

R. Srinivasan

Strategic Business Decisions

A Quantitative Approach

Contents

Part I Operations Research (OR)

1	Introduction	3
1.1	Evolution of OR: Traced	3
1.2	OR: Defined	4
1.3	Models	4
1.4	Solving the OR Model: Explained	5
1.5	Queuing and Simulation Models	6
1.6	Phases of OR Study	6
1.7	Review Questions	7
2	Introduction to Linear Programming	9
2.1	Introduction	9
2.2	Two-Variable LP Model	9
2.2.1	Example: RM Company	10
2.3	Graphical Solution to an LP Model	17
2.3.1	Graphical Solution of a Maximization Model	17
2.3.2	Solution for a Minimization Problem	19
2.4	Review Questions	20
3	The Simplex Method	23
3.1	Introduction	23
3.2	Simplex Method	23
3.2.1	Computational Procedure of Simplex Method	25
3.3	Big M Method	39
3.3.1	Unrestricted Variables	43
3.3.2	Introduction of a Constant	47
3.3.3	Disadvantages of Big M Method	48
3.4	Duality	49
3.5	Application of Duality	51
3.6	Dual Simplex Method (DSM)	53
3.6.1	Dual Simplex Method is Explained by an Example	53

3.7	Special Cases of LP	60
3.7.1	Infeasible Solution	60
3.7.2	Unbounded Solution	62
3.7.3	Unbounded Solution Space with Finite Solution . . .	64
3.7.4	Alternate Optimal/Multiple Optimal Solution	66
3.7.5	Degeneracy	69
3.7.6	Graphical Representation of Degeneracy	72
3.8	Review Questions	73
4	Transportation Models and Its Variants	79
4.1	Introduction	79
4.2	Mathematical Formulation	79
4.3	Types of Transportation Problems	80
4.4	Solving the Transportation Problem	82
4.4.1	Methods to Solve a Transportation Problem	83
4.5	Moving Toward Optimality	88
4.5.1	Determination of Net Values (U, V Method)	89
4.6	Degeneracy in Transportation Problems	94
4.6.1	Checking the Initial BFS for Degeneracy	94
4.6.2	Resolving Degeneracy at the Initial Stage	94
4.6.3	Resolving Degeneracy During Solution Stages	98
4.7	Maximization in Transportation Problems	99
4.8	Unbalanced Transportation Problem	101
4.8.1	Excess of Availability ($\sum A_i \geq \sum B_j$)	101
4.8.2	Shortage of Availability ($\sum A_i \leq \sum B_j$)	103
4.9	Transshipment Problem	104
4.10	Generalized Transportation Problem	107
4.11	Assignment Problem	107
4.11.1	Types of Assignment Problems	108
4.11.2	Hungarian Method	108
4.11.3	Variations in Assignment Problem (Maximal Adjustment Problem)	113
4.11.4	Restrictions in Assignment	117
4.11.5	Sensitivity in Assignment Problems	119
4.11.6	Traveling Salesman Problem	120
4.11.7	Unbalanced Assignment Problem	125
4.11.8	Airline Crew Problem	127
4.12	Review Exercises	130
5	Network Models	139
5.1	Representation Using Network Diagram	140
5.1.1	Rules for Drawing a Network Diagram	140

5.2	PERT and CPM	142
5.2.1	Applications	142
5.2.2	Phases in PERT/CPM	142
5.2.3	Differences Between PERT and CPM	142
5.3	Critical Path Method	143
5.3.1	Time Estimates and Critical Path	143
5.3.2	Project Evaluation and Review Technique	148
5.3.3	Crashing	150
5.4	Flow in Networks	156
5.4.1	Maximal Spanning Tree Algorithm	156
5.5	Review Questions	158
6	Game Theory	163
6.1	Introduction	163
6.1.1	Terminologies	164
6.2	Games with Saddle Points	166
6.3	Games with Mixed Strategies	168
6.4	Dominance Principle	171
6.4.1	Dominance Property for Rows	171
6.4.2	Dominance Property for Columns	171
6.5	Graphical Method for $2 \times n$ or $m \times 2$ Games	176
6.5.1	Graphical Solution for $2 \times n$ Games	177
6.6	Graphical Solution for $m \times 2$ Games	180
6.7	Limitations of Game Theory	183
6.8	Advances in Game Theory	183
6.9	Notions in Game Theory	183
6.9.1	Example for Illustrating Common Knowledge	184
6.10	Classification of Games	185
6.10.1	Cooperative and Non-cooperative Games	185
6.10.2	Games with Complete and Incomplete Information	185
6.10.3	Games with Perfect and Imperfect Information	185
6.11	The Notion of Strategy	185
6.11.1	Examples of Strategic Games	186
6.12	Extensive Form Games	187
6.13	Games with Perfect and Imperfect Information	189
6.14	How to Define Strategy?	189
6.14.1	Pure Strategy Nash Equilibrium	190
6.14.2	Dominated and Dominating Mixed Strategies	190
6.15	Review Questions	192
7	Queuing Systems	195
7.1	Introduction	195
7.2	Elements of a Queuing Model	195
7.3	Model I: Pure Birth Model	196

