Contents

Foreword by Marc Goetschalckx xi

Preface xiii

Acknowledgements xv

About the Authors xvii

List of Abbreviations xix

1 Introducing logistics 1
   1.1 Definition of logistics 1
   1.2 Logistics systems 1
      1.2.1 Logistics activities 5
      1.2.2 Information flows and logistics networks 5
      1.2.3 Case of more products 7
   1.3 Reverse logistics 9
   1.4 Integrated logistics 10
   1.5 Objectives of logistics 12
      1.5.1 Measures of the service level 14
   1.6 Management of the logistics system 18
      1.6.1 Planning phase 18
      1.6.2 Organizational phase 19
      1.6.3 Control phase 28
   1.7 Case study: The Pfizer logistics system 33
   1.8 Questions and problems 36

2 Forecasting logistics requirements 44
   2.1 Introduction 44
   2.2 Qualitative methods 46
   2.3 Quantitative methods 48
      2.3.1 Graphical representation of time series 48
      2.3.2 Classification of time series 48
2.4 Data preprocessing 51
  2.4.1 Insertion of missing data 52
  2.4.2 Detection of outliers 52
  2.4.3 Data aggregation 53
  2.4.4 Removing the calendar variations 55
  2.4.5 Deflating monetary time series 56
  2.4.6 Adjusting for population variations 57
  2.4.7 Normalizing the data 58
2.5 Choice of the forecasting method 59
  2.5.1 Notation 59
  2.5.2 Casual versus extrapolation methods 59
  2.5.3 Decomposition method 60
  2.5.4 Further time series extrapolation methods: The constant
      trend case 71
  2.5.5 Further time series extrapolation methods: The linear
      trend case 75
  2.5.6 Further time series extrapolation methods: The seasonal
      effect case 80
  2.5.7 Further time series extrapolation methods: The irregular
      series case 88
  2.5.8 Sporadic time series 91
2.6 Advanced forecasting method 97
2.7 Accuracy measure and forecasting monitoring 98
  2.7.1 Accuracy measures 99
  2.7.2 Tuning of the forecasting methods 100
  2.7.3 Forecast control 102
2.8 Interval forecasts 106
2.9 Case study: Forecasting methods at Adriatica Accumulatori 109
2.10 Case study: Sales forecasting at Orlea 110
2.11 Questions and problems 112
3 Locating facilities in logistics systems 122
  3.1 Introduction 122
  3.2 Qualitative methods 126
  3.3 Quantitative methods 127
    3.3.1 Single-commodity single-echelon continuous location
         problems 128
    3.3.2 Single-commodity single-echelon discrete location
         problems 132
    3.3.3 Single-commodity two-echelon discrete location
         problems 155
    3.3.4 The multicommodity case 159
    3.3.5 Location-covering problems 163
    3.3.6 $p$-centre problems 168
  3.4 Hybrid methods 174
CONTENTS ix

3.5 Stochastic location models 175
3.6 Case study: Container warehouse location at Hardcastle 179
3.7 Case study: The organ transplantation location–allocation policy of the Italian National Transplant Centre 183
3.8 Questions and problems 185

4 Selecting the suppliers 193
4.1 Introduction 193
4.2 Definition of the set of potential suppliers 194
4.3 Definition of the selection criteria 194
4.4 Supplier selection 198
4.5 Case study: The system for the selection of suppliers at Baxter 202
4.6 Questions and problems 205

5 Managing a warehouse 210
5.1 Introduction 210
  5.1.1 Performance parameters 213
  5.1.2 Decision-making problems 216
5.2 Warehouse design 216
  5.2.1 Choice of warehouse systems 217
  5.2.2 Choice of warehouse layout 230
  5.2.3 Sizing of the storage zone 234
  5.2.4 Sizing of the receiving zone 240
  5.2.5 Sizing of the shipping zone 241
5.3 Tactical decisions for warehouse logistics planning 242
  5.3.1 Product allocation to the storage points 242
  5.3.2 Inventory management 249
5.4 Operational decisions for warehouse logistics management 276
  5.4.1 Package picking from the storage zone 276
  5.4.2 Package consolidation in load units 285
5.5 Case study: Performance evaluation of an AS/RS system conducted by Wert Consulting 303
5.6 Case study: Inventory management at Wolferine 305
5.7 Case study: Airplane loading at FedEx 306
5.8 Questions and problems 309

6 Managing freight transport 318
6.1 Introduction 318
  6.1.1 Modes of transport 318
  6.1.2 Classification of transport problems 323
6.2 Freight Traffic Assignment Problems (TAPs) 326
  6.2.1 Minimum-cost flow formulation 327
  6.2.2 Linear single-commodity minimum-cost flow problems 328
  6.2.3 Linear multicommodity minimum-cost flow problems 336
6.3 Service network design problems 342
6.3.1 The linear fixed-charge network design model 344
6.4 Vehicle allocation problems 350
6.5 A dynamic driver assignment problem 352
6.6 Fleet composition 354
6.7 Shipment consolidation 356
6.8 Vehicle routing problems 359
   6.8.1 The travelling salesman problem 362
   6.8.2 The Node Routing Problem with Capacity and Length Constraints 378
   6.8.3 The Node Routing and Scheduling Problem with Time Windows 391
   6.8.4 Arc routing problems 398
   6.8.5 Route sequencing 409
6.9 Real-time vehicle routing problems 410
6.10 Integrated location and routing problems 412
6.11 Vendor-managed inventory routing 414
6.12 Case study: Air network design at Intexpress 422
6.13 Case study: Meter reader routing and scheduling at Socal 427
6.14 Case study: Dynamic vehicle-dispatching problem with pickups and deliveries at eCourier 430
6.15 Questions and problems 432

Index 443