INSTRUCTOR'S MANUAL

to accompany

MANAGING INFORMATION TECHNOLOGY

Sixth Edition

Carol V. Brown
Daniel W. DeHayes
Jeffrey A. Hoffer
E. Wainright Martin
William C. Perkins

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Preface

Since the first edition of *Managing Information Technology* was published in 1991, an organization's dependence on information technologies for business survival and growth has continued to expand. Today's IS leaders have become more visible and strategically important, as both technological and business forces have continued to increase the IT management responsibilities and roles within their organizations.

Over the past decade alone, new enterprise-wide applications on client/server platforms have been expanded to provide secure, electronic linkages with suppliers and business customers and for workers to collaborate across organizational boundaries. At the same time, the Internet has become a trusted channel for communicating directly with end consumers and enabling other new ways for businesses to compete. These types of business and IT innovations have also catapulted IT management concerns to the agendas of top management teams and sometimes boards of directors as well.

The overall objectives and targeted audience for this sixth edition remain the same: to provide a thorough guide to IT management practices and issues for advanced students and managers. We believe that our approach of providing both up-to-date chapter content and full-length case studies, written by the same authors, results in a unique set of materials for instructors to customize for their own instructional needs. Earlier editions of this textbook have been used for courses in MBA, MS in IS, and executive education programs, as well as in advanced undergraduate courses for students who seek careers as both business and IS managers, as well as IT specialists.

The Chapter Content

Following an introductory chapter that sets the stage for IT management roles and responsibilities, the text is divided into four main parts:

- **Part 1: Information Technology** presents background knowledge about four major technology components: hardware, software, networks, and data. (Depending on the targeted audience, these chapters can be used for background reading only as a kind of "level-setting" for students from different backgrounds and experiences.)
- **Part 2: Applying Information Technology** introduces in detail the capabilities of three categories of software applications: enterprise systems, managerial support systems, and e-business systems.
- **Part 3: Acquiring Information Systems** prepares the reader for leading and participating in projects to implement and support the use of software applications—including methodologies for custom-developed and purchased software.
- **Part 4: The Information Management System** lays the groundwork for understanding the range of IS leadership roles and current best practices for managing IT assets.

The Teaching Cases

To demonstrate real-world IT management challenges—based on undisguised *Fortune* 500 companies and midsized companies as well as some camouflaged companies—the textbook authors have also developed a set of case studies for each part of the textbook.

These 30 full-length case studies can only be found in this publication.

From these case studies, students can learn directly from both successful and problematic real-world situations about the challenges of implementing new technologies, the capabilities of new types of applications, managing systems projects of different sizes with different methods, leveraging new Internet opportunities, and addressing systems integration and leadership challenges.

This Instructor's Manual

This Instructor's Manual includes many valuable resources for both the new adopter as well as prior adopters.

- Syllabus Examples for Master's and Undergraduate courses
- For each Chapter: Objectives, Chapter Overviews, Teaching Suggestions, and Sample Answers to all Review and Discussion Questions in the textbook.
- For each Case Study: Objectives, Case Overviews, and Questions for Discussion (with potential responses). In some instances we have also included supplementary references and other teaching hints.

For those instructors who were adopters of the previous (fifth) edition of this text, we also provide below some summary descriptions of What's New for each chapter, as well as short synopses for all New and Revised teaching cases prepared for this edition. (Note: these descriptions also are printed in the Preface for the sixth edition of the textbook itself.)

Additional course materials are also available to you as downloads from the Prentice Hall web site. These include PowerPoint slideshows and Multiple Choice and True/False questions for each Chapter, as well as an Image Library for all artwork that appears in the textbook:

www.prenhall.com/brown

PowerPoint Slides

A separate PowerPoint slideshow has been created for every Chapter. In some instances, exhibits from the text have been incorporated into these slideshows to help the instructor highlight and expand on key concepts in the text. These slideshows can also be customized by instructors to best match the student audience.

Test Bank: Test Item File and TestGen Software

Multiple choice, True/False, and fill-in-the blank questions as well as some essay questions have been prepared for the Chapters, with a cross-reference to the page number of the text where the concept is discussed.

- The Test Item File is available in Microsoft Word and for use with the computerized Prentice Hall TestGen, as well as WebCT- and Blackboard-ready conversions.
- TestGen is Prentice Hall's comprehensive suite of tools for testing and assessment. It allows instructors to easily create and distribute tests for their courses, either by printing and distributing through traditional methods or by online delivery via a local area network (LAN) server. TestGen features Screen Wizards to assist you as you move through the program, and the software is backed with full technical support.

Image Library

All of the text art (figures, tables, and screenshots--as permissions allow) is also available to you as separate images, organized by Chapter.

New Chapter Content: *For Users of the Fifth Edition*

All prior chapters have been revised to reflect up-to-date technology trends and current IT management practices. This edition also has a totally new and separate chapter on the topic of Information Security (Chapter 16). Below we provide synopses of "what's new" for each chapter. (Note: these descriptions also are printed in the Preface for the sixth edition of the textbook itself.)

Chapter 1, "Managing IT in an E-World," has been updated, shortened, and simplified. Updated trends in hardware, software, and networks are used as motivators for learning more about information technologies and how they are managed in organizations. Examples of differing "modes" of dependency on IT found in different organizations and a sample organization chart are now provided in this first chapter to introduce students to the focus of this text: managing IT in organizations. Concerns about demands for IT workers in the United States being greater than the current supply are also presented as motivators for students considering entering the IT workforce.

Part 1: Information Technology

Chapter 2, "Computer Hardware," has been thoroughly updated to incorporate the latest information on microprocessor chips, REV and flash drives, optical disk storage, and multiprocessor systems, as well as the technology developments and the major vendors in the microcomputer, midrange systems, mainframe, and supercomputer market segments. New topics covered include smartphones (also known as killer PDAs) and blade servers.

Chapter 3, "Computer Software," has also been thoroughly updated to include new developments in personal productivity software, open source applications and support software (with an emphasis on Linux), and Web programming. The concepts of service-oriented architecture and Web services are introduced, and the chapter takes a fresh look at the changing nature of software and the makeup of the software industry.

Chapter 4, "Telecommunications and Networking," has been changing even more rapidly than hardware and software, necessitating major revisions in this chapter. Among the new topics covered are city-wide Wi-Fi networks, WiMAX wireless networks, Voice over Internet Protocol (VoIP) telephony, the Internet2 network, and Web developments such as blogs, wikis, and other social networking technologies. This chapter also includes an updated look at the ever-evolving telecommunications industry.

Chapter 5, "The Data Resource," provides additional coverage on why data management is important, including metadata as a tool for controlling data quality. Additional new material addresses master data management (subject area data across multiple systems and databases) and lays the groundwork for later chapter discussions on data integration.

Part 2: Applying Information Technology

Chapter 6, "Enterprise Systems," contains an important new section on service-oriented architecture and Web services, as well as expanded treatment of both portals and supply chain management systems. The chapter also incorporates significant updates in the enterprise resource planning, data warehousing, customer relationship management, and groupware sections.

Chapter 7, "Managerial Support Systems," includes new examples in every application area discussed in the chapter. The chapter has an increased emphasis on business intelligence applications, and it introduces the important idea of location intelligence (based on the Global Positioning System) as a growing subarea of geographic information systems.

Chapter 8, "E-Business Systems," has been substantially revised to include updated coverage on B2B and B2C applications that demonstrate how bricks-and-clicks firms have evolved to challenge dot-com pioneers, and how dot-com intermediaries have continued to leverage new technologies and an expanded base of Internet users. Updated statistics and case examples, including new discussions of Google, Netflix, Blockbuster, Staples, and Autobytel, are provided. New summaries have been written about what makes a successful e-tailer or dot-com intermediary.

Part 3: Acquiring Information Systems

Chapter 9, "Basic Information Systems Concepts," now better clarifies the distinction between systems analysis techniques and tools. A new E-R diagram helps students link data and process modeling, and a new section on design patterns (prepackaged E-R and process diagrams) explains how these purchased artifacts can speed up and improve the development of system descriptions. The physical systems descriptions have been streamlined to match a wider student audience. The knowledge of basic systems concepts and tools is now also motivated by the need for organizations to adopt practices (such as ITIL) to comply with new financial reporting regulations (such as Sarbanes-Oxley and Basel II).

Chapter 10, "Methodologies for Custom Software Development," now emphasizes the need for risk assessment as a part of any software development process. More details on custom software development methods and a section on agile methodologies have been added. Comparisons with nonagile approaches are made and eXtreme programming is discussed as one of the principal methods used with agile methodologies. The Scrum technique is also motivated and explained. The coverage of managing offshore custom development work has been expanded.

Chapter 11, "Methodologies for Purchased Software Packages," includes leasing as an option for acquiring software packages (Software as a Service, or SaaS). The section on ASPs (leasing software on a hosted service) has been extensively updated. The chapter also expands the explanation of why organizations purchase (or lease) application software and elaborates on the factors to consider for package and vendor selection. The discussion of when to modify purchased software has been revised, including what this means for software contracts and managing vendors. Recent research on acquiring and managing ERP packages is incorporated, as well a new section on open source software.

Chapter 12, "IT Project Management," has been revised to reflect recent research on managing IT project risks, including recognizing potential IT project failures. The concept of a Program Management Office (PMO) is introduced, and new guidelines are provided for engaging project

sponsors and conducting a post-project review. The chapter now ends with a special section on managing virtual teams, including topics to include in training programs for increasing awareness of potential cultural differences.

Chapter 13, "Supporting Computer Users," has been shortened, simplified, and updated. Additional computer security issues are presented, and the section on supporting telecommuters has been expanded to address new support and security concerns. Issues to consider when introducing new social networking tools within organizations are discussed in a new section on managing intranets.

Part 4: The Information Management System

Chapter 14, "Planning Information Systems Resources," has been revised to incorporate IT architecture maturity stages, scenario planning (as a tool), and updated technology planning examples.

Chapter 15, "Leading the Information Systems Function," has been completely restructured to emphasize management of the three IT assets introduced in Chapter 1. Current management practices and recent field research have been incorporated in the discussions of IT governance, IT service delivery, managing an organization's portfolio of applications, IT staff retention, and managing offshore IT outsourcing arrangements. Relevant IT labor statistics have been incorporated, including research on IT skills that organizations consider to be critical to keep in-house.

Chapter 16, "Information Security," is a totally new chapter written for this edition. It emphasizes managerial approaches to managing information risks, including the development and distribution of security policies and business continuity planning. Recent laws that impact IT security practices are summarized, and electronic records management approaches and the role of the chief information security officer are introduced. E-crime statistics and the technical approaches to prevent and deter them have been updated.

