

## Contents

Preface	V
CHAPTER ONE	1
INTRODUCTION	
1.1. Problem statement	1
1.2. Outline of the book	4
1.3. Relevant economic literature	6
1.4. The multilevel approach	7
CHAPTER TWO	9
THE MODEL OF THE FIRM: MULTIPLE TECHNIQUES AND MAKE-OR-BUY DECISIONS	
2.1. Introduction	9
2.2. The firm in input-output terminology	9
2.3. Multiple techniques for market products	13
2.4. Make-or-buy decisions for technical services	18
2.5. Summary	22
CHAPTER THREE	23
THE MODEL OF THE FIRM: COST ALLOCATIONS AND ORGANIZATIONAL STRUCTURE	
3.1. Introduction	23
3.2. Cost allocation problems	24
3.3. Three illustrative examples	25
3.3.1. The Louderback-Moriarity approach	25
3.3.2. The reciprocal allocation method	27
3.3.3. Fixed cost allocation via mathematical programming	29
3.4. Cost allocation and multilevel decisions	30
3.4.1. Motives for the analysis of allocation problems	30
3.4.2. Cost allocation in a decentralized organizational structure	32
3.5. The overall model	33
3.6. Summary	38

CHAPTER FOUR	39
DECOMPOSITION BASED PLANNING: PRICE AND RESOURCE DIRECTIVE COORDINATION	
4.1. Introduction	39
4.2. The planning problem	40
4.3. Price-directive planning according to the Dantzig-Wolfe decomposition method	43
4.4. Resource-directive planning according to Benders' decompo- sition method	46
4.5. Discussion	49
4.6. Summary	53
CHAPTER FIVE	55
DECOMPOSITION BASED PLANNING: MIXED PRICE-RESOURCE DIRECTIVE APPROACHES	
5.1. Introduction	55
5.2. Division-oriented mixed decomposition	56
5.3. Resource-oriented mixed decomposition	60
5.3.1. Development of the algorithm	61
5.3.2. Generation of globally feasible solutions	67
5.3.3. Economic interpretation	68
5.4. Summary	72
CHAPTER SIX	75
OVERALL ANALYSIS OF THE MODEL OF THE FIRM	
6.1. Introduction	75
6.2. Properties of overall solutions	77
6.2.1. The case with common resources in excess supply	77
6.2.2. The case with common resources in limited supply	79
6.3. Numerical example	81
6.4. Establishment of the overall production plan	85
6.5. Incorporation of cost allocation mechanisms	86
6.5.1. The allocation of internal-TS costs	87

6.5.2. Common cost allocation	88
6.6. Summary	90
CHAPTER SEVEN	91
MULTILEVEL ANALYSIS OF THE MODEL OF THE FIRM	
7.1. Introduction	91
7.2. The multilevel approach for decentralized firms	91
7.3. Proposal for a two-level planning procedure	95
7.3.1. Outline of the planning procedure	96
7.3.2. Intermediate divisional activity plans	97
7.3.3. The information contents of exchanged data	101
7.3.4. Numerical example	104
7.4. Cost allocations during the planning process	108
7.4.1. Allocation of internal-TS costs	109
7.4.2. Common cost allocation	111
7.5. Summary	114
CHAPTER EIGHT	115
REVIEW AND EVALUATION	
8.1. Review of the text	115
8.2. Evaluation of the results	116
APPENDIX A: appendix to CHAPTER TWO.	121
APPENDIX B: appendix to CHAPTER THREE.	129
APPENDIX C: appendix to CHAPTER FOUR.	131
C.1. Derivation of the price-directive planning procedure according to Dantzig-Wolfe	131
C.2. Derivation of the resource-directive planning procedure according to Benders	134

APPENDIX D: appendix to CHAPTER FIVE.	139
D.1. Proof of Theorem 5.1	139
D.2. Further relaxation of problem (5.20)	140
D.3. A convergence proof for the algorithm as presented in section 5.3.1	141
APPENDIX E: appendix to CHAPTER SIX.	143
APPENDIX F: appendix to CHAPTER SEVEN.	149
LIST OF SYMBOLS	153
REFERENCES	163