

Managing Engineering and Technology

Sixth Edition

Lucy C. Morse

Associate Professor — Emerita

University of Central Florida

Daniel L. Babcock

Professor — Emeritus

Missouri University of Science and Technology

International Edition contributions by

Madhav Murthy,

Assistant Professor

B.M.S. College of Engineering, Bangalore

PEARSON

Boston Columbus Indianapolis New York San Francisco Upper Saddle River
Amsterdam Cape Town Dubai London Madrid Milan Munich Paris Montreal Toronto
Delhi Mexico City Sao Paulo Sydney Hong Kong Seoul Singapore Taipei Tokyo

Contents

Preface	15
Acknowledgments	17
Part I Introduction to Engineering Management	19
Chapter 1 Engineering and Management	21
Preview	21
Learning Objectives	21
Engineering	22
Management	27
Engineering Management: A Synthesis	33
Discussion Questions	38
Sources	38
Statistical Sourcebook	39
Chapter 2 Historical Development of Engineering Management	40
Preview	40
Learning Objectives	40
Origins	41
The Industrial Revolution	43
Management Philosophies	47
Scientific Management	48
Administrative Management	54
Behavioral Management	57
Contemporary Contributions	59
Discussion Questions	62
Sources	63

Part II	Functions of Technology Management	* 65
Chapter 3	Leading Technical People	67
	Preview	67
	Learning Objectives	68
	Leadership	68
	Motivation	82
	Motivating and Leading Technical Professionals	92
	Discussion Questions	99
	Sources	100
	Statistical Sourcebook	102
Chapter 4	Planning and Forecasting	103
	Preview	103
	Learning Objectives	104
	Nature of Planning	104
	The Foundation for Planning	106
	Some Planning Concepts	112
	Forecasting	114
	Strategies for Managing Technology	121
	Discussion Questions	124
	Problems	125
	Sources	125
	Statistical Sourcebook	126
Chapter 5	Decision Making	127
	Preview	127
	Learning Objectives	128
	Nature of Decision Making	128
	Management Science	130
	Tools for Decision Making	133
	Computer-Based Information Systems	146
	Implementation	148
	Discussion Questions	148
	Problems	148
	Sources	150

Contents	*	9
Chapter 6 Organizing	*	151
Preview	151	
Learning Objectives	152	
Nature of Organizing	152	
Traditional Organization Theory	154	
Technology and Modern Organization Structures	161	
Teams	163	
Discussion Questions	167	
Sources	168	
Chapter 7 Some Human Aspects of Organizing		169
Preview	169	
Learning Objectives	170	
Staffing Technical Organizations	170	
Authority and Power	182	
Delegation	184	
Committees	187	
Teams	188	
Discussion Questions	188	
Sources	189	
Statistical Sourcebook	189	
Chapter 8 Controlling		190
Preview	190	
Learning Objectives	191	
The Process of Control	191	
Financial Controls	194	
Human Resource Controls	202	
Discussion Questions	205	
Problems	206	
Sources	207	
Part III Managing Technology		209
Chapter 9 Managing Research and Development		211
Preview	211	
Learning Objectives	212	

Product and Technology Life Cycles	212	*
Nature of Research and Development	214	
Research Strategy and Organization	216	
Selecting R&D Projects	218	
Making R&D Organizations Successful	221	
Creativity, Innovation, Entrepreneurship	231	
Discussion Questions	236	
Problems	237	
Sources	237	
Statistical Sourcebook	238	

Chapter 10 Managing Engineering Design 239

Preview	239
Learning Objectives	240
Nature of Engineering Design	240
Systems Engineering/New Product Development	241
Concurrent Engineering	244
Control Systems in Design	245
Design Criteria	250
Other Criteria in Design	259
Discussion Questions	265
Problems	265
Sources	266

Chapter 11 Planning Production Activity 267

Preview	267
Learning Objectives	268
Introduction	268
Planning Manufacturing Facilities	272
Quantitative Tools in Production Planning	277
Production Planning and Control	283
Manufacturing Systems	290
Discussion Questions	293
Problems	294
Sources	294
Statistical Sourcebooks	295

Contents		11
Chapter 12	Managing Production Operations	296
	Preview	296
	Learning Objectives	297
	Assuring Product Quality	297
	Total Quality Management	304
	Productivity	309
	Maintenance and Facilities (Plant) Engineering	312
	Other Manufacturing Functions	316
	Discussion Questions	318
	Problems	318
	Sources	319
	Statistical Sourcebooks	320
Chapter 13	Engineers in Marketing and Service Activities	321
	Preview	321
	Learning Objectives	322
	Marketing and the Engineer	322
	Engineers in Service Organizations	331
	Discussion Questions	339
	Sources	340
	Statistical Sourcebooks	340
Part IV	Managing Projects	341
Chapter 14	Project Planning and Acquisition	343
	Preview	343
	Learning Objectives	344
	Characteristics of a Project	344
	The Project Proposal Process	345
	Project Planning Tools	348
	Monitoring and Controlling	360
	Discussion Questions	365
	Problems	365
	Sources	367

Chapter 15	Project Organization, Leadership, and Control	368
	Preview	368
	Learning Objectives	369
	Project Organization	369
	The Project Manager	377
	Motivating Project Performance	379
	Types of Contracts	385
	Discussion Questions	387
	Sources	387
Part V	Managing Your Engineering Career	389
Chapter 16	Engineering Ethics	391
	Preview	391
	Learning Objectives	391
	Professional Ethics and Conduct	392
	Discussion Questions	413
	Sources	414
	Case Study Websites	415
Chapter 17	Achieving Effectiveness as an Engineer	416
	Preview	416
	Learning Objectives	417
	Getting off to the Right Start	417
	Charting Your Career	421
	Communicating Your Ideas	424
	Staying Technically Competent	429
	Professional Activity	432
	Diversity in Engineering and Management	436
	Management and the Engineer	439
	Managing Your Time	448
	Discussion Questions	451
	Sources	453
	Global Website	456

Contents	13
Chapter 18 Globalization and Challenges for the Future *	457
Preview	457
Learning Objectives	458
Globalization	458
BRICS	464
Engineering Grand Challenges	468
Future Considerations in Engineering and Management	470
Discussion Questions	473
Sources	473
Global Websites	474
Index	475