students apply concepts discussed in the chapter. Some projects require the student to conduct research or contact an organization to find out more about its information processing. I usually use one of the systems design projects as a group assignment. Students report that the experience of designing the logic of a system helps pull together much of the material in the course.
- *The Simon Marshall Case* Several of the chapter projects involve the Simon Marshall case. There is a systems analysis and design problem for Simon Marshall that involves PCs, a server, a local area network, a main-frame data source, and a satellite distribution system. This assignment, carried out as a group project, helps students master the technical and design material in the text.

## Supporting Materials

- *Instructor’s Manual* The *Instructor’s Manual* contains a course outline, teaching hints, and answers to selected questions. Also included are a discussion of all the Management Problems and sample course syllabi.

## NEW TO THE SIXTH EDITION

In general, the sixth edition of *Information Technology for Management* reflects current thinking about the role of IT in management. The name of the book is new to reflect the fact the information technology is more than computer systems. It includes communications, networks, paging devices, fax, and voice communication among other technologies.

Compared with the previous edition, the sixth edition contains less emphasis on the technical details and more on the managerial issues of IT and state-of-the-art topics. The two chapters on hardware are reorganized in this edition while the software chapter has fewer technical details. I have found that few instructors discuss file systems, so the text now contains a single, expanded chapter on database. The appendix to Chapter 16 still contains a detailed example of structured design. I have added a second example to this appendix using object-oriented design so students can compare and contrast these two approaches.

Over the years, we have seen major changes in the way leading firms use information technology. Transactions processing systems helped improve efficiencies. Strategic systems provide some companies with a competitive advantage. Now, with the addition of workgroup technology, group DSS, and extensive connectivity, we have the ability to use IT to *transform the organization*. This theme of change is now reflected throughout the book. In particular, I have incorporated the concepts discussed in *The T-Form Organization: Using Technology to Design Organizations for the 21st Century* (Jossey-Bass, 1996).

The text has been extensively updated to reflect advances in technology and in its application. There are many more examples of applications and systems in the text to supplement the Applications Briefs that are ruled off in the text.

Chapter 3 presents a new framework for looking at IT in organizations that updates the ideas presented by Gorry, Scott Morton, and others. Chapter 4 has been completely changed to reflect research we are conducting at NYU on the impact of technology on organizations. This chapter discusses how *technology can impact flexibility and how IT can be used in the design of organizations*. This chapter is crucial in making the case that technology can be used to transform the organization.

Chapter 5 on the strategic use of IT stresses the difficulty of sustaining an advantage once it is achieved. This chapter also contains a more lengthy description of a firm that has used the technology over the years to develop a clear competitive advantage.

Globalization is a major trend in business today. Trade barriers are falling and firms are expanding their markets beyond their own borders. Chapter 6 explores the implications of globalization for information technology. What can IT contribute to the international firm? What are the special IT problems created by trying to operate globally? I have always thought that it is important for managers to have knowledge of what they are trying to manage.

Part Three of the text is devoted to information technology; it attempts to provide the student with sufficient familiarity with technology that he or she can make good management decisions.

Chapter 8 attempts to place the different types of computers available today in perspective. It has been expanded to discuss the different generations of Intel chips and the features that are used to increase the speed of these processors. I have attempted to provide a balanced and realistic picture of the role and future of mainframes, both in this chapter and throughout

the text. Chapter 9 contains a discussion of the major operating systems choices today: Windows95, OS/2, Unix, and Windows NT.

Chapter 10 presents the fundamentals of database management and describes how the organization uses a DBMS for transactions processing and to extract information to be used in managing the firm. The chapter also stresses how the student can use a DBMS for his or her own personal productivity.

Chapter 11 on communications emphasizes the role of this technology in transforming organizations. The chapter features more material on networks and connectivity along with examples of how firms are using communications technology in creative ways. Chapter 12 on networks is new. It covers topics ranging from EDI to the Internet. Networks are one of the fastest growing phenomena in the field, and this chapter tries to excite the reader about their potential.

There is a great deal of confusion about what kind of architecture is best for a given application or organization. Chapter 13 attempts to clarify any confusion the student may have about people who use the different types of technology described in earlier chapters. This chapter discusses the role of large, medium, and small computers and illustrates them with examples of different systems, ranging from a centralized, mainframe airline reservations system to a highly decentralized, client-server system at Chevron Canada.

A key objective for the text is to prepare students to apply technology through participation in systems analysis and design projects. We have encountered users who developed their own systems on PCs that served as the specifications for the same system to be developed for the entire corporation! The manager who understands how to build systems is at a distinct advantage in business today.

Chapter 15 introduces systems analysis and design. It has been extensively edited and updated. Chapter 16 covers some design details. One of the highlights of this section is the appendix to the chapter. This appendix presents a high-level design for a system for the Hardserve company. There are complete DFDs for the retail store component of the system and for the subsystem in the company's warehouse. This in-depth example should provide students with a good understanding of the output of the design process and the way in which one describes a system. New to this edition is a second example of object-oriented design for a hypothetical community hospital.

Chapter 17 talks about enhancements to the traditional life-cycle approach to developing a system, especially packages and prototyping. Chapter 18 is new and is devoted to the popular topic of business process reengineering. This chapter presents two examples of process reengineering and two examples where IT design variables have been used to reengineer the entire organization.

Implementation is concerned with how you bring about change in the organization. At the level of the individual system you are trying to see that systems provide the maximum return from the firm's investment



in IT. In using IT design variable, you are likely to be trying to change the structure of the entire organization, a major challenge. Chapter 19 is devoted to implementation; it is still true that systems are underutilized and that users take advantage of only a fraction of the capabilities of existing, installed technology. Chapter 19 integrates research findings to produce an implementation framework to help the student understand and manage this process. The chapter also suggests how to approach IT-enabled organization change as students prepare to manage in the twenty-first century.