Chapter 17, "Legal, Ethical, and Social Issues," has been substantially revised (and the discussions on e-crime and related issues were moved to Chapter 16). The opening section on ethics frameworks has been shortened and simplified. The remainder of the chapter focuses on individual and societal issues, with a focus on privacy issues, identity theft, and intellectual property rights.

New (or Revised) Case Studies: *For Users of the Fifth Edition*

In addition to the 17 prior published cases that are essentially unchanged, this edition includes 13 totally new or substantially revised cases. The seven new cases not previously published that appear in this sixth edition address such topics as:

- VoIP technologies and implementation
- open source project approaches
- data governance issues
- business intelligence
- developing a vendor-managed inventory capability
- managing a multiyear IT outsourcing contract

A short synopsis of each New or Revised case study is provided below. (Note: these descriptions also are printed in the Preface for the sixth edition of the textbook itself.)

Case Study I-2: VoIP2.biz: Deciding on the Next Steps for a VoIP Supplier
NEW—This case study deals with product development issues faced by an IT industry company developing products and services for an emerging technology: Voice over Internet Protocol (VoIP).

Case Study I-3: VoIP Adoption at Butler University
NEW—The VoIP adoption decision process, and details about the implementation approach used to implement this new technology, are described in detail. Potential benefits for administrative departments and students are assessed, and the case ends as the impacts on the IS organization in this midsized university are beginning to be realized.

Case Study I-4: Data Governance at InsuraCorp
NEW—A corporate restructuring and new business pressures for data integration raise issues about data ownership, data quality, and other new data governance issues for a newly centralized IS organization in a large insurance firm.

Case Study II-1: Vendor-Managed Inventory at NIBCO
NEW—Following its initial big-bang implementation of multiple modules of an ERP system, NIBCO continuously improves its business processes and purchases additional vendor modules to pursue new strategic opportunities. A vendor-managed inventory initiative, in which NIBCO becomes a sole-source provider for selected business customers, is described in detail. The case study ends with NIBCO's management wondering how best to continue to leverage its new IT and business capabilities.

Case Study II-3: Real-Time Business Intelligence at Continental Airlines
NEW—Based on an award-winning case study, the Continental Airlines case study demonstrates how real-time data warehousing and business intelligence applications resulted in the organization's turnaround from a poor performer to an industry leader. The case is not heavy on technical details, but the essence of the technology is explained. The focus is on the process for delivery of data management services (data warehousing) for data sharing and decision making.

Case Study II-4: The Cliptomania Web Store: An E-Tailing Start-up Survival Story
REVISED—This case study has been expanded to cover Cliptomania's experience as the Web has evolved in ways that have challenged e-tailers to adapt or perish. A Web-based company's position on a search results page is paramount, and material on how Google ranks the results of a search is included as well as an example of what can happen to your sales if you do not understand the ranking algorithms.

Case Study II-5: Meridian Hospital Systems, Inc.: Deciding Which IT Company to Join
REVISED—This case study builds on an earlier case about a real start-up firm (Mezzia, Inc.). The focus now is entirely on a graduating student's career decision about whether to accept a position to work for a small start-up company (now a fictional company) or for a well-established IT industry company (Hewlett-Packard).

Case Study III-5: The Kuali Financial System: An Open Source Project
NEW—Several universities have joined together to develop a comprehensive suite of financial systems tailored to the needs of higher education institutions and make it available to the

educational community without charge under an open source license. The case study presents the organizational, management, and development approaches employed to overcome the challenges in getting agreement on system requirements by seven institutions and in successful development using personnel located from Hawaii to New York.

Case Study III-10: Purchasing a Student Management System at Jefferson County School System (Revised)
REVISED—The JCSS case study has been substantially revised to update the technology to the current infrastructure at the camouflaged organization. It is now purely a software purchase rather than a bundled hardware and software purchase. The issues in the case remain the same but some restructuring has been done to more clearly separate the purchase decision from its implementation.

Case Study IV-1: The Clarion School for Boys, Inc.—Milwaukee Division: Making Information Systems Investments
REVISED—This case study has been revised to demonstrate decisions about technologies available today.

Case Study IV-4: IT Infrastructure Outsourcing at Schaeffer (A): The Outsourcing Decision
REVISED—The camouflaged context of the previously published IT outsourcing decision story at Schaeffer has been somewhat modified to incorporate insights learned from the development of a "B" case (see Case Study IV-5).

Case Study IV-5: IT Infrastructure Outsourcing at Schaeffer (B): Managing the Outsourcing Contract
NEW—Managing a seven-year IT infrastructure outsourcing contract at Schaeffer involves accommodating some anticipated business changes, as well as addressing some unexpected challenges in managing the vendor relationship. The case ends with management facing the decision of whether or not to renew the vendor contract in light of its experiences working with the vendor and its most recent business change.

Case Study IV-8: Mary Morrison's Ethical Dilemma (Revised)
REVISED—The issues in this version remain the same as before, but Mary's personal background has been modified to keep the focus on the ethical issues.

The Graduate Information Technology Management Course

This book is written for students who are, or aspire to be, *either business managers or IS managers*, as well as for students who are, or aspire to be, primarily technology specialists who will work in and for different types of businesses—including consultant firms and other firms competing in an IT services industry. The content of the book is therefore intentionally broad in its coverage, with an emphasis on what managers and IS professionals need to know about IT management.

Part I of the textbook can be used as background reading only—especially if the course is for IT specialists familiar with most of these IT concepts. For business students with less familiarity, other approaches may be required—such as independent reading with assessments using quizzes based on the text bank questions for those chapters—and/or providing lectures on these topics.

Part II provides a broad introduction to the range of applications available to today's organizations, and the business opportunities enabled by them. Our experience is that the content in these three chapters is of great interest to working managers as well as younger students. Part III primarily focuses on the management of software development initiatives: alternative approaches to acquiring and implementing custom-developed and purchased software and managing IT projects of different types them. We have also chosen to include our chapter on supporting computer users in this part, as it includes the management of user-developed applications. Part IV informs both business and IS managers of what is required to effectively manage and lead an IS organization today; the last chapter also addresses the bigger IT-related issues of ethical and social concerns.

The graduate IT management course therefore helps prepare the individual manager to leverage IT resources in his or her career, as well as to leverage IT resources for the strategic benefit of an organization.

Examples of Master's Level Courses

There are many variations of MBA and MSIS courses for which this book can be used. We have taught many different versions at Indiana University: a course in our regular full-time MBA program at the Bloomington campus, a course in our evening MBA program at our Indianapolis campus, a course in our full-time MBA in Accounting program at the Bloomington campus, a course in an Executive MBA program, a course in our online MBA and MS programs (Kelley Direct), and a course in our full-time MSIS program. The outlines that follow can be modified for full-time twice-a-week, one evening a week, and online course schedules.

Our experience is that graduate-level courses are most effective when students are involved in discussions and projects. The following course outline therefore uses the case studies in the book to obtain student involvement. All of these cases are based on data collected from real organizations. Although some of the companies are disguised, only non-essential contextual information and names have been changed to camouflage these sources.

Case studies can of course be used in many ways. In this manual we provide some objectives, an overview of the case study, and some discussion questions for each case. A common approach is to have the instructor lead the case study discussion, asking students to outline the situation, identify the problems, and suggest solutions. With this approach, we often distribute the preparation questions ahead of time to guide the students' reading of the case. This discussion can be handled either by taking volunteers from the class to move the discussion forward, or by "cold-calling" on students using some kind of random selection process. Here the instructor can make sure that many of the major points he or she wants to cover on the topic are brought out and discussed via the case study. One way to ensure participation in each case discussion is to raise a question that requires each student to "vote," and then call on students to justify their vote. If case studies are carefully chosen, they should tie in well with the associated chapter, so lecturing can be minimized.

Another approach for graduate classes involves dividing the class into teams of 4 or 5 students, and having each team prepare a written analysis of one case study and make a formal presentation of that case study to the entire class, and giving a second team the assignment to critique this presentation in class. (See the description for students called "Team Case Assignments" that follows the three graduate course outlines below.) Here, the instructor can ask questions of both teams to ensure that the most important points have been discussed. Each member of the audience can also be asked to fill out a short evaluation form on each team presentation, and the instructor aggregates the results and adds their own observations as part of their feedback to the team. We may also videotape the presentation and ask each presenter to write a short critique of his or her own presentation. The number of team presentations scheduled depends on the size of the class, but including team presentations gives students the opportunity to develop their communications skills, as well as their effectiveness in teamwork, all of which are very important for MBAs.

The first two course outlines below follow the book very closely, but it can easily be modified in many ways to suit your preferences. The chapters have been written to be as independent as possible, so (for example) we sometimes vary the order in which the chapters are covered. You can also modify the amount of time devoted to the various topics. For example, this outline devotes only one class period to each of the first two technical chapters (Chapters 2 and 3). If your students have a good technical background, you may be able to omit these chapters entirely or perhaps schedule an optional session on this material. Alternatively, if you believe it is important to give your students a stronger technical background, you may choose to spend the equivalent of a full week on each of these chapters. The third outline is an example of how the chapters can be used in a different order to emphasize IT project examples at the frontend of an online course.

For graduate-level examinations, we recommend a combination of essay questions and multiple choice questions. If a multiple choice is used, we recommend a subset of questions from the testbank questions *that students have already been asked* before (as exam prep or ongoing quizzes). In addition, we include some instructor-developed questions that test the learning of key points from the case studies.

Master's IT Management Course Outline (Full-Time Students)

The following course outline is for full-time students. The schedule is two 75-minute classroom sessions per week, a fifteen-week semester, and a separate final examination period.

