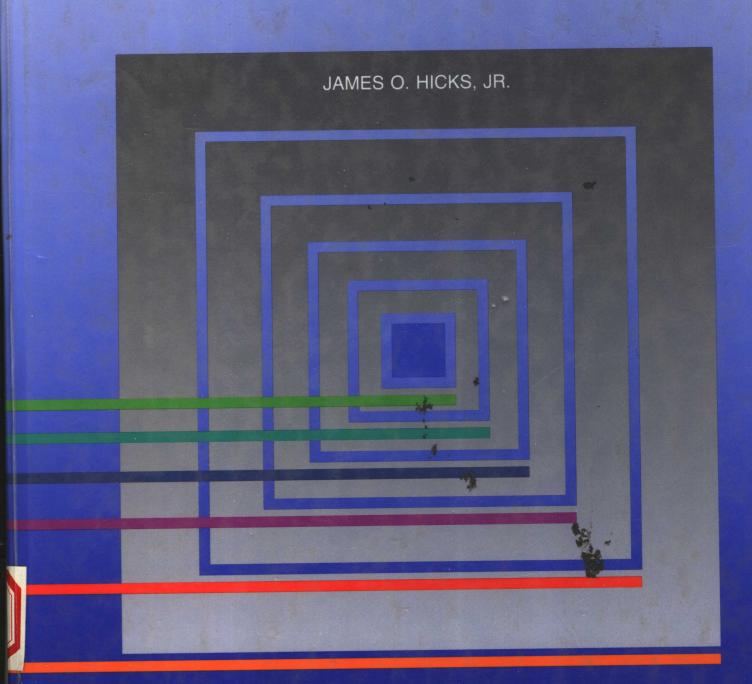
Information Systems in Business: An Introduction

SECOND EDITION



INFORMATION SYSTEMS IN BUSINESS: AN INTRODUCTION

Second Edition

James O. Hicks, Jr.

Virginia Polytechnic Institute and State University

West Publishing Company

Copyediting: Deborah Annan
Illustrations: John and Jean Foster
Composition: Carlisle Communications
Cover Design: Diane Beasley Design

COPYRIGHT ©1986 By WEST PUBLISHING COMPANY COPYRIGHT ©1990 By WEST PUBLISHING COMPANY

50 W. Kellogg Boulevard P.O. Box 64526 St. Paul, MN 55164-1003

All rights reserved

Printed in the United States of America 97 96 95 94 93 92 91 8 7 6 5 4 3 2 Library of Congress Cataloging-in-Publication Data

Hicks, James O.

Information systems in business : an introduction / James O. Hicks, Ir. — 2nd ed.

p. cm

1. Management information systems. I. Title.

T58.6.H488 1990 658.4'038—dc20

89-28670 CIP

ISBN 0-314-66772-5

ISBN 0-314-03391-2 (with Information Systems in Business: Software Applications Manual, by James O. Hicks, Jr.)

ISBN 0-314-03192-8 (with Information Systems in Business: Software Applications Manual, by James O. Hicks, Jr. and educational software (three 3½" disks)) ISBN 0-314-03193-6 (with Information Systems in Business: Software Applications Manual, by James O. Hicks, Jr. and educational software (four 5¼" disks))

