

Christoph Schneeweiss

Distributed Decision Making

Second Edition

With 107 Figures and 13 Tables



Springer

Contents

Chapter 1: Introduction	1
1.1 Some Typical Examples of Distributed Decision Making Situations	7
1.2 • Examples of DDM Systems	11
1.3 Some Important Properties of DDM Systems	17
1.4 Outline of the Treatise	19
 PART I: Basic Foundations	 23
Chapter 2: Basic Concepts	25
2.1 General Characterization of Hierarchical Planning Structures	26
2.2 Coupling Equations and Anticipation Function	32
2.3 Distinguishing DDM Systems by Their Team Character within Hierarchical Interactions	39
2.4 . Classifying General Planning Hierarchies by Their Anticipation	41
2.5 Illustrative Examples	46
2.5.1 Example 1: Make-or-Buy Decisions	46
2.5.2 Example 2: A Working Time Planning Model	53
2.5.3 Example 3: Supply Contracts	57
2.5.4 Example 4: Stackelberg Duopoly	65
2.6 Some Remarks Concerning General Solution Properties	69

Chapter 3: Constructional DDM Systems	73
3.1 Decomposition DDM Systems	75
3.1.1 A Capacity Adaptation Model	76
3.1.2 A Coordination DDM System of the Dantzig/Wolfe Type ..	81
3.2 Relaxation Systems	86
3.3 A Brief Remark on Bi-Level Programming	90
Chapter 4: Organizational DDM Systems	93
4.1 Top-Down DDM Systems	94
4.1.1 A Hierarchical Planning Model for the Repair Shops of the Deutsche Lufthansa AG	95
4.2 Tactical-Operational DDM Systems	99
4.2.1 Capacity Adaptation Hierarchy	101
4.2.2 Investment-Production Hierarchies	104
4.2.3 Strategic-Tactical-Operational DDM System	107
4.3 Value of Information and Delegation	113
4.3.1 Value of Information	113
4.3.2 Value of Delegation	115
4.4 Some Brief Remarks on Stochastic Programming	116
4.4.1 An Example of a Two-Stage Linear Stochastic Programming	119
4.4.2 Some General Remarks on Solution Procedures	121
Chapter 5: Principal Agent Theory	125
5.1 Information Situation in the Principal Agent Theory.	126
5.2 The Standard Problem of Principal'Agent Theory.	130
5.3 An Illustrative Example with Risk-Neutral Antagonists_____	133
5.3.1 Problem Statement and Problem Formulation	133
5.3.2 Problem Solution	135
5.4 Some General Observations Concerning the Solution of the Principal Agent Coupling Equations	138
5.5 The LEN Model	140
5.6 Some Extensions of the Standard Situation	146
5.6.1 Self-Selection Illustrated with a Supply Chain Contract_____	147
5.6.2 Hidden Information and Truthful Communication.	149

PART II: General Applications157**Chapter 6: Hierarchical Production Planning**159

6.1	Standard Model of Hierarchical Production Planning.	160
6.1.1	The Structure of the Model.	160
6.1.2	Mathematical Formulation of the Decision Models for the Three Levels.	163
6.1.3	General Discussion of Hierarchical Production Planning ...	166
6.2	Integrative Hierarchical Production Planning.	170
6.2.1	A Model to Illustrate the Integrative Approach to HPP_____	171
6.2.2	Interpretation of the Integrative Model in Terms of a Tactical-Operational DDM System.	177
6.2.3	General Discussion of Aggregation Procedures and the Integrative HPP.	179
6.3	Process Production.	183
6.3.1	A Dynamic Programming Formulation for Medium-Term and Short-Term Process Production.	184
6.3.2	Integrative Hierarchical Production Planning for Process Production.	191
6.4	General Discussion.	201

Chapter 7: Organizational Design205

7.1	Designing the Organizational Structure as a DDM Problem.	206
7.2	Process Design: The Design of a Flexibility Potential	209
7.2.1	Some Preliminary Remarks.	210
7.2.2	Elementary Components of a Flexibility Measure.	211
7.2.3	A General Measure of Flexibility.	213
7.2.4	Numerical Specification of Flexibility.	214
7.2.5	Planning and Implementation Ability as Further Components of Flexibility.	216
7.2.6	The Design of Flexibility as a Hierarchical Planning Problem.	217