Week	Session	Topic	Reading Assignment / Case Study Assignment
Week 1	First	Course Introduction; Managing IT in an E-World	Chapter 1
	Second	Managing IT in an E-World	Midsouth Chamber of Commerce (A)
Week 2	First	Computer Systems	Chapter 2; IMT Custom Machine Company, Inc.
	Second	Computer Software	Chapter 3
Week 3	First	Telecommunications and Networking	Chapter 4
	Second	Telecommunications and Networking	VoIP Adoption at Butler University
Week 4	First	The Data Resource	Chapter 5; Data Governance at InsuraCorp
	Second	Enterprise Systems	Chapter 6; ERP Purchase Decision at Benton Manufacturing, Inc.
Week 5	First	Enterprise Systems	Real-Time Business Intelligence at Continental Airlines
	Second	Managerial Support Systems	Chapter 7; The MaxFli Sales Force Automation System at BAT
Week 6	First	E-Business Systems	Chapter 8; Vendor-Managed Inventory at NIBCO
	Second	E-Business Systems	The Cliptomania Web Store
Week 7	First	Basic Systems Concepts	Chapter 9
	Second	Basic Systems Concepts	Naval Surface Warfare Center, Crane Division: Implementing BPR Recommendations
Week 8	First	Review	
	Second	MIDTERM EXAMINATION	
Week 9	First	Methodologies for Custom Software Development	Chapter 10
	Second	Methodologies for Custom Software Development	Consumer & Industrial Products, Inc.
Week 10	First	Methodologies for Purchased Software Packages	Chapter 11; Make-or-Buy Decision at Baxter Manufacturing Company
	Second	Methodologies for Purchased Software Packages	Purchasing a Student Management System at Jefferson Country School System
Week 11	First	IT Project Management	Chapter 12; NIBCO's "Big Bang"
	Second	IT Project Management	A Troubled Project at Modern

Week	Session	Topic	Reading Assignment / Case Study Assignment
			Materials, Inc. *or* Kuali Financial Systems: An Open Source Project
Week 12	First	Supporting Computer Users	Chapter 13
	Second	Planning Information Systems Resources	Chapter 14; The Clarion School for Boys, Inc., Milwaukee Division
Week 13	First	Leading the IS Function	Chapter 15; New Baxter Manufacturing Plant in Mexico
	Second	Leading the IS Function	IT Infrastructure Outsourcing at Schaeffer (A) and (B)
Week 14	First	Leading the IS Function	FastTrack IT Integration for the Sallie Mae Merger
	Second	Leading the IS Function	BAT APSS: Shared Services for a Multinational Firm; Meridian Hospital Systems, Inc.: Deciding Which IT Company to Join
Week 15	First	Information Security	Chapter 16; A Security Breach on the Indiana University Computer Network
	Second	Legal, Ethical, and Social Issues	Chapter 17; Mary Morrison's Ethical Dilemma
Week 16		FINAL EXAMINATION	

Master's IT Management Course Outline (Evening or Weekend Students)

This outline is for a Master's IT course that meets once a week in the evening or on a Saturday. This syllabus also includes team project presentations (a Web Site Analysis project described in this instructor's manual for Ch. 8), a guest speaker (as recommended for Ch.15), and two exams.

Week	Topic	Reading Assignment / Case Study Assignment
Week 1	Course Introduction; Managing IT in an E-World	Chapter 1; Midsouth Chamber of Commerce (A)
Week 2	Computer Systems; Computer Software; Industry Update	Chapter 2; Chapter 3; Web Site Analysis assignment introduced
Week 3	Telecommunications and Networking; The Data Resource	Chapter 4; Chapter 5; VoIP Adoption at Butler University; Data Governance at InsuraCorp.
Week 4	Enterprise Systems; Using IT to Redesign Processes	Chapter 6; NIBCO's "Big Bang"
Week 5	Managerial Support Systems	Chapter 7; Real-Time Business Intelligence at Continental Airlines
Week 6	E-Business Systems	Chapter 8; Vendor-Managed Inventory at NIBCO
Week 7	Team Presentations: Web Site Analysis	Web Site Analysis Due
Week 8	MIDTERM EXAMINATION	
Week 9	Basic Systems Concepts; Methodologies for Custom Software Development	Chapter 9 (skim); Chapter 10; Consumer & Industrial Products, Inc.
Week 10	Methodologies for Purchased Software Packages	Chapter 11; Make-or-Buy Decision at Baxter Manufacturing Company
Week 11	IT Project Management	Chapter 12; A Troubled Project at Modern Materials, Inc.
Week 12	Supporting Computer Users	Chapter 13; Systems Support for a New Baxter Manufacturing Company Plant in Mexico
Week 13	Planning IS Resources; Leading the IS Function	Chapter 14; Chapter 15; IT Infrastructure Outsourcing at Schaeffer (A) and (B)
Week 14	Leading the IS Function; Guest Speaker: CIO	FastTrack IT Integration for the Sallie Mae Merger
Week 15	Information Security; Legal, Ethical, and Social Issues	Chapter 16; Chapter 17; A Security Breach on the IU Computer Network
Week 16	FINAL EXAMINATION	

Master's IT Management Course Outline (Online)

A course outline for an online course that takes place during a 12-week trimester schedule is given below. In this alternative, a readings packet (typically *Harvard Business Review* and *Sloan Management Review* articles) and digitized mini-lectures are used in addition to the textbook. For this course, the Part I technology chapters are interspersed with the Part III readings at the beginning of the course, and online quizzes are provided for the technology chapters to help students achieve a certain literacy level.

Week	Topic	Reading Assignment / Case Study Assignment
	Unit 1: Introduction	**Video: Introduction to the Course and Unit 1**
Week 1	Course Introduction; Managing IT in an E-World	Chapter 1; readings on the business value of IT
	Unit 2: Understanding Business Opportunities Enabled by IT	**Video: Introduction to Unit 2**
Week 2	Recognizing Disruptive Technologies; Technology Concepts – Hardware	Chapter 9 on BPR; reading on disruptive technologies; Chapter 2; IMT Custom Machine Company, Inc.
Week 3	Leveraging E-Business; Technology Concepts – Software and Networking	Chapter 8; reading on e-business leadership and influence of the Internet on competitive forces; Vendor-Managed Inventory at NIBCO; The Cliptomania Web Store; Chapter 3; Chapter 4
Week 4	The IT Business Case	Chapter 14; Chapter 15; online PowerPoint presentations on the business case (in general and IT-specific); Teletron, Inc.: Using IT to Transform a Company
Week 5	MIDTERM EXAMINATION	
	Unit 3: Acquiring Information Systems	**Video: Introduction to Unit 3**
Weeks 6 and 7	Group Project Signup: Technologies in Business	Familiarization with tools for group project
Week 6	Strategic Value from Enterprise Systems	Skim Chapter 5 for database concepts; readings on the implementation of CRM systems using a data warehousing approach; Real-Time Business Intelligence at Continental Airlines
Week 7	Strategic Decision-Making Support	Chapter 10; Chapter 12; The MaxFli Sales Force Automation System at BAT
Week 8	The Delivery of Information Systems	Chapter 6; Chapter 11; reading on continuous improvement with enterprise systems; NIBCO's "Big Bang"

Week	Topic	Reading Assignment / Case Study Assignment
	Unit 4: Leveraging IT	**Video: Introduction to Unit 4**
Week 9	Sourcing IT Work	Chapter 15; readings on outsourcing trends, including BPO; IT Infrastructure Outsourcing at Schaeffer (A) and (B)
Week 10	Managing in a Virtual World	Chapter 13; Chapter 15 on global IT; readings on globalization and managing virtual teams
Week 11	Team Projects Due: Technologies in Business	

Team Case Assignments

Team Presentation

A problem-solving approach to case analysis will be introduced in class. For this approach, the team should take a consultant role, and assume that it was hired by the organization to:

Make use of your knowledge of IS management
Provide an objective opinion on one or more problems
Provide realistic options for action for this organization

For other cases, a problem-solving approach may not be relevant, and the team should take an educator role. The case may be viewed as a "textbook example" to be critiqued in relation to other class readings and/or experience.

Written Presentation

The text should be a maximum of 6 double-spaced pages. You should include copies of all tables, diagrams, etc. used in your presentation. The cover sheet should include team member names. Provide copies to each member of the critiquing team and 2 copies to the instructor.

Oral Presentation

The presentation should be your professional best, last no more than 30 minutes, and each team member should have a part. You should illustrate your presentation with PowerPoint slides; be sure that the fonts on these sides are readable when projected in your classroom.

Oral Critique

There will be a 5-minute break after the oral presentation while the critiquing team prepares. During this time the other class members will complete a presentation evaluation form for each presenter.

The critiquing team should point out the positive aspects of the case presentation as well as those areas where there may be room for improvement or alternative conclusions. If a problem-solving approach was appropriate for this case, the critiquing team should evaluate the case presentation for the following:

Accurate assessment of the current situation
Complete formulation of issues or problems
Technologically and organizationally sound recommendations for action

If a problem-solving approach was not appropriate, the critiquing team should evaluate the case presentation for:

Accurate presentation of the situation
Relevant application of class readings and experience

If your team has little to actually criticize about the earlier presentation, your team should at least present some alternative recommendations and the implications (or "next steps") that you would recommend.

The Undergraduate Information Technology Management Course

This text has also been used with success at the undergraduate level. For the undergraduate student, the review and discussion questions at the end of each chapter can be used to help them focus on specific aspects of each chapter. We sometimes require that written answers be prepared for a small subset of these questions; these are evaluated by the instructor, but perhaps with only 3 grades given: A+, satisfactory, and unsatisfactory.

Several case studies are also assigned. Our experience is that this course may be the first one that students take that involves the use of case studies. If so, the instructor needs to provide some guidance to the student about how to go about preparing for a class discussion. The case studies also must be carefully selected so that the contextual details do not overwhelm a student that has had little (or essentially no) relevant work experience.

For this course we also recommend the use of computer laboratories/computer assignments to help students get some hands-on experience with some of the key concepts. In the following outline we have provided for five laboratory sessions and related assignments. This approach adds an element of variety in delivery to a predominantly lecture/discussion course. It is assumed that each laboratory session will take the form of a demonstration and/or laboratory exercise, and that most computer homework assignments will be given at the end of a laboratory session and due a few weeks later. Of course, the particular topics covered in these lab sessions will vary depending upon the coverage in prerequisite courses and the needs of your particular undergraduate program.

Several other points should be made about the course coverage. First, while a significant number of case study discussions are listed, these discussions do not tend to be as long or in as much depth as they would be in a graduate course. Our usual approach is to distribute the case study discussion questions via electronic mail two to three days before the class session, and then use these discussion questions to channel the case study discussion. Second, more complex case studies are assigned at the end of the course; by this time, the students should have increased their skills in case study problem-solving, but preparation questions should be used to help them focus on specific aspects of the case study. Third, we have shown the scheduling of a single guest speaker, but it may be useful to bring in more than one guest speaker for short presentations at other points during the semester.

We believe that the course described below provides a very useful capstone IT management course for the IS major. Together with a first course that is computer tools-oriented, we also believe that it can be effectively used as an MIS component for the non-IS undergraduate business major as well. The objective of both courses is to help prepare the undergraduate business major to be an effective user of information technology in his or her career.

Example of Undergraduate Level Course

Undergraduate IT Management Course Outline

This course outline assumes two 75-minute classroom sessions per week, a fifteen-week semester, and a separate final examination period.