Photo/Figure Credits

Part One Opening Photo (pp. ix, 1) Chris Jones, The Stock Market. Chapter 1 Opening Photo (p. 3) M. Gottlieb, FPG International. Fig. 1-14 (p. 18) Copyright Lotus Development Corporation 1985. Used with Permission. Chapter 2 Opening Photo (p. 31) Antonio Rosario, The Image Bank. Figs. 2-2 (p. 35), 2-3 (p. 36), 2-7 (p. 39), 2-9 (p. 40) From "Personal Computers," by H. D. Toong and A. Gupta. Copyright 1982 by Scientific American, Inc. All rights reserved. Fig. 2-4 (p. 37) Courtesy of National Semiconductor Company. Figs. 2-6 (p. 38), 2-8 (p. 40) Courtesy of International Business Machines Corporation. Fig. 2-10 (p. 41) Illustration by Yukio Kondo, reprinted from "Meet the Mouse", by Phil Lopiccola, published in the March 1983 issue of "Popular Computing" magazine, Copyright 1983 by McGraw-Hill, Inc., NY 10020. All rights reserved. Fig. 2-11 (p. 42) Photo Courtesy of Hewlett-Packard Company. Fig. 2-13 (p. 43) Courtesy of Hayes Microcomputer Products, Inc. Fig. 2-16 (p. 48) Courtesy of "InfoWorld" February 11, 1985, p. 28. Fig. 2-17 (p. 49) Courtesy Polaroid Corporation. Fig. 2-18 (p. 50) Screen shot copyright 1983-1989 Microsoft Corporation, Reprinted with permission from Microsoft Corporation. Fig. 2-22 (p. 56) Reprinted with permission of Dunsplus, Inc. Fig. 2-23 (p. 60) Reprinted with permission of Price Waterhouse from "MICROCOMPUTERS: Their Use and Misuse in Your Business". Copyright 1983. Price Waterhouse. All rights reserved. Part Two Opening Photo (pp. x, 75) Ralph Mercer, Tony Stone Worldwide. Chapter 3 Opening Photo (p. 77) Steve Niedorf, The Image Bank. Chapter 4 Opening Photo (p. 97) Ken Biggs, The Stock Market. Chapter 5 Opening Photo (p. 113) E. Lettau, FPG International. Fig 5-7

INFORMATION SYSTEMS IN BUSINESS: AN INTRODUCTION

Second Edition

To My Wife Eva and My Son Kevin

Contents in Brief

PART	ONE		Information	Systems	Fundamentals	1
TIXET	OLIL	==	IIIIOIIIIIIIIII	O y o t c i i i		_

An Introduction to Computers 3 Chapter 1

Chapter 2 Personal Computers 31

PART TWO How Managers Use Computers 75

Chapter 3 Management Information Systems 77

Decision-Support Systems 97 Chapter 4

An Overview of Information System Chapter 5

Applications 113

PART THREE Developing User Applications 137

Chapter 6 System Analysis 139

Chapter 7 System Design and Implementation 165

Chapter 8 Application Development by End Users 187

PART FOUR Computer Resources 209

The Central Processing Unit and Storage Chapter 9

Devices 211

Chapter 10 Data Entry and Information Response 237

Chapter 11 System Software 259

Chapter 12 Data Storage and Processing

Chapter 13 Data-Base Management Systems 319

Chapter 14 Distributed Data Processing and Office

Automation 345

PART FIVE Information Systems, Management, Society, and You 385

Chapter 15 Managing the Information-System Resource 387

Chapter 16	Information Systems and Society	403
Chapter 17	Information Systems and You 415	;

Module A History of the Computer Industry 432
Module B Programming Languages 459
Module C Computer System Evaluation and Acquisition 496

Contents

Preface xxi

CHAPTER 1 An Introduction to Computers 3

Introduction 4
Why Study Information Systems? 4

What is a Computer? 4

Definition 4 Characteristics and Capabilities 5 Stored
Programs 6

Overview of a Computer System 7

Input Devices 8 Central Processing Unit 8 Secondary Storage 9 Output Devices 9

How Does a Computer Store Data? 9

The Data Hierarchy 9 Finding Data in a File 12

How Does a Computer Process Data? 12

Batch Processing 12 Immediate Processing 13

How to Put the Computer to Work for You 15

Putting the Computer to Work Without Programming 16

Putting the Computer to Work by Writing Programs 22

A Preview of the Remainder of the Text 24

Summing Up 26

Key Terms 27

Review Questions 28

Discussion Questions and Cases 29

CHAPTER 2 Personal Computers 31

Introduction 32

The Hardware of a Personal Computer 33

Types of Personal Computers 33 The System Unit 33 Input/Output Devices 36 Data Communications 42 The Hardware Industry 42

■ PART ONE Information Systems Fundamentals



The Software of a Personal Computer 46

General Business Software 46 Special-Interest Software 50 Interacting with Software 50

