SPATIAL ANALYSIS AND LOCATION-ALLOCATION MODELS

Edited by

Avijit Ghosh

New York University

Gerard Rushton

University of Iowa

TECHNISCHE HOCHSCHULE DARMSTADT
Fachbereich 1
Gesamtbibliothek
Betriebswirtschaftslehre
Inventar-Nr. : 40.510
Abstell-Nr. : A 14/1316
Sachgebiete: 1.6.8.5
1.6.9.2.1
00093811

VAN NOSTRAND REINHOLD COMPANY
New York

CONTENTS

Preface / viii
Contributors / x

Introduction: Progress in Location-Allocation Modeling/Avijit Ghosh and Gerard Rushton **1**

Location Allocation Modeling: The Classic Phase, 2 Location-Allocation Modeling: The Contemporary Phase, 5 Location-Allocation Models and Location Theory, 11 Evaluating Past Location Decisions, 12 Conclusion, 14 References, 15

PART I: LOCATION THEORY AND LOCATION-ALLOCATION MODELS

1. **Location-Allocation Models and Central Place Theory**/ John R. Beaumont **21**

Central Place Theory, 22 Location-Allocation Models and Central Place Theory, 25 Some Fundamental Location-Allocation Problems, 26 Incorporation of Spatial-Interaction Models, 29 Locational Surplus Maximization, 30 Location-Allocation Models and Central Place Concepts, 33 Location, Size, and Number of Centers, 38 Dynamic Location-Allocation Models, 45 References, 51

2. **Optimal Location and Allocation with Multipurpose Shopping**/ Sara McLafferty and Avijit Ghosh **55**

Trip Patterns and the Frequency of Trips, 56 The Shopping Model, 59 The Location-Allocation Model, 61 Effect of Cost and Price Variations on Locations, 68 Conclusion, 72 References, 74

3. **Location-Allocation Modeling in Archaeology**/ Thomas L. Bell and Richard L. Church **76**

Settlement Efficiency and Archaeological Settlement Patterns, 77 Political Centralization of the Nile Valley During the Ramesside Period, 78 Analysis of Late Horizon (Aztec) Settlement in the Northeastern Basin of Mexico, 88 The Future of Location-Allocation Models in Archaeology, 96 References, 97

4. **A Spatial Model of Party Competition with Electoral and Ideological Objectives**/V. Ginsburgh, P. Pestieau, and J.-F. Thisse **101**

The Two-Party System, 103 Sensitivity Analysis, 108 Long-Run Analysis, 111 The Multiparty System, 114 Conclusion, 116 References, 117

PART II: APPLICATIONS OF LOCATION-ALLOCATION MODELS

5. **Location-Allocation and Impulsive Shopping: The Case of Gasoline Retailing**/Michael F. Goodchild and Valerian T. Noronha **121**

Sales Forecasting Model, 123 Location-Allocation Model, 125 References, 135

6. **High School Location Decision Making in Rural India and Location-Allocation Models**/Vinod K. Tewari and Sidheswar Jena **137**

Organizational Structure For School Location Planning In Karnataka, 138 Criteria For Locating High Schools, 140 Decision Making in Locating High School Facilities, 141 Efficiency of Recent Decisions in Bellary District on Locating High Schools, 143 Conclusion, 157 References, 161

7. **Hierarchical Location Analysis Using Covering Objectives**/ Richard L. Church and David J. Eaton **163**

Planer Models, 166 Network Nonreferral Models, 166 Network Referral Models, 168 Hierarchical Referral Systems and Accessibility, 169 Use of Covering Models, 169 The Hierarchical Referral Problem, 172 Applications of Referral Hierarchical Covering Models, 176 Summary, 182 References, 182

8. **Spatial Distribution Design for Fire Fighting Units**/ Pitu B. Mirchandani and John M. Reilly **186**

Fire Department Operations and Locational Issues, 186 Literature Review, 188 Additional Modeling Considerations, 195 The Model And Its Solution, 201 Model Application, 205 Conclusions and Further Remarks, 213 Appendix 8.A: Computing Travel Time Means, Variances, and Covariances, 214 Notes, 220 References, 221

9. Location, Dispatching, and Routing Models for Emergency Services with Stochastic Travel Times/Mark S. Daskin **224**

Review of Related Literature, 226 A Multivehicle Response-Time Model with Stochastic Travel Times, 231 A Combined Location, Dispatching, and Routing Model for Emergency Services, 242 Simpler Formulations, 251 Conclusions and Recommendation For Future Study, 261 References, 263

PART III: METHODOLOGICAL ISSUES IN LOCATION-ALLOCATION MODELING

10. Interperiod Network Storage Location-Allocation (INSLA) Models/Samuel J. Ratick, Jeffrey P. Osleeb, Michael Kuby, and Keumsook Lee **269**

Literature Review, 271 INSLA Models for Commodity Distribution, 277 Sample Model Application, 286 Model Enhancements and Solution Techniques, 294 References, 298

11. Spatial-Interaction-Based Location-Allocation Models/ Morton E. O'Kelly **302**

Nearest-Center or Probabilistic Allocation?, 302 Real-World Travel Patterns, 303 Implications for Facility Location, 304 Spatial-Interaction-Based Location-Allocation Models, 304 A Probabilistic Location-Allocation Model, 309 Results, 312 Suggestions for Further Research, 317 References, 322

12. Data Aggregation and the *p*-Median Problem in Continuous Space/Paul A. Casillas **327**

Data Aggregation in Locational Analysis, 327 The *p*-Median Problem in Continuous Space, 329 Conclusions, 343 References, 344

13. Selecting the Objective Function in Location-Allocation Analyses/Gerard Rushton **345**

Provider Behavior in Location-Allocation Models, 346 Consumer Behavior in Location-Allocation Models, 348 Problems in Formulating The Objective Function, 350 An Illustration: Improving Access to Primary Health Care, 352 Conclusion, 360 References, 361

About the Contributors / 365

Index / 369