Week	Session	Topic	Reading Assignment / Case Study Assignment
Week 1	First	Course Introduction; Using Web resources	Web Mini-Assignment given with a focus on resources for learning about the topics in this course
	Second	Managing Information Technology in an E-World	Chapter 1; Midsouth Chamber of Commerce (A); Web Mini-Assignment Due
Week 2	First	Computer Systems	Chapter 2
	Second	In-Class Lab Session: Advanced Hardware Concepts (How does a microcomputer work?)	
Week 3	First	Computer Software	Chapter 3
	Second	Computer Software	IMT Custom Machine Company, Inc.
Week 4	First	Telecommunications and Networking	Chapter 4
	Second	Laboratory Session: Geographic Information Systems (GIS)	GIS Assignment Given
Week 5	First	Telecommunications and Networking	VoIP Adoption at Butler University; Review session
	Second	FIRST MIDTERM EXAMINATION	
Week 6	First	The Data Resource	Chapter 5
	Second	Laboratory Session: Decision Support Systems Using Microsoft Excel	GIS Assignment Due; Decision Support Systems Assignment Given
Week 7	First	Enterprise Systems	Chapter 6; ERP Purchase Decision at Benton Manufacturing, Inc.
	Second	Managerial Support Systems (including several demonstrations)	Chapter 7
Week 8	First	E-Business Systems	Chapter 8; The Cliptomania Web Store
	Second	Laboratory Session: Web Site Analyses	Decision Support Systems Assignment Due
Week 9	First	E-Business Systems	Vendor-Managed Inventory at NIBCO
	Second	Basic Information Systems Concepts	Chapter 9 (skim)
Week 10	First	Guest Speaker: Leveraging an ERP System	Assignment to prepare for Guest Speaker presentation
	Second	Laboratory Session: Microsoft Access	Web Site Analyses Due; Access Assignment Given
Week 11	First	SECOND MIDTERM EXAMINATION	

Week	Session	Topic	Reading Assignment / Case Study Assignment
	Second	Methodologies for Custom Software Development	Chapter 10; Consumer and Industrial Products, Inc.
Week 12	First	Methodologies for Purchased Software Packages	Chapter 11; Make-or-Buy Decision at Baxter Manufacturing Company
	Second	Supporting Computer Users	Chapter 13; Access Assignment Due
Week 13	First	IT Project Management	Chapter 12; NIBCO's "Big Bang"
	Second	Information Security	Chapter 16; A Security Breach on the IU Computer Network
Week 14	First	Leading the IS Function	Chapter 15; Meridian Hospital Systems: Deciding Which IT Company to Join
	Second	Leading the IS Function	IT Infrastructure Outsourcing at Schaeffer (A)
Week 15	First	Leading the IS Function	IT Infrastructure Outsourcing at Schaeffer (B)
	Second	Legal, Ethical, and Social Issues	Chapter 16; Mary Morrison's Ethical Dilemma; Review session
Week 16		FINAL EXAMINATION	

Additional Course Outline Suggestions

The four course outlines presented here in this *Instructor's Manual* represent only four of the many possible ways in which *Managing Information Technology* can be used in an IT management course. For example, in a course with experienced managers (such as an Executive MBA Program), coverage of the early portion of the book (especially Chapters 2, 3, 4, 5, 6, and 7) could be greatly reduced to permit more time and discussion of the content in the later chapters (beginning with Chapters 8). Conversely, an undergraduate course with limited prerequisites might concentrate on the early chapters and reduce further our coverage of the chapters in Part IV. In addition, different sections of Chapter 15, for example, could be covered throughout the course to help students understand the IS organization contexts of the case studies, but Chapter 14 could be skipped. Note that the section in Chapter 15 that presents some statistics about the IS workforce, including the skillsets needed by client organizations in the U.S. and other developed countries, can be used in conjunction with the case studies shown in the undergraduate outline: the two-part outsourcing case study as well as the short case study about an undergraduate weighing the pros and cons of working for an established firm versus a startup.

In our view, the key to a successful IT management course at all levels rests in the frequent use of real-world examples, including Web-based resources, and enhancement activities that go beyond a classroom lecture format. We believe that this particular textbook affords a special opportunity to use **unique case studies**, not available elsewhere, that have been written by the same textbook authors who have also authored the IS management chapters. In the course outlines we have emphasized case studies for the Master's course and a combination of selected case studies and computer laboratories for the undergraduate course.

However, other enhancement activities also exist, such as films, guest speakers, and technology demonstrations. If your university has an agreement with a major vendor such as SAP or Oracle, aspects of their enterprise systems can be reinforced with demos and lab exercises. We also recommend to instructors the Teradata University initiative in which a vendor is hosting an environment for students to learn more about data warehousing approaches. A core team of IS academics is supporting this initiative by designing exercises to work with secondary data so that students can experience what it means to work with large data sets. One of our coauthors, who also coauthored the business intelligence case at Continental Airlines in this textbook, has played a key role in the Teradata initiative.

The following pages of this manual provide teaching suggestions for each chapter and discussion questions for each case study, as well as objectives and overviews to help you select the content and assignments that best fit your own teaching needs.

Enjoy developing your own course!

Chapter 1
Managing IT in an E-World

Objectives

Chapter 1 sets the context for studying the management of information technology in an Internet age. The overall objective of this chapter is to motivate the course content. An overall theme of the text is that IT is a strategic enabler and the management of IT is a responsibility of not only IS specialists, but also IT-knowledgeable business managers.

Unlike the early 1990s when the first edition of this textbook was published, virtually all of today's students are experienced users of personal computers and handheld communications devices. Many already depend on the Web for information, entertainment, and perhaps shopping, online banking, and social networking as well. Graduate students may also have already had an introduction to IS management concepts as undergraduate students and are more likely to have had firsthand experiences with information systems in an organizational setting.

Because of the broad impacts of the Internet, most students today should be familiar with the competitive impacts of a pervasive IT world, or *e-world.* A brief discussion of IT trends in hardware, software and computer networks sets the stage for these three chapters on IT components in Part I.

The sections that follow are designed to introduce students to IS management issues and roles in organizational settings. For students who have not yet been exposed to business strategy issues, we briefly introduce some ideas of how IT can enable an organization to lower its costs as well as differentiate the product or service that it offers to its customers. IT has also enabled new ways that people work and live, and we introduce the concepts of IT-enabled telework and virtual teams; in Chapters 12 and 13 we will provide some guidelines for supporting these newer ways of working.

We then use two IS management frameworks well known to many IS academics. The first of these is the 2x2 model by McFarlan that describes four IS department roles: Support, Factory, Turnaround, and Strategic. For the axes in Figure 1.1, we use a recently published *Harvard Business Review* article co-authored by McFarlan that describes the notion of "defensive" and "offensive" IS roles. The support and factory quadrants are defensive, the other two offensive. The second framework is the IT-asset framework by Ross et al.: the technology asset, IS people (human resource) asset, and a relationship asset. The relationship asset refers to how well business and IS personnel work together for the benefit of the organization—which is a theme throughout the text. We also introduce here a generic organization chart to help students begin to understand the role of a CIO and other IT leaders.

This chapter therefore sets the stage for the remainder of the text, which includes chapters and case studies organized into four parts:

- Part I of this textbook focuses on the basic IT components that need to be managed: hardware, software, networks, and data.
- Part II provides in-depth descriptions of the key features and uses of enterprise systems, managerial support systems, and e-business systems.
- Part III presents methodologies and techniques for acquiring systems – both custom-built and purchased packages; separate chapters are also provided on managing IT projects and supporting computer users.

- Part IV focuses on IS planning and the management of the IS departments within organizations, including a chapter on information security issues and a final chapter on IT-related legal, ethical, and social issues.

Teaching Suggestions

To help students understand how IT capabilities have evolved, we have found it useful to ask students to think about how they used IT (for personal, educational, and/or professional activities) several years ago versus how they are using IT today. If you have non-traditional undergraduate or master's students, it is possible that they may remember differences prior to the Web as we know it today.

For graduate-level students, we have also used the *Harvard Business Review* article by N. Carr published in May 2003, which questions the value provided by IT. Its title ("IT Doesn't Matter") can be used to set up a debate for or against the views of Carr. (Note: the "Letters to the Editor" published in the subsequent *HBR* issue in June 2003 provide some strong alternative arguments.) Our own experience is that if the faculty member does not preempt the debate with his/her own opinions, or emphasize the perceived status of an article published in the *HBR*, the students in the class will indeed be split on the issue.

One approach for motivating the technology chapters (in Part I of the text) is to split the class in half, give everyone the letters a, b, and c, and then ask multiple choice questions on hardware, software, and network innovations (such as the first Web browser) and the use of data warehouses and data mining terminology. All students hold up their own answers, the correct answer is revealed, and those that get the answer right are the team "survivors" for the next question. The team with the most survivors at the end of the game is declared the most "IT-ready" or something equivalent.

News stories on IT topics and the IT industry (in newspapers or periodicals for the business reader such as *Business Week*) can also be used to help motivate the course content. Non-IS students will also be introduced to the idea that they can advance their IT knowledge by continuing to read articles written for a general business audience about emerging technologies and IT industry developments not only during this course, but after this course has ended. Keeping up with IT advancements is a responsibility of every manager, both business managers and IS managers. Web sites such as Wikipedia as well as news sites for IS managers (such as cio.com) may also be introduced at the first class meeting by the instructor and students in the class.

It is also important to emphasize how managing IT in organizations (i.e., the role of information systems departments) has become much more complex over the past decade. One approach is for the class to brainstorm about what is needed to support workers who are "anytime, anywhere" versus located in a single building, or to have the organization's public Web site available 24 x 7 (24 hours a day, 7 days a week).

The two frameworks in the Managing IT in Organizations section can be used to help introduce to students the managerial and IS-business partnership focus of the course. For example, the 3-part framework of IT Assets by Ross, Beath, and Goodhue (Figure 1.2) can be used to emphasize the importance of not only technology and IS professional resources, but also the importance of developing a strong "relationship" asset. The importance of this relationship asset will be brought out in various chapters in Part III and Part IV, as well as in most of the case studies in this textbook. The four quadrants in Figure 1.1 can be introduced as a useful tool for characterizing the IT role in the different organizational contexts covered by the teaching cases in this textbook, especially those cases that involve IT investment decisions.

Finally, Figure 1.3 is introduced to "dispel" myths that have recently been associated with a downturn in undergraduate IS enrollments within the U.S. In Chapter 15 we provide additional data about IS personnel needs, but we recommend introducing some relevant workforce statistics here as another way of motivating this course content.

The Midsouth Chamber of Commerce (A) case study that immediately follows Chapter 1 can be used to excellent advantage even during the first week of classes. The case shows what can happen when a well-meaning business manager is the champion for the purchase of an information system in which there is no formal project team. Because this case takes place in a very small organization, it is relatively easy for these management issues to be brought out. This case can also be used to illustrate the difficulty of managing a system implementation with a very small group and without a strong IS leadership role. The Midsouth case can also be used as a common point of reference for subsequent chapters, especially those on methodologies for purchasing software packages (Chapter 11), IT project management (Chapter 12), and IS leadership (Chapter 15).

Review Questions

1. **Define what is encompassed in the term information technology.**

   Information technology includes both the computer technology that enables the processing and storing of information as well as the communication technology that enables the transmission of this information.

2. **What are some of the ways that IT has become "pervasive"?**

   In the workplace, IT has become commonplace. It is becoming rare for an employee in most industries to go a day without interacting with some form of IT. Further, more employees are becoming reliant upon IT for some of their daily tasks or even may perform the majority of their daily work using IT.