Buying Personal-Computer Hardware and Software 53

Getting Help in Buying a PC System 53 Where to Buy PC Systems 55

Personal Computers in the Home 58

Personal-Computer Challenges 58

Software Piracy 58 Illegal Access 59 Managing Personal Computers 59

Future Directions of Personal Computers 60

Summing Up 61

Key Terms 62

Review Questions 63

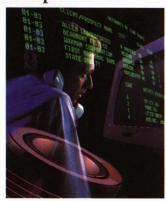
Discussion Questions and Cases 63

Appendix: Introduction to the Macintosh Personal

Computer 65

PART ONE APPLICATION CASE Users Steering Toward Self-Service 72

PART TWO How Managers Use Computers 75



CHAPTER 3 Management Information Systems 77

Introduction 78

What Is a MIS? 78

What Are the Parts of a Management Information System? 79

Objectives, Decisions, and Information 80

Levels of Decision Making 81

Management Uses of Information 84

Using Information Systems for Competitive Advantage 85

Qualitative Characteristics of Information 85

Relevance 86 Timeliness 86 Accuracy 86 Verifiability 86

Data or Information Processing? 87

Types of Reports 87

Scheduled Reports 87 Demand Reports 88 Exception Reports 88 Predictive Reports 88

The MIS and Business Functions 88

The MIS and Data-Base Management Systems 89

Decision-Support Systems and the MIS 90

The Impact of Management Information Systems on Business 92

Easier Business Growth 92 Fewer Clerical Workers 92 Reduced Information-Processing Costs 93 Automation of Some Decisions 93 More and Better Information 93

Summing Up 93

Key Terms 95

Review Questions 95

Discussion Questions and Cases 96

CHAPTER 4 Decision-Support Systems 97

Introduction 98

What is a Decision-Support System? 98

Definition 98 DSS Software 99

Functions of a Decision-Support System 100

Model Building 100 Procedural and/or Nonprocedural
Language 100 What-If Analysis 100 Goal Seeking 101
Risk Analysis 101 Statistical Analysis and ManagementScience Models 101 Financial Functions 101
Graphics 101 Hardware Capabilities 101 Data Bases
and External Files 102

Why Do Managers Need Decision Support Systems? 102

Organization Environment for a Successful DSS 102

Building a Decision-Support System 103

Predesign 103 Design 105 Implementation 105 Evaluation 105

Expert Systems 106

What Is an Expert System? 106 Advantages of Expert Systems 106 Picking the Right Problem for an Expert System 107 Components of an Expert System 107 Developing an Expert System 109

Summing Up 109

Key Terms 110

Review Questions 111

Discussion Questions and Cases 111

CHAPTER 5 An Overview of Information System Applications 113

Introduction 114
The Business Cycle 114
Inventories 116
Computer-Integrated Manufacturing 118
Order Processing 122

Accounts Receivable 123
Accounts Payable 127
Payroll 128
Other Applications 130
Summing Up 131
Key Terms 132
Review Questions 132
Discussion Questions and Cases 133

PART TWO APPLICATION CASE
Executive Info System: Easy, Easier, Easiest 134

■ PART THREE Developing User Applications 137



CHAPTER 6 System Analysis 139

Introduction 140
Partitioning of Systems 140
Structured System-Development Life Cycle 141
Angelo's Pizza 142
Feasibility Study 143
Structured System Analysis 144

Study the Current System—Process 2.1 146 Model the New-System Requirements—Process 2.2 146 Generate Alternative Systems—Process 2.3 155 Quantify Each Alternative—Process 2.4 156 Select an Alternative System—Process 2.5 157 Package the Requirements—Process 2.6 157

Advantages of Structured System Development 157
Computer-Aided Software Engineering 158
System Analysis and Application Development
Without Programming 159
Summing Up 160
Key Terms 161
Review Questions 161
Discussion Questions and Cases 162

CHAPTER 7 System Design and Implementation 165

Introduction 166

Design the System 166

Derive Structure Chart—Process 3.1 167 Design Modules—
Process 3.2 173 Package the Design—Process 3.3 173

Build the System 176

Structured Walkthroughs 176 Top-Down Coding 177 Top-Down Testing 177 Procedure Development 179 Chief-Programmer Teams 179