Chapter 8: Implementation	221
8.1 Planning and Implementation as a Two-Stage Decision Problem.....	223
8.2 Implementation as a Three-Stage Hierarchy.	225
8.2.1 A General Model	225
8.2.2 The Solution Hierarchy.....	227
8.3 Formal Description of the Planning and Implementation Problem.....	228
8.3.1 The Coupling Equations.....	228
8.4 Working Time Contract	230
8.5 Implementation of Lotsizes	233
8.5.1 The Planning Level: Determination of Target Lotsizes. . . .	235
8.5.2 The Implementation Level: Adaptation of Target Lots. . . .	236
8.5.3 Anticipation.....	238
8.5.4 Description within the Framework of Hierarchical Planning	239
 Chapter 9: Supply Chain Management	 243
9.1 The Design of Supply Chain Contracts to Coordinate Operational Interdependencies.....	247
9.1.1 Type of Contracts and Their Operational Impact	248
9.1.2 A Formal Description of the Operational Level	253
9.1.3 The Contract Level	262
9.1.4 Numerical Analysis.....	266
9.1.5 Summarizing Remarks.....	273
9.2 Process Coordination in a Supply Chain - a Continuous One-Period Model	274
9.2.1 Problem Description	274
9.2.2 Main Features of the Producer's and Supplier's Model. . . .	277
9.2.3 Coordination Schemes	278
9.2.4 Analytic Investigation.....	279
9.2.5 An Illustrative Numerical Example	283
9.3 A Multi-Period Model with Private Information	285
9.3.1 General Characteristics of the Multi-Period Model	286
9.3.2 Formal Description of the Supply Link	288
9.3.3 The Interrelation of the Producer's and the Supplier's Model	295
9.3.4 Types of Anticipation and Coordination.....	296

9.3.5	Numerical Analysis	300
9.3.6	• General Discussion	307
9.4 Distributed Decision Making in Supply Chain Management	310
9.4.1	The Nature of DDM Problems in Supply Chain Management	312
9.4.2	Proper DDM Problems in Supply Chain Management . . .	316
9.5	The Contribution of Different Sciences to DDM in SCM ...	319

Chapter 10: Service Operations 323

10.1	Characterization of Services	324
10.1.1	Specification of Service Operations	324
10.1.2	Phases of Service Production	326
10.2	' Execution Phase of a Service Operation	329
10.3	The Agreement-Execution Relationship	331
10.4	Delegation of a Service Operation	334
10.4.1	Coupling Equations	337
10.4.2	Modeling the Relationship Between Manager and Agent ...	339

Chapter 11: Managerial Accounting 341

11.1'	General Considerations and the Cost Value Problem	343
11.1.1	Classification	344
11.1.2	The Cost Value Problem	347
11.2	Steering Costs	347
11.2.1	Description of the Concept of Steering Costs	348
11.2.2	A Numerical Example	350
11.3	Tactical-Operational Cost Evaluation	352
11.3.1	Investment-Oriented Depreciations - Preliminary Considerations	353
11.3.2	Description of the Investment and the Production Level ...	354
11.3.3	Defining Investment-Oriented Depreciations	360
11.3.4	An Illustrative Numerical Example and Some Further Numerical Insights	363
11.3.5	General Discussion	367
11.4	Decision-Oriented Assignment of Common Cost	368
11.4.1	The Cost Separation Problem	370
11.4.2	The Algorithmic Determination of Steering Costs	372

11.4.3	The Complete Cost Assignment Problem	374
11.5	Strategic Costs.	376
11.6	Cost Parameters as Incentives	377
11.6.1	Incentives and Behavioral Costs.	377
11.6.2	Distorted Costs as Incentives.	379
11.6.3	Transfer Prices as Incentives.	381

PART III: Leadership and Coordination Processes 385

Chapter 12: General DDM Systems 387

12.1	The Individual Decision Process.	389
12.1.1	General Two-Step Structure.	389
12.1.2	A More Refined Description.	391
12.1.3	The Entire Decision Process.	395
12.2	A Formal Description of General DDM Systems	398
12.2.1	The Interaction of Individual Decision Processes.	398
12.2.2	The General Coupling Equations.	401
12.2.3	Leadership Properties of the Coupling Equations.	405

Chapter 13: Coordination through Communication 411

13.1	General Features of a Coordination and Communication Process.	412
13.2	A Linear Coordination Process.	415
13.3	Hierarchical Interference with the Base-Level Decision Processes.	418
13.4	The Entire Coordination Process.	420

Chapter 14: Negotiations 423

14.1	A Hierarchical Negotiation Situation	424
14.2	A Formal Description of the Negotiation	427
14.3	Negotiations in the Presence of Multiple Scenarios.	429
14.4	The Strategic Decision.	432
14.5	The Entire Negotiation Process.	433

Chapter 15: Distributed Decision Making in

Multi-Agent Systems	437
15.1 A Brief Description of MAS.	438
15.2 Three Illustrative Examples of MAS.	442
15.2.1 Coordination of Inventories in a Supply Chain.	442
15.2.2 A Complex Multi-Facility Scheduling Problem.	445
15.2.3 A Market Coordination of Locally Optimizing Agents in the Supply Chain.	446
15.3 Multi-Agent Systems as Special DDM Systems.	447

Chapter 16: A Unifying Perspective of the

Management Process	451
16.1 Summarizing Key Notions of DDM.	452
16.2 DDM and Specific Theories in Business Administration_____	456
16.3 DDM and Non-Management Sciences.	459
16.4 The Management Process.	460

Exercises	463
------------------------	-----

Solutions to the Exercises	477
---	-----

Bibliography	507
---------------------------	-----

Index	525
--------------------	-----