   However, IT has not only become pervasive in the workplace: IT can also commonly be found in the home and in public areas. In fact, by the end of the 1990s, these technologies had become so commonplace that airplane passengers today are instructed as to when the use of computers and cellular phones are and are not permitted. Airports, cafes, and other public locations are also already offering wireless network access, which make possible access to other individuals and computer networks while walking down a hallway or eating lunch.

   Further, for some individuals, their social life is facilitated by or completely dependent upon IT. Cell phones, text messages, blogs, social networking websites, emails, web cams, online games, virtual worlds, and other forms of digital communication have become more pervasive in recent years and have replaced some face-to-face social interaction.

3. **What kinds of portable IT can help employees work more efficiently and effectively?**

   Today's portable technologies allow employees to work outside of the confines of physical offices – at home, at a client organization, or on the road. Lightweight portable microcomputers and handheld devices have become so useful and affordable that they have become indispensable for the traveling business professional. This means that employees can gain access to company

resources as needed, and can keep working while using public transportation.

4. What kinds of IT can help support teams when team members work at different locations?

The most basic kind of IT for supporting virtual teams is the communication technology that facilitates the transmission of information among the team members. This may include telephone and Internet connectivity as well as devices and software that use the connectivity. Additionally, many organizations provide means for employees in many locations to access important network resources

5. How have some businesses used the Internet to compete based on low cost or on product/service differentiation?

Many retailers have used their Internet website to compete on cost. By offering sales transactions online, these businesses may decrease their expenses by eliminating physical stores, reducing holding inventory costs, and lowering the costs of individual transactions. Lowering costs also allows some retailers to better compete on price—a "low cost" strategy.

The Internet has also allowed some businesses to compete using differentiation. One example of using the Internet to compete on product/service differentiation is The LEGO Group's "LEGO Factory" (http://shop.lego.com/Product/Factory/About.aspx). With downloadable software customers can design their own custom LEGO models, upload their designs over the Internet, and then purchase a custom set of LEGO blocks that can be used to physically build the pre-designed model. In this way, The LEGO Group differentiates their offerings from its competitors who do not offer custom block sets.

6. What kind of a business might be in the Factory quadrant of Figure 1.1?

Many types of businesses might be in the Factory quadrant. Many manufacturing businesses (as suggested by the name for this quadrant) that need highly reliable IT to sustain their operations, yet do not require the newest IT capabilities, may be in this quadrant. Retailers with very high transaction volumes may be another example because if their IT is not reliable for even a short time period, their sales losses can be considerable. Another example of a business in the Factory quadrant is an airline: these companies may not invest in current IT to compete in new ways, but require 24/7 reliability for continued operations in booking flights, checking-in passengers, etc.

7. What three IT assets have been identified as more important in today's Internet age, and why?

[Note: The three assets are presented in Figure 1.2]

Technology Assets, **Relationship Assets**, and **Human Assets** must all be managed effectively by IT leaders in modern IT organizations.

The **Technology Assets** are becoming more complex and businesses are increasingly dependent upon these resources. It is important for IT managers to help business managers understand the value of standard IT platforms across the organization to ensure reliable computer and communications operations.

In addition to effectively managing the technological assets, IT managers must continually

evaluate the **Relationship Assets:** how well the IS department is working with business managers so that IT investment and implementation decisions are made that benefit the organization. IT leaders who partner well with business managers are most likely to implement IT solutions that provide value to the business organization.

Effectively managing **Human Assets** is a crucial component of every business function. In IT, this involves recruiting, training, and managing employees who possess highly specialized technical knowledge, as well as those who have both business knowledge and technical skills. The management of IT human resources has become more difficult as many businesses are finding a shortage of the newer IT skills that they need, as well as new demands for managing across organizational boundaries with other employees are outsourcing personnel.

8. **What does CIO stand for, and why has such a position been created?**

The **Chief Information Officer** (CIO) position was created to manage the increasing complexity and pervasiveness of IT in today's organizations. The CIO works with other executive-level business leaders and manages other IS managers responsible for IT functions. (The organization chart in Figure 1.3 shows the IS units in one organization.)

9. **For what reasons might an IS manager report not only to a CIO, but also to a business manager?**

IS managers responsible for business applications for a specific business unit may report to a business manager in that business, in addition to the CIO, to help ensure IT-Business alignment. (An example is shown in the organization chart in Figure 1.3.)

10. **What types of IT leadership roles are performed by a business manager, not an IS department manager, and why?**

The IT leadership roles that business managers may perform are of strategic importance to the organization. For example, business managers typically take part in decisions about which new IT investments the business chooses, based on how well these investments fit the strategic goals of the business. Business managers also may co-lead a specific project to develop and implement a new IT application. All of these activities have strategic impacts on how the firm competes.

Discussion Questions

1. **Provide an example of how a business function with which you are familiar (e.g., marketing, finance, operations/production, accounting, human resources) can be highly dependent on IT.**

[Note: Many of the traditional business functions can be highly dependent on IT, although the types of IT may vary. Some functions may be more dependent on IT for communication, others on standard office software or upon specialized software packages, etc.]

2. **Describe some ways that today's information technologies make your life as a student different from students just a few years ago.**

Examples: The Internet provides access to research databases, commercial sites, Federal government offices, and other online sources that in the past may not have been directly accessible to students; access to university resources is also typically provided online so that students can make use of library resources overnight when its physical doors are closed. E-mail supports communication with others throughout the day or night, as well as provides a means to share documents with team members or submit an assignment without physically going to an office location. Word processing software provides spell checking and ease of correction. Spreadsheets improve the accuracy and sophistication of certain quantitative analyses. Presentation software programs make it much easier to prepare interesting "slideshows" for team presentations that include color, images, and links to the Internet.

3. **Some organizations purposefully select IT leaders that have strong business management backgrounds, not just technical experience. Under what circumstances do you think this might be an effective choice?**

   The CIO is the leader of the IT organization who typically reports to the CEO, COO, or CFO. To effectively work with other senior leaders and ensure IT-business alignment, many organizations require their CIO to possess strong business management experiences so that they work well with other business executives and can effectively participate in business strategy and other high-level discussions. The selection of a CIO who possesses both business management skills *and* strong technical knowledge and experience may be the ideal choice for a business. However, sometimes such an executive is difficult to find, and the organization chooses instead a manager with strong business management skills but weak technology experience; in these situations, the CIO would rely heavily on direct reports with strong technical backgrounds and technology management expertise.

4. **Describe a new business for which you think a "virtual organization"—which has no physical office or headquarters—could be an effective design, and some ways that the leaders of such an organization could use IT to help them effectively run their business.**

   Pure virtual organizations are not that common today, but can be increasingly found within small organizations that were recently formed. An example business would be a consulting firm where employees are typically working on-site with clients and have less need for a shared physical office. The leaders of any virtual organization must use IT to enable communication and coordination among the many professionals working individually or in virtual teams.

5. **Would you like to work as a free agent? Why or why not?**

   As free agents, workers are able to develop and utilize their expertise across different companies based on the needs of their clients. They can become part of a "virtual team" that is assembled to complete a project or program and disbanded when the program is complete. Free agents can set their own schedules, pick their own clients, and decide which projects they want to work on. The company can gather the expertise it needs for each project without committing to permanent employment. The downside for the free agent is the lack of job security and the potential absence of tangible and intangible benefits (such as health care or retirement benefits) afforded to a company employee. For the company, the downside is that they may not be able to find or attract the expertise they need when they need it, especially when there is a limited supply of qualified talent.

6. Using Internet resources, identify what is meant by the term digital divide. What actions do you think could be taken to lessen this divide—both within your own country and elsewhere in the world?

Digital divide is the perceived "gap" between people who have access to digital technology and those who do not. Sometimes this term is used to refer to computers and information technology in general, and other times it is used to refer to Internet access.

[Hint: There are many Web sites that report on groups and initiatives within the United States and internationally that are addressing this issue. For example, some initiatives have been funded by governments at different levels (state, county, city/town).

7. Identify some Web sites that could be useful supplementary resources for studying some of the IT management topics in this textbook.

Some examples of potentially useful Web sites for research on IT management topics include:

www.brint.com
www.businessweek.com/technology
www.cio.com
www.computerworld.com
www.gartner.com
www.itic.org
www.whatis.com
www.wikipedia.com

Teaching Note on Case Study 1
Midsouth Chamber of Commerce (A): The Role of the Operating Manager in Information Systems

Objectives

Midsouth Chamber of Commerce (A) is based on an actual situation with only cosmetic changes made to protect the identities of the organization and the individuals involved. This case describes the complex and often chaotic process of implementing information technology change in an organization with conflicting objectives.

The primary objective of this first case in the book is to examine the role of the business manager in the management of information technology in organizations (in this case, the implementation of a new software system).

Secondary objectives of this case include:

1. Illustrating some of the possible roles business managers may play in the implementation of information technology
2. Demonstrating some of the pitfalls that a business manager may encounter as technology is introduced
3. Illuminating the role of the technology provider—in this case the software vendor
4. Revealing the importance of information systems (IS) politics

Overview

The Midsouth Chamber of Commerce (MSCC) was a growing, aggressive, statewide chamber of commerce that had historically benefited from its strong leadership. One example of its leadership was Leon Lassiter, the vice president of marketing at the MSCC. Early in his tenure, Lassiter realized that the MSCC needed to acquire new software in order to provide the enhanced sales and marketing support he felt was necessary for his department and the MSCC to be truly successful. As a result, Lassiter became the champion for acquiring a new software system, in particular a system developed by the Unitrak Software Corporation simply called Unitrak. After Lassiter successfully convinced the Executive Committee of the Board of Directors to authorize the purchase, the real problems began for the MSCC.

While Lassiter had been the champion for the purchase of the software system, he was not in charge of computer operations nor was he able to garner cooperation from the main individual who was in charge, Jeff Hedges, the vice president of public finance. Furthermore, the systems analyst, Simon Kovecki, proved to be a weak resource for the Chamber as he was both inexperienced and upset that he was not appointed manager of computer operations when Hedges was given the role of running the MSCC's information technology organization.

With animosity developing throughout the organization, Kovecki, in particular, pulled away from the project and provided very little support in the early stages of Unitrak's installation. Even once he became more involved, the MSCC began to experience additional technical problems that neither Unitrak nor Kovecki could solve. And, while Unitrak did assist in the training, the firm provided very little help during the attempted data migration between the systems. So, by the time Lassiter stepped in to champion the project, he was forced to do so without the support of key players within the MSCC. As this case closed, the old system had been rendered essentially inoperative after Kovecki's failed attempt at migrating the data to the new system. As a result, the MSCC was left with no computer support for its operations, and the organization needed solutions quickly to prevent additional operations from stalling.