Conversion 180

Post-Implementation Audit and Maintenance 181

Summing Up 181

Key Terms 182

Review Questions 182

Discussion Questions and Cases 183

CHAPTER 8 Application Development by End Users 187

Introduction 188

Problems with Conventional Application Development 188

Increasing Labor Cost 188 Long Time Span Required 189 Slow Implementation of Changes 190 Work Overload 190 Prespecified versus User-Driven Computing 191

Methods for User Development of Application Software 192

Personal-Computer Tools 192 Query Languages and Report Generators 192 Graphics Generators 192 Decision-Support/Financial-Modeling Tools 193 Application Generators 193

Blending User Development with Conventional Development 195

Types of Application Development 195 Data-Base Administration 198 End-User Development and Computer-Aided Software Engineering (CASE) 199 Some Cautions about Application Development by End Users 199

Information Centers 200

Changing Roles of System Analysts and

Programmers 201

Summing Up 203

Key Terms 204

Review Questions 204

Discussion Questions and Cases 204

PART THREE APPLICATION CASE

Corporate Programmers Lead the Way with CASE 206

■ PART FOUR Computer Resources 209



CHAPTER 9 The Central Processing Unit and Storage Devices 211

Introduction 212

The Central Processing Unit 213

Primary Storage 213 Arithmetic-Logic Unit 218 Control Unit 218

Micros, Minis, Mainframes, and Supercomputers 218

Microcomputers 218 Minicomputers 219 Mainframe Computers 220 Supercomputers 221

Parallel Processing 222

Secondary Storage 222

Primary versus Secondary Storage 222 Magnetic Tape 223 Hard Disks 225 Floppy Disks 226 Laser-Optical Disks 231 Other Forms of Secondary Storage 232 Cache Memory 232

Summing Up 233

Key Terms 234

Review Questions 235

Discussion Questions and Cases 235

CHAPTER 10 Data Entry and Information Response 237

Introduction 238

Data Entry 238

Offline versus Online Data Entry 238 Key-to-Diskette Data Entry 238 Key-to-Disk Data Entry 239 Interactive Data Entry 241 Source-Data Automation 242

Information Response 249

Visual Display Terminals 249 Printers 250 Computer-Output Microfiche 253 Laser-Optical Disks 253 Graphics 254 Other Output Media 254

Summing Up 255

Key Terms 255

Review Questions 256

Discussion Questions and Cases 256

CHAPTER 11 System Software 259

Introduction 260

System Software versus Application Software 260
System Software 260 Application Software 262

Types of System Software 262

System Control Software 262 System Support Software 266 System Development Software 266

Types of Operating Systems 268

Batch Systems 268 Interactive Systems 268

Multitasking 269

Advantages of Multitasking 269 Disadvantages of Multitasking 271

Virtual Storage 271

Advantages of Virtual Storage 272 Disadvantages of Virtual Storage 273

Timesharing 274

Multiprocessing 274

Summing Up 275

Key Terms 276

Review Questions 277

Discussion Questions and Cases 277

Appendix: OS/2 versus DOS 280

CHAPTER 12 Data Storage and Processing 287

Introduction 288

Data Representation 288

True Binary Representation 288 EBCDIC
Representation 290 ASCII Representation 290
Hexadecimal Representation 292 Parity Bits 292

Record-Access Methods 293

Primary and Secondary Keys 293 Sequential Access 294 Random Access 295

File Organization 295

Terminology Used with Files 295 Sequential File Organization 296 Direct File Organization 299 Indexed File Organization 302 Selecting a File Organization 304

Information-Processing Modes 306

Batch Processing 307 Immediate Processing 308 Batch-Sequential 308 Batch-Direct 308 Immediate-Direct 309

Online Direct-Access Systems 310

Real-Time Systems 312

Summing Up 314

Key Terms 315

Review Questions 315

Discussion Questions and Cases 316

CHAPTER 13 Data-Base Management Systems 319

Introduction 320

The Traditional Approach to Information Processing 320

Data Redundancy 320 Lack of Data Integration 320 Program/Data Dependence 321 Lack of Flexibility 322