7.4	Model II: Pure Death Model	200
7.5	Model III: Generalized Poisson Queuing Model	203
7.6	Empirical Queuing Models	206
7.7	Single Server Models	207
7.7.1	Model IV ($M/M/1$): ($GD/\infty/\infty$).	207
7.7.2	Model V: ($M/M/1$): ($GD/N/\infty$)	211
7.7.3	Model VI ($M/M/1$): ($GD/N/N$); ($N > 1$)	215
7.8	Multiple Server Models	217
7.8.1	Model VII ($M/M/C$): ($GD/\infty/\infty$).	217
7.8.2	Model VIII ($M/M/C$): ($GD/N/\infty$).	221
7.9	Review Questions and Problems	224

Part II Engineering Management

8	Introduction to Engineering Management	229
8.1	Introduction	229
8.2	Engineering as a Profession	229
8.3	Management	230
8.4	Management Levels	230
8.5	Managerial Roles	231
8.6	Functions of Managers	232
8.7	Management: Art or Science	232
8.8	Engineering Management	233
8.9	Origin and Growth of Engineering Management.	233
8.10	Management Thoughts	234
8.11	Summary	238
8.12	Review Questions	238
	References	238
9	Foundations of Technology Management	241
9.1	Introduction	241
9.2	Strategic Planning.	241
9.3	Purpose and Mission	242
9.4	Objectives and Goals	242
9.5	Program Strategies	243
9.6	Stimulus for Strategy	245
9.7	Strategic Decision Making	246
9.7.1	Mintzberg Model	246
9.7.2	Management by Objectives	247
9.8	Strategic Management Process	249
9.9	Forecasting	250
9.9.1	Qualitative Methods	250
9.9.2	Quantitative Methods	251

9.10	Technological Forecasting	253
9.11	Strategies for Managing Technology	254
9.11.1	Invention and Innovation	254
9.12	Entrepreneurship and Intrapreneurship	255
9.13	Managing Technological Change	255
9.14	Summary	255
9.15	Review Questions	256
	References	256
10	IT and Strategy	257
10.1	Introduction	257
10.2	Strategic IT Investment	257
10.3	IT Strategy Components	258
10.4	Viewing IT as Strategy	258
10.5	Influence of Information Technology on Pricing Strategies	260
10.5.1	Increased Information Availability	260
10.5.2	Enhanced Reach	261
10.5.3	Expanding Interactivity	261
10.6	Why the Emphasis on Strategy for IT?	262
10.7	What can the Strategic Contribution of IT Comprise?	263
10.8	Summary	264
10.9	Issues for Discussion	265
	References	265
11	R&D and Strategy	267
11.1	Introduction	267
11.2	R&D Development Within Industrial Network	268
11.3	Characteristics of the R&D Development Process	269
11.4	Important Issues for the Individual Company	270
11.5	Special Issues for International Companies	270
11.6	Location of R&D	271
11.7	New Opportunities	271
11.8	Cooperation Strategies	272
11.8.1	National Companies	272
11.8.2	International Companies	273
11.8.3	Domestic Partners	274
11.8.4	International Partners	274
11.9	Patterns of R&D Strategy	275
11.10	TechStrategy for R&D Planning	275
11.11	Summary	277
11.12	Issues for Discussion	277

12 Managing Projects	279
12.1 Introduction	279
12.1.1 What is a Project?	279
12.2 Project Characteristics	280
12.3 Project Management: An Integrative Approach	280
12.4 Four Activities of the Strategic Management Process	282
12.5 How do We Plan Projects?	282
12.5.1 Project Scope	282
12.5.2 Establishing Priorities.	283
12.5.3 Creating the Work Breakdown Structure (WBS)	283
12.5.4 Project Communication Plan	283
12.5.5 Estimating Project Costs.	283
12.6 Project Planning Tools	285
12.7 Project-Driven Organization.	287
12.8 Functional Organizational Structure	287
12.9 Matrix Structure	288
12.10 Projectized Organization	289
12.11 Comparison	289
12.12 Project Performance	291
12.13 Summary	291
12.14 Review Questions	292
References	292
13 Professional Communication	293
13.1 Introduction	293
13.2 Scope and Effectiveness of Communication	293
13.3 Internal Communication	294
13.4 What Is Communication?	295
13.4.1 The Ideal Communication System	295
13.4.2 Types of Communication	296
13.4.3 Types of Organizational Communication	296
13.5 Project Communication	297
13.5.1 Communicating Through the Course of the Project	299
13.5.2 Communication to Manage Conflicts	299
13.5.3 Preparation of Reports	300
13.6 Comparative Statements of a Profession	300
13.7 Summary	304
13.8 Discussion Questions	304
References for Further Reading	305
Index	307