Questions for Discussion

1. **Identify the key players in the case and describe their respective roles. Are these the right roles? What roles in particular should be modified? How might such role modifications be accomplished?**

Key Players and Roles

- **Leon Lassiter—vice president of marketing of the MSCC.** Lassiter was a high-ranking business manager, with no information technology background, who recognized the need for a new software system at the MSCC and acted as its champion during the acquisition (and eventually the implementation) process. In his short tenure, Lassiter had proven to be a very strong marketing manager for the MSCC, but he was nevertheless unsuccessful in getting more appropriately positioned people involved in the implementation of the new software system. This forced Lassiter to serve as the champion of the project throughout the entire process—a role that he was unqualified to perform.
- **Jeff Hedges—vice president of public finance of the MSCC.** Hedges was the leader of the MSCC's tiny computer operations section. Given the bulk of tasks he had before him, Hedges was not significantly involved in the new system's implementation. Generally speaking, Hedges appeared to look at his computer responsibilities at the MSCC as a secondary duty—a fear that Kovecki had when Hedges was named to this position.
- **Simon Kovecki—systems analyst of the MSCC.** Kovecki—a young computer science graduate with no experience in a membership organization or with administrative software—was the only IS professional inside the MSCC. Kovecki spent his first three months at the MSCC learning not only the organization but also the computing systems—without the benefit of any systems documentation. Nevertheless, Kovecki was able to have the old system running reliably. His cursory involvement during the early stages of the new system implementation process, though, got Lassiter's project off to a slow start. His lack of involvement was due to two issues—(1) Kovecki not receiving the responsibility for leading the MSCC's computer operations, and (2) Kovecki's distaste for the features of the software package chosen. Unfortunately, once Kovecki finally did become involved in the project, he was unable to make the new system operational.
- **Ed Wilson—vice president of public affairs and operations of the MSCC.** Before his reassignment, Wilson had been in charge of computer operations and had actually introduced the MSCC to the world of microcomputers and database management. While Wilson and Lassiter did not have a strong relationship at first, eventually the relationship became amicable, and Wilson provided Lassiter with some support during the Unitrak acquisition process. Overall, however, that was the extent of Wilson's involvement in this process.

- **Jack Wallingford—president of the MSCC.** While Wallingford was the president of the MSCC, his involvement in this decision and the system implementation was negligible.
- **Executive Committee of the MSCC.** While this group made the ultimate decision to purchase the Unitrak software, they did not appear to have followed up on this purchase during the implementation process. Additionally, their decision to support the Unitrak system may have been too quick and based too much on Lassiter's input instead of the due diligence one would expect from this group.
- **Greg Ginder—president of Unitrak Software Corporation.** Ginder made considerable concessions in order to sell his company's software to the MSCC including unlimited support during the system installation. Nevertheless, when the MSCC needed Unitrak the most—during the system migration and conversion process—Unitrak's support was missing or ineffective.

Role Modification

Clearly several of the roles discussed above should have been modified. Neither Hedges nor Kovecki—the two most important IS players at the MSCC—were meeting their job responsibilities, and Lassiter proved inept at gaining their cooperation or improving their effort level. At the same time, Wallingford and the executive committee should not have remained aloof in the face of the crisis that was upon the MSCC and could have played a larger role in getting Hedges and Kovecki's attention. Furthermore, while Ginder did provide some support for the MSCC, it was not at the level or in the amount that a reputable software vendor should provide.

How to implement these role modifications is a more difficult question. Hedges or Kovecki may not have had the expertise to perform their job descriptions and may have simply needed to be replaced. Generally, however, Lassiter did a poor job of playing IS politics and may have been able to avoid this entire situation by doing so. As an example, as mentioned above, Lassiter could have gone to Wallingford to request help in garnering the support of Hedges and Kovecki. Furthermore, depending upon the software contract, Ginder's support might have been more forthcoming during the critical stages of implementation had legal action been threatened.

2. Focus on the role of the software vendor—Unitrak Software Corporation. Was it an appropriate role? Did Unitrak act responsibly?

This question was partially answered in question 1 above. Unitrak certainly did not act responsibly during this entire scenario. Whether Unitrak was legally at fault depends upon the terms of the software contract, which were not presented in the case. It is reasonable to assume, however, that such a contract would have included specific assurances for Unitrak to meet that would include an operational system—something the MSCC did not have when this case closed. One would hope that Ginder's promise to provide 'unlimited support at no charge to install the system' would have been in that list of assurances/warranties. If so, Unitrak would have opened itself up to legal action.

Furthermore, when the MSCC was at a critical phase—the data migration step—Unitrak was 'missing in action.' For a company that had a stated goal of penetrating the chamber of commerce market, this act appears to be working against its own self-interests. While neglecting any customer is a sign of concern, neglecting a key component for a company's business growth and development is that much more inexcusable.

3. How much is Kovecki to blame for this situation?

While most students tend to put much of the blame on Lassiter, Kovecki is also a key component to this problem. Clearly company politics played some role, but Kovecki failed to perform some of the basic pieces of his own job description by, as one example, failing to provide support in the early stages of this process. From a technical standpoint, too, one would never migrate data on a system without first performing a system backup—a move that Kovecki failed to make. This failure has to make one question whether Kovecki's technical skills were as strong as they may have at first appeared. When coupled with the high likelihood that the software had a serious internal problem, however, Kovecki was in a no-win situation by the time the data migration occurred. One could argue, however, that he had placed himself in that position by failing to be more involved in the process from the beginning.

Nevertheless, politics played a significant role in this scenario, as Lassiter and Kovecki needed to work closely during this process and that was not possible due to the animosity that had built up between them and between Kovecki and the organization—because he had been passed over for a position that he was clearly more qualified to perform than the person given the job. As Kovecki pulled away from his position and the MSCC, the organization's IS began to fall apart.

4. One of the recurring themes of this book is the importance of information systems politics. To what extent does IS politics explain the situation that has developed at the Midsouth Chamber of Commerce?

IS politics helps explain much of the MSCC's situation. The new system was Lassiter's idea, and he was unable to 'sell' the system to either Hedges or Kovecki, the two people who were critical to the system's ultimate success. As such, Lassiter went over these individuals' heads, and the system became Lassiter's system, not their system, or even the MSCC's system.

Furthermore, when Lassiter initially proposed the new system to the executive committee, it was pushed through, but likely as the result of respect for Lassiter rather than because of reasonable due diligence. After the project did not make progress for a few weeks, Lassiter began to ask questions. Hedges then told him to simply push the project through himself because it was 'his project.' As he did so, several staff members expressed concern that they had not been consulted or informed of the idea before its approval. And as a result, with no one having ownership of the system and no buy-in from any of the other executives in the MSCC, the animosity level rose and the excitement about the new system was drowned out by it.

5. The case involves what appears to be a fairly routine use of information technology to support a service organization. Yet the Midsouth Chamber of Commerce encountered major problems in bringing up its new system. Is there a lesson here for organizations seeking to adopt new information technology? What is it?

What appears to be a routine application of information technology to an organization with an experienced, knowledgeable IS staff may be anything but routine to an organization lacking IS skills in its business managers. Certainly there is no way that the MSCC could have successfully adopted truly new information technology with its current level of interal IS knowledge and its apparent unwillingness to find that knowledge outside the company. By placing control of the information technology with someone who had little information technology background and was managing the process 'on the side,' the MSCC had lessened the opportunity for its information technology to provide a competitive advantage for this organization.

Therefore, the lesson to be learned from this case is that organizations should honestly and carefully consider whether they have a sufficient level of expertise before attempting to adopt new technology. Furthermore, an organization must have 'buy-in' from all its executives before making such a purchase. Even if a system works perfectly from a technical perspective, it will never reach its potential if management is not advocating its use throughout the organization.

6. What should Lassiter do now?

Lassiter must immediately focus on making the conversion process work. With both the new and the old systems down, Lassiter has two choices: outsource the MSCC's IT needs to an outside vendor or create an ad hoc paper system in the interim. A paper system is likely not going to work for long. At the same time, it will take Kovecki (or his replacement if fired) time to get the system up and running without help or viable documentation. As a result, Lassiter must also look outside the company to find Kovecki some additional help—perhaps from another company that uses and/or has had some experience with the Unitrak system. And within all this is the obvious need to ensure that the system is made Y2K compliant as the turn of the century is upon the MSCC.

Finally, Lassiter needs to pull the entire management team together, explain the situation, and reintegrate them by inquiring about suggestions on how to proceed. He also needs to ask them to inform their staff of the situation and the steps being taken to correct the situation. By doing this the staff might become less disgruntled with the system's inoperativity in the short term.

Chapter 2
Computer Hardware

Objectives and Overview

Chapter 2 is the first of a quartet of chapters devoted to the primary building blocks of information technology. Chapter 2 concentrates on computer hardware—the physical pieces of a computer system—while Chapter 3 considers computer software. Chapter 4 covers telecommunications and networking, and Chapter 5 explores the data resource that is manipulated by the hardware, software, and telecommunications. These four chapters constitute the "hard-core" technology portion of this textbook. We believe that every information systems or information technology course using this textbook should incorporate these four chapters, covered in sequential order, *unless* the students already have strong technology backgrounds. The amount of time spent on these chapters will vary considerably, of course, depending upon the level and purpose of the course. Alternative approaches to using Chapter 2 are discussed in the "Teaching Suggestions" section below.

The primary objective of Chapter 2 is to provide the student with a basic understanding of computer systems. The goal of the chapter, simply stated, is to let the reader know what he or she needs to know about computer systems *and no more*. Managers need to understand the major ideas involved in computer systems, and they need to know the important terminology and concepts. Chapter 2 is aimed at satisfying this "need to know" in a straightforward, understandable way. Please note that the "Extensions to the Basic Model" section of the chapter goes beyond this basic understanding of computer systems and may be downplayed or even omitted.

Chapter 2 in the Sixth Edition has been significantly revised and updated from the Fifth Edition. The basic components of computer systems and the stored-program concept have not changed, of course, but there have been major advancements in computer systems and significant changes in the information systems industry. Major changes in the revised chapter include:

1. An emphasis has been placed on new hardware developments, including flash drives, REV drives, "killer" personal digital assistants (PDAs), dual-core and quad-core microprocessor chips, tablet PCs, and blade servers.
2. In the Fourth and Fifth Editions, the "workstations" and "midrange systems" categories of computer systems were collapsed into a single intertwined category that we called "workstations/midrange systems" to reflect the overlap in cost, power, and applications of these formerly distinct categories. Now we have renamed this category "midrange systems," as the "workstations" label has essentially disappeared. We still discuss the roots of this important category of computer systems, including both minicomputers and workstations.
3. The dividing lines between categories of computer systems have been redrawn based on recent estimates of processing power, costs, and uses.
4. A great deal of updated information about the information systems industry has been embedded in appropriate sections of the chapter, particularly in the discussion of the various categories of computer systems.