When the first edition of this text was published, there were no hands-on users outside of the IS department. We have moved from no contact to terminals to workstations on the user's desk. Chapter 20 discusses the range of user interaction with technology and suggests ways to encourage it. The evolving model of *client-server computing* means that users on workstations will obtain the data and programs they need to answer their questions from the server.

Chapter 21 describes how IT can be used in non-traditional ways to enhance the effectiveness of individuals and organizations. The DSS part of the chapter contains new examples of how these applications contribute to improving productivity. Material on EIS and group DSS is also new to the chapter. Groupware is one of the most exciting applications for transforming organizations and is discussed in this chapter. A section on multimedia stresses how this technology can be used for business, as opposed to entertainment, purposes.

Chapter 22 on intelligent systems contains an in-depth example of an expert system we developed at the American Stock Exchange. There is also material on neural networks and new coverage of case-based reasoning and genetic algorithms.

Part Six of the text deals with management issues. Chapter 24 includes a discussion of several different models of IT in the firm and an in-depth discussion of the role of the CIO. It also contains guidelines or action steps one might follow to diagnose and improve the IT effort in an organization. Chapter 25 presents framework for categorizing social issues and a discussion of ethics. It also contains predictions on the future of key technologies including multimedia and virtual reality.

## CONCLUSION

This sixth edition of the text contains major changes which are intended to help your students appreciate the contribution of information technology and learn how to manage it.

## ACKNOWLEDGMENTS

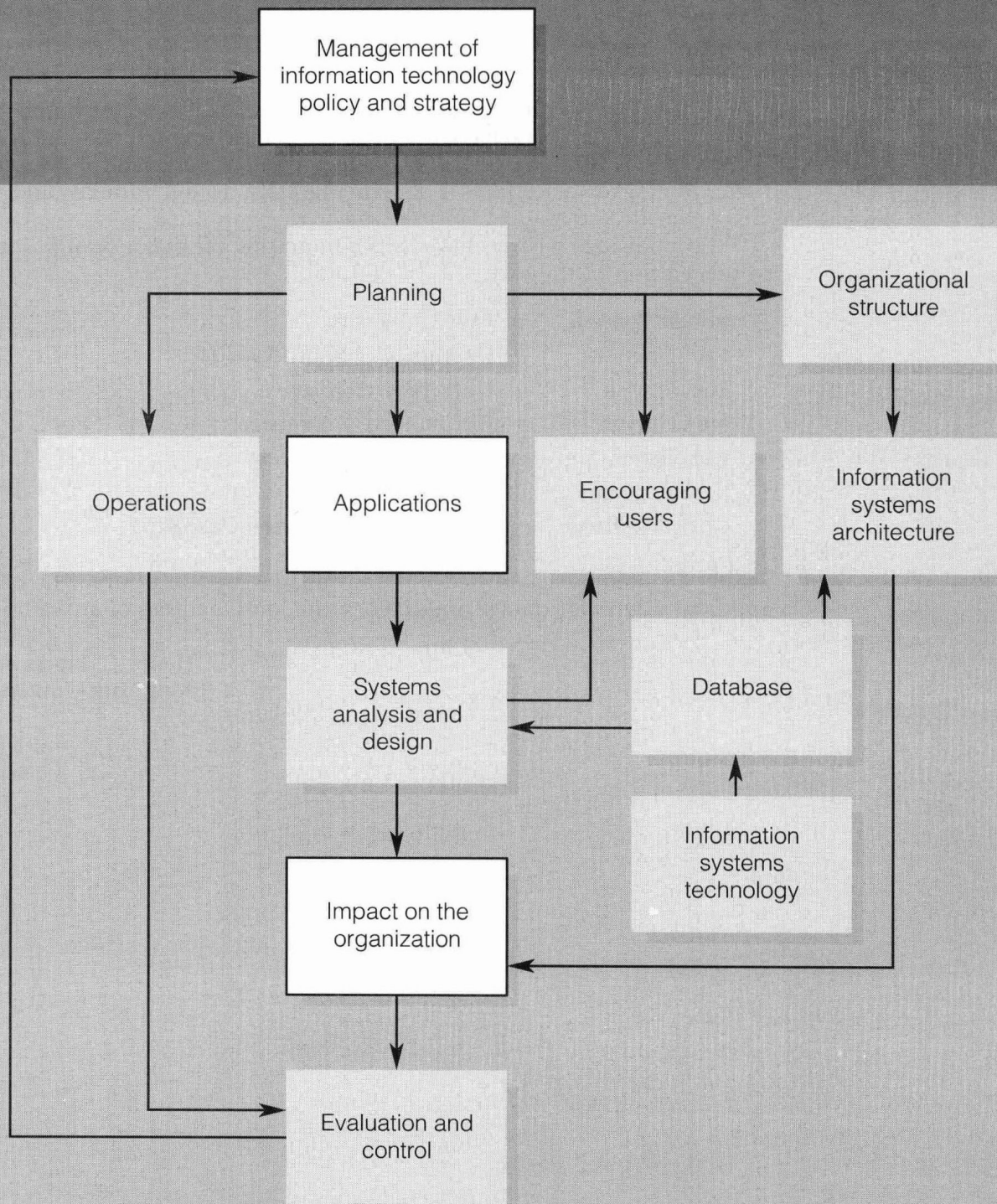
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