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SYSTEMS EVALUATION

Methods, Models, and Applications

Sifeng Liu • Naiming Xie
Chaoqing Yuan • Zhigeng Fang

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Systems Evaluation

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Preface

Evaluation is a practical activity by which people judge the value of an object or process. The need for socioeconomic development and scientific decision making led to a wide range of evaluation activities such as engineering project evaluation, science project evaluation, industrial development assessment, environmental assessment, evaluation of university subject construction, enterprise competitiveness assessment, personnel quality evaluation related to technology and economic development evaluation, and even evaluation of comprehensive national strength and government policies. Evaluation is related to all aspects of production and life.

This book outlines various systems evaluation methods and models. The evolution of systems evaluation is presented in a clear, logical way, starting with qualitative assessment and proceeding to a description of the process and methods to building an index system of evaluation, and again with some common evaluation methods and models of comparative evaluation methods, the logical framework approach, analytic hierarchy process (AHP), and data envelopment analysis (DEA) methods. Several new evaluation models of grey systems including the general grey incidence model, grey incidence models based on similarity and closeness, grey cluster evaluation based on triangular whitenization functions, and multi-attribute grey target decision models are introduced. Empirical studies based on reality are introduced and cover evaluation of road–bridge construction projects, the efficiency evaluation of science and technology activities, assessment of energy saving in China, and the evaluation and selection of international cooperation projects.

This book is unique in its emphasis on the practical applications of systems evaluation methods and models. The methods and models are introduced briefly and we attempt to explain intricate concepts in an easily understandable way. In addition, practical examples illustrate the practical application, analysis, and computation of systems evaluation methods and models.

Chapters 1 and 2 are written by Sifeng Liu, Chapter 3 by Zhigeng Fang, Chapters 4 and 6 by Naiming Xie, and Chapter 5 by Chaoqing Yuan. Lirong Jian, Hongzhuan Chen, Jeffrey Forrest, Yaoguo Dang, Hecheng Wu, Chuanmin Mi, Shawei He, Yong Liu, Yaping Li, Zhaowen Shi, Jianfei Xiao, Lifang He, Ying Cao,

Liang Yu, Yuqiang Guo, Xiao Tang, Mei Wang, Tong Yin, Hongchang Ren, Pengtao Lin, Dufang Fan, Fei Wang and Xin Jin participated in related studies. Professor Sifeng Liu took charge of the draft summarization and the final approval.

This book is intended to serve as a textbook for postgraduates and senior undergraduate students specializing in economics and management and as a reference text for those engaged in management, scientific research, engineering technology, and other disciplines.

Any errors or omissions that may be pointed out by readers will be appreciated.

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The authors consulted several experts, studied the research of many scholars, and received a great deal of help from Professor Jeffrey