It may be useful to view this chapter as consisting of three major sections. The first major section, which includes the first half of the chapter, provides a brief review of the history of

computers and an extended discussion of the underlying structure of computer systems, including the stored-program concept. This section will be largely review for those students who have significant practical computing experience (more than just word processing and spreadsheets) or those who have had previous courses in computer programming or information technology. The second major section—which has been greatly reduced in length from the previous edition—provides "Extensions to the Basic Model" of computer systems. This section is included to provide the manager with an overview of the technical advances taking place in computer systems, and it should be new material to virtually all students. As noted above, this section may be downplayed or omitted if the instructor believes it is not appropriate for the particular course. The third major section describes the categories of computers in use today, including information about the hardware component of the information systems industry near the end of the first decade of the twenty-first century. This material will be new for most students and should provide a useful current perspective for everyone. The first and second sections of the chapter have been updated from the Fifth Edition, while the third section is essentially brand new.

When students are forewarned about the nature of this chapter, they react very favorably to it. They find the chapter quite easy to read and well organized. Those with a background in computing find the first half of the chapter an excellent and reasonably concise review and the last half (the second and third major sections) new and interesting material. Those without a background in computing experience no significant difficulty in reading the first and third major sections, but may need further explanation and reinforcement to fully comprehend the second major section. In both cases, students should be told in advance about the three major sections of the chapter. They should be told that the first major section is the most important—because it is the basis for understanding how computers work—but that it will be review for some of them; that the second major section is the most technical and the least important from a managerial perspective; and that the third major section provides a useful current view of the types of computers and the hardware component of the information systems industry.

The specific objectives of this chapter are:

1. To consider the evolution of computer systems through four generations as well as the development of minicomputers and microcomputers.
2. To outline the underlying structure of all digital computers, including input, output, memory, arithmetic/logical unit, control unit, and files.
3. To describe the binary coding schemes used in computer systems.
4. To describe the all-important stored-program concept, which is the basis for the way in which all computers are used today.
5. To introduce the terminology of programming, including program, instruction, machine language, operation code, addresses, and programmer.
6. To consider the ways in which the power of a computer system can be measured, including MIPS, MegaFLOPS, and benchmarking.
7. To describe a number of extensions to the basic model of computer systems, including cache memory, symmetric multiprocessor, parallel processor, and massively parallel processor.
8. To describe the different categories of computers, including microcomputers, midrange systems, mainframes, and supercomputers, and to identify the major hardware manufacturers in each category.

Teaching Suggestions

In one sense this is not a difficult chapter to teach, because computer hardware possesses a natural mystique that makes it interesting to most students. The primary difficulty lies in correctly assessing the level of computing knowledge of a given class and adjusting the classroom sessions accordingly. It is important to neither undershoot nor overshoot the majority of the audience. On the other hand, don't attempt to cater to the few students who have an excellent computing background, or to the few who know nothing at all about computers.

As implied earlier, the major problem is in deciding how to cover the first half of the chapter (the first major section). For most courses, we prefer to use a "mini-lecture" of no more than thirty minutes to cover this first major section, employing overhead transparencies of Figures 2.3, 2.4, 2.5, and 2.6. If your class has a particularly strong background, you may wish to omit this first major section as a classroom discussion topic. For an undergraduate class with a limited computing background (such as a single computer tools course), we suggest most of a 75-minute lecture to cover this important material.

The second and third major sections present less of a problem. The second major section requires careful explanation on the instructor's part, but this is new and fascinating material to almost everyone. Twenty minutes is about right for this discussion, using an overhead transparency of Figure 2.8, "Partial Logical Structure of Computer Incorporating Cache Memory" for the cache memory discussion and some blackboard or whiteboard work to cover multiprocessor configurations. The third major section is interesting to almost everyone, and it can be enlivened by bringing in very recent industry statistics or news clippings describing recent events in this rapidly changing industry. Thirty to forty-five minutes can usefully be spent on this third major section.

Enrichment activities for Chapter 2 could include the use of the IMT Custom Machine Company, Inc. case study (see the case teaching note in this *Instructor's Manual*) as a classroom discussion vehicle, or an alternate case study that emphasizes the use of some type of computer hardware. You may also be able to borrow one or more videotapes from a computer vendor (such as IBM, Hewlett-Packard, or Sun Microsystems) that describe the features of the vendor's newest large computer systems. Today's students tend to be quite familiar with microcomputers, but may never have seen any larger machines. Don't overdo the use of such advertising vehicles, but ten to fifteen minutes may provide an interesting and educational interlude in a long classroom session.

In summary, we suggest allotting two 75-minute classroom sessions to Chapter 2 in most courses. In a graduate or undergraduate course where most students have a strong computing background, one 75-minute session might suffice. The "one session" approach to Chapter 2 would usually omit the first major section, spend 30 to 45 minutes on the second and third major sections, and spend 30 minutes or so on IMT Custom Machine Company, Inc., an alternate case, or computer hardware videotapes. The "two session" approach would cover the first and second major sections in the first session, and the third major section and an enrichment activity in the second session. An alternate "two session" approach might cover all of the chapter material in the first session, and then devote the second session to an alternative enrichment activity—bring in an old desktop PC and take it apart in front of the students. Take off the cover, and take out (one at a time) the microprocessor chip, the hard drive, the floppy drive, a memory chip, the modem, the network interface card, and any other easily removable parts (DO NOT do anything with the power supply), and pass them around to the class. Of course, get an old PC well ahead of time

and practice taking it apart, including opening up the hard drive so that the students can see the disk.

Review Questions

1. Distinguish between microcomputers, midrange systems, mainframes, and supercomputers. Give approximate speeds (millions of floating point operations per second, or MFLOPS) and costs.

Microcomputers are personal computers that may be desktops, notebooks, or palmtops. They are used for Web clients, clients in client/server applications, and small business processing. MFLOPS range from 50 to 1,000. They cost from under $200 to $4,000.

Midrange systems are used for departmental computing and for specific applications such as office automation and computer-aided design. They are servers in client/server applications and are used for midsized business processing and by universities; they also function as Web servers, file servers, and local area network servers. MFLOPS range from 100 to 10,000. They cost from $4,000 to $1,000,000.

Mainframes can handle thousands of terminals and can operate as very large servers, including as Web servers. They are used for large business general processing and can handle the widest range of applications. The MFLOPS are from 400 to 10,000. They cost from $500,000 to $20,000,000.

Supercomputers handle numerically intensive scientific calculations; they can also operate as very large Web servers. The MFLOPS are from 10,000 to over 1,000,000,000,000. They cost $1 million to $100 million.

2. List the six building blocks that make up digital computers, and describe the flows of data that occur among these blocks.

The six building blocks are input, output, memory, arithmetic/logical unit, control unit, and files. Data flows from input to memory; from memory to the control unit; from memory to and from files and the arithmetic/logical unit; and from memory to output. Data flows are always to and from memory.

3. Distinguish between the *contents* of a memory cell and the *address* of a memory cell. Distinguish between a *byte* and a *word*. Distinguish between a *bit* and a *byte*.

The *contents* of a memory cell are the data that are stored in the cell. These data are not fixed and may change over time. The *address* is the identifying number of a memory cell. The address is fixed and will not change. A *word* is a memory cell that can store two or more characters of data. A *byte* is a memory cell that can store only one character of data. A *bit* is a binary digit. In most computers, a single character is represented by eight bits. Therefore, in most machines, eight bits equal one byte.

4. What are the advantages and disadvantages of using direct access files versus using sequential access files? Why do organizations bother to use sequential access files today?

Sequential access files are organized in order according to the control key of each file. Because there are no addresses in a sequential access file, the only way the computer can find a specific record is to start at the beginning of the file and read each record until it reaches the desired one. If retrieval time is an important consideration, sequential access files may not be practical. However, huge quantities of data can be stored very economically using sequential access files. Therefore, if retrieval time is *not* an important consideration—such as for batch processing and little-used archives—then sequential access files are an attractive choice.

When using direct access files, the computer can retrieve a specific record immediately by going directly to the file address to find the record. The advantage of using direct access files is the speed of access and retrieval. This is especially important for online systems. For applications that are batched and where response time is not critical, sequential access files may be more economical. The main challenge in using direct access files is translating the identification number for a record into an address. This translation requires highly sophisticated software.

5. Explain in your own words the importance of the stored-program concept. Include the role of the control unit in your explanation.

The stored program is important to effectively use the computer and reduce programming time. The stored program eliminates the need to reprogram a computer each time a task is executed by saving the required machine instructions. A stored program consists of a set of operating instructions that provides a precise listing of exactly what the computer is to do, prepared in a form that the control unit of the computer has been built to understand. Most importantly, the control unit carries out these instructions at *electronic speed* rather than waiting for humans to tell it what to do next. Because each computer model differs, the "language" their programs are written in will differ also.

6. Define the expressions in italics in the following sentence copied from this chapter: "In general, each *machine language* instruction consists of two parts: an *operation code* and one or more *addresses*."

The *machine language* is a language used for programming that a particular type of computer understands. There are many different machine languages (generally, one for each computer model). An *operation code* is a symbol within a machine language instruction that tells the control unit what operation is to be performed. For example, M might mean move. The *address* is the specific cell (location) in memory whose contents will be used in the operation.

7. Provide the full names for the following acronyms or abbreviations used in this chapter.

OCR: optical character recognition, an input method that directly scans typed, printed, or hand-printed material

CPU: central processing unit, which includes the control unit and the arithmetic/logical unit

MFLOPS: millions of floating point operations per second, a rating derived by running a set of programs in a specific language on various computers to analyze relative performance speed

CD-RW: compact disk-rewritable, the most versatile form of optical storage because the data stored on the disk can be altered

MIPS: millions of instructions per second, a measure of control unit speed which is of limited usefulness because of differing numbers of simultaneous bytes processed and different instruction sets of different machines

MPP: massively parallel processor, describes machines with large numbers of parallel CPUs; used for such complex tasks as simulating nuclear weapons explosions and for genetic research

DASD: direct access storage device, rotating stack of disks that enables direct access to files

SMP: symmetric multiprocessor, a multiprocessor machine in which all the processors or CPUs are identical, with each processor operating independently of the others

UPC: universal product code, a bar code language, used widely by groceries, that enables accurate, fast input by scanning the bar code into a terminal

CD-ROM: compact disk-read only memory, an optical disk with data recorded by laser beam, holds hundreds of megabytes of data

PP: parallel processor, various CPUs operate in a coordinated fashion on separate sections of a single program; many supercomputers have PPs

DVD: digital video disk or digital versatile disk, a newer type of CD that holds several gigabytes of data; some of these are rewritable

8. Four categories of computer systems were considered in this chapter: microcomputers, midrange systems, mainframes, and supercomputers. Provide the name of at least one prominent vendor in each of these categories (and you can use IBM only once!).