The Data-Base Approach to Information Processing 323

Logical versus Physical Views of Data Storage 324 The Users 325 The Data-Base Management System 326 The Data-Base Administrator 329 The Data Base 329

Logical Data-Base Structures 331

Tree Structures 332 Network Structures 332 Relational Structures 334

Advantages and Disadvantages of the Data-Base Approach 339

Advantages 339 Disadvantages 339

Summing Up 340

Key Terms 341

Review Questions 341

Discussion Questions and Cases 342

CHAPTER 14 Distributed Data Processing and Office Automation 345

Introduction 346

Data Communication 346

Types of Data Communication 346 The Data Transmission Process 350 Communication Hardware 353 Network Systems 356

Distributed Data Processing 359

The Need for Decentralized Processing 359 Hardware
Distribution 360 Software Distribution 362 Data
Decentralization 364

Office Automation 368

Desktop Publishing 370 Word Processing 369 Computer and Voice Mail 372 Electronic Mail 371 Electronic Calendaring Video Conferencing 373 Image Storage and Facsimile Transmission 373 Integrated Forms Processing 374 Retrieval 373 Word Processing/Data Processing 374 Office Human Decentralization and Productivity 376 Factors 376

Summing Up 378

Key Terms 379
Review Questions 380
Discussion Questions and Cases 380

PART FOUR APPLICATION CASE
Fast-Food Distributor Counts on LANs for Swift
Service 382

CHAPTER 15 Managing the Information-System Resource 387

Introduction 388

Structure of a MIS Function 388

The Organizational Location of MIS 388 The Internal Structure of MIS 390

Managing System Development 391

Managing System Operations 394

System Maintenance 394 Data-Processing Operations 395 Physical Security 397

Summing Up 400

Key Terms 400

Review Questions 401

Discussion Questions and Cases 401

CHAPTER 16 Information Systems and Society 403

Introduction 404

The Potential Impact of Computer Information Systems 404

The Information Revolution 404 Working at Home 405 Control Problems 405

Displacement of Human Beings 406

Automation 406 Artificial Intelligence 406

Computers and Individual Privacy 408

Potential Problems 408 Privacy Legislation 409

Personal Computers 410

International Data Transfers 410

Computer Crime Cases 411

Equity Funding 411 Pacific Bell 412 Wells Fargo 412

Summing Up 412

Key Terms 413

Review Questions 413

Discussion Questions and Cases 413

PART FIVE

Information Systems, Management, Society, and You 385



CHAPTER 17 Information Systems and You 415

Introduction 416

The Effect of Computers on Professional Careers 416

Information-System Careers 417

Programmer 417 System Analyst 418 EDP Auditor 419 Data-Processing Operations 420 Data-Base Administrator 420 Knowledge Engineer 420 Information-System Consultant 421 Information-System Manager 421

Professional Associations 422

AFIPS 422 DPMA 422 ACM 422 ASM 423 SIM 423 EDP Auditors Foundation 423

Professional Certification Programs 423

THE CDP and CCP 424 CISA 424

Information-System Education 424

Summing Up 426

Key Terms 427

Review Questions 427

Discussion Questions and Cases 428

PART FIVE APPLICATION CASE Microcomputer Managers Need Well-Rounded Backgrounds 430

MODULE A History of the Computer Industry 432

Introduction 432

Early Developments in Data Processing 433

The Abacus 433 Mechanical Calculators 433 Jacquard's Loom 434 Babbage's Engines and Ada, Countess of Lovelace 434

Punched-Card Equipment 436

Metcalfe's Cards 436 Hollerith's Punched Cards 437
Powers's Punched Cards 437 Mark I Electromechanical
Computer 438

The First Electronic Computers 439

The ENIAC 439 The Binary Number System 441 The EDVAC and EDSAC 441

First-Generation Computers: 1951–1958 441

UNIVAC-I 441 First-Generation Software 442

Second-Generation Computers: 1959–1964 443

Hardware Advances 443 Software Advances 444

Third-Generation Computers: 1965-1971 445

Hardware Advances 445 Software Advances 445