Microcomputers:	Apple, Dell, Gateway, Hewlett-Packard, Lenovo, Toshiba
Midrange systems:	Fujitsu, Hewlett-Packard, IBM, NCR, NEC, Silicon Graphics, Sun Microsystems
Mainframes:	Fujitsu, IBM, Unisys
Supercomputers:	Cray Inc., Fujitsu, Hewlett-Packard, Hitachi, IBM, NEC, Silicon Graphics, Sun Microsystems

9. Describe what is meant by *benchmarking*. When and how would you carry out benchmarking?

Benchmarking is used to evaluate how various computers will be able to handle the workload of a particular organization. A representative sample of the organization's regular computing jobs is run on the new systems that are being considered. Benchmarking can provide comparison information for selecting or configuring computer systems. However, it may be difficult to get existing jobs to run on target machines due to incompatible formats and difficult to compare the final results between various computers.

10. What is cache memory? Where would it be used, and why?

Cache memory is a high-speed, high-cost type of storage that is used as an intermediary between the control unit and the main memory or between a direct access storage device (DASD) and the data channel (a specialized input/output processor that takes over the function of device

communication from the CPU). Cache memory is used to compensate for the speed mismatches that are inherent in different computer system components. For example, data retrieval is much slower than data processing. With cache memory, data can be retrieved from the main memory and held in the cache memory until the computer is ready to process it.

11. Distinguish between a symmetric multiprocessor computer and a parallel processor computer. Which is the most important at this time for business information processing, and why?

A symmetric multiprocessor computer houses two or more identical CPUs as part of the same system, with each one operating independently of the others (i.e., processes separate programs) and working in its allotted portion of memory. A parallel processor computer has several processors which all work on a separate piece of the *same* program. The program must be divided up among the processors and the activities of the processors must be coordinated. Currently, the most important computer for business information processing is a symmetric multiprocessor. Each CPU can be devoted to a specific processing need such as online transactions, engineering calculations, and marketing/economic forecasts.

12. What is a blade server, and why have blade servers become important in the last few years?

A blade server (also referred to as a blade) is a very narrow, compact server that can be placed into a blade server chassis along with several other blade servers. For example, one variation of a blade server is 1.2 inches wide and about 15 inches tall; 14 of these blade servers can be mounted in a single chassis—they slide in much like sliding a book into a bookshelf. The chassis supplies the power supply for the blades, the management system, and the network switch; each blade server has its own processor, memory, and hard drive.

Blade servers are important because they save space in the computing center, they reduce the required cabling, and they improve system management. Blade servers save space, time, and money.

Discussion Questions

1. From the discussion in this chapter and your own knowledge from other sources, what do you think is the most important advancement in computer hardware technology in the past 5 years? Why?

One possible answer to this question follows: The most important advancement in computer hardware technology is the continued development of the microprocessor chip, including the recent development of dual-core and quad-core microprocessors. Advancements in this area have led to more affordable, faster, and more powerful microcomputers. These factors have helped make computers more commonplace, and able to perform a wider variety of functions in the office, at home, and in educational settings. Microprocessors, used in combination, are also the building blocks for supercomputers. And microprocessor technology has impacted products and services ranging from automobiles to airplanes to cellular telephones to home appliances.

2. Carry out library or Internet research on the latest microprocessor chips available from Intel and AMD, collecting data similar to that contained in the box entitled

"Microprocessor chips get faster and faster."

The answer to this question will obviously change over time, but be sure to check out the number of transistors on the newest and fastest Intel and AMD chips and the associated clock speeds. Also see how many processors have been manufactured as part of each of these chips—2, 4, 8, or more?

3. Some writers have suggested that mainframe computer systems could be squeezed out of existence in the next few years, with the incredible advances in the capabilities of midrange systems and the power of supercomputers combining to divide up the present mainframe market. What do you think? Why?

Perhaps the most important thing to say is that the boundaries between midrange systems and mainframes, between mainframes and supercomputers, and even between midrange systems and supercomputers, are becoming more and more blurred. All three categories of machines are evolving. The most likely scenario is that, through evolution, mainframes will continue to be important because of their versatility, reliability, stability, throughput capabilities, and incredible array of already-developed software applications. Mainframes will change and evolve, but they are not going to go away.

4. What are the advantages and limitations of palmtop or handheld computers? Do you have one? If so, for what do you use it? If not, what features would be particularly attractive to you?

Advantages include increased mobility and reduced cost—convenience at a reasonable cost. Limitations include the difficulty of inputting much data and displaying significant output, as well as the lack of standards until now, although the RIM, Palm, and Microsoft Windows Mobile operating systems have become de facto standards. The recent development of smartphones has added to the attractiveness of palmtop/handheld computers—they now combine computer capabilities with a telephone, Internet access (and therefore e-mail), a camera, and an MP3 player. Of course, these additional features have increased the cost.

5. What are the advantages and limitations of a tablet PC? Do you believe tablet PCs will be successful? Why or why not? Do you see yourself using a tablet PC in a few years?

The major advantage of a tablet PC is that handwritten notes are directly stored in the computer's memory in digital form such that they can be recalled and modified as desired. Otherwise, a tablet PC acts as any other PC. The limitations are that a tablet PC is somewhat heavier and more awkward to use than a notepad and pen or pencil, and that writing on the tablet PC surface takes some getting used to on the part of the user. A tablet PC is an unfamiliar medium for note-taking, but one that makes it easier to store and further process these notes.

One opinion that could be offered is that tablet PCs will be successful, but only in a niche market made up of persons who take lots of notes and who are technologically inclined. Not everyone will use a tablet PC, and tablet PCs will not force out desktop, laptop, or handheld PCs. Each student will have to answer for himself or herself whether the student is likely to be using a tablet PC in a few years.

6. As this chapter has indicated, IBM has been a dominant force in the computer industry since the late 1950s. Why do you think this is the case? More specifically, why were so many large U.S. corporations seemingly committed to "Big Blue" (as IBM is affectionately known), at least until the early 1990s?

IBM first gained a position of prominence in the computer industry when it introduced the IBM 650 machine. From this point on, other computer companies had to play catch up. IBM gained what may be considered a first mover advantage in the areas of customer service, customer loyalty, and research and development. Part of the first mover advantage was that IBM set the industry standards for computing that its competitors had to meet. Another factor that the competition had to meet was to build an excellent sales force. IBM set the standard for excellent salesmanship and marketing. IBM capitalized on those first vendor-customer relationships to form a leadership position in the marketplace. At least until the early 1990s, companies may have received bids that appeared to be more attractive than the IBM bid but there may have been uncertainties of service with another company that did not exist with IBM. IBM built a nearly flawless reputation. Although IBM might have been more expensive, the assurance of good service was worth the cost to many customers.

7. Building on your answer to question 6, why did IBM suffer serious reverses in the early 1990s? Why did IBM bounce back in the latter half of the 1990s? Do you think that IBM will retain its dominant position as we move further into the twenty-first century? Why?

The problem was that, from IBM's perspective for IBM's products and services, "one size fits all." Customer desire for customized solutions caused IBM serious reverses in the early 1990s. For example, other large-machine manufacturers developed more attractive alternatives to IBM machines, and IBM fell behind in the PC marketplace. IBM bounced back by opening up to the concept of integrating products with other vendors, including the ability to use non-IBM operating systems in conjunction with an IBM operating system. IBM also moved strongly into the computer services (consulting) arena in the mid- to late-1990s. IBM is likely to remain a major player in the twenty-first century if it can continue to position itself as a partner with other vendors, with the vision of open global standards and interoperability, and if it continues to focus on computer services. It will likely never move back into the dominant position it held until the late 1980s.

8. With one firm (IBM) dominating the mainframe hardware market in the United States since its inception, and with that same firm currently near the top in every segment of the hardware industry (except microcomputers), has the computer hardware industry truly been competitive over the past five decades? Support your position.

The computer market has been competitive although perhaps not to the extent it would have been if IBM controlled a smaller share of the market. IBM's size has allowed it to devote significant resources to R&D. However, IBM's market power has also allowed it to determine *when* a new development will be released for distribution. IBM has been able to further control the market by buying the development efforts of smaller firms. However, IBM has been careful not to force competitors out of business. Even though IBM is the dominant player in the mainframe market, there are other long-term players and other markets in the industry. Areas that IBM does not dominate include software and microcomputers. It should also be noted that IBM's market share and profits declined in the late 1980s and the 1990s. The market has probably not suffered much because of IBM's control. However, it is certain that competition in the marketplace would have been different if IBM had not held such a dominant position. Certainly, the computer industry

has become much more competitive in the past decade or so. Microcomputers have become almost a commodity product, while software applications and computer services are the real revenue and profit generators today.

9. List possible uses of a supercomputer in a business setting.

Industries using supercomputers include aerospace, automotive, chemical and pharmaceutical, general manufacturing, petroleum, and energy, in addition to the government. Supercomputers are used extensively in research and development in order to cut costs and time. Simulations of design and fabrication help analyze value-added activities. Complex simulations that would take weeks on smaller computers take hours on supercomputers. Three-dimensional analysis over time represents such complex modeling that a supercomputer is needed. Supercomputers are sometimes used as very large Web servers.

10. MIPS and MFLOPS were mentioned in this chapter as measures of the power of computer systems. If you were in charge of buying a new large computer system (and you might be someday), what measures of power would you want to find out? How would you go about determining these measures of power?

The number of transactions per second provides the most practical measure of power. Purchasers of large computer systems must not accept at face value the vendor's performance standards but must run simulations with actual applications to test transactions per second. Usually the tests are run at the vendor's site, with the organization's sample database as a basis for the trial run.

11. For most business information processing, what do you believe are the critical or limiting characteristics of today's computing systems—CPU speed, memory capacity, DASD capacity, internal communication speed, input-output speed, other factors, or some combination of these factors? Justify your answer.

Different factors or combinations of factors limit different types of application systems. For example, expert systems and artificial intelligence are limited by CPU speed. Many online database intensive applications (like ATMs or reservation systems) are limited by the speed of transferring data to/from secondary storage (internal communication speed). For users of microcomputers, limiting factors may be memory, disk capacity, or output speed, or rarely CPU speed.

12. For Web serving, what do you believe are the critical or limiting characteristics of today's computing systems? CPU speed, memory capacity, DASD capacity, internal communication speed, input-output speed, other factors, or some combination of these factors? Justify your answer.

In most cases, the answer is some combination of the factors listed above. However, Web serving is quite similar to database serving, with massive amounts of data (Web pages) being moved from DASD storage to main memory, so a significant limiting factor is often the speed of transferring data to/from secondary storage (internal communication speed). Memory capacity, DASD capacity, and CPU speed can also play a major role in timely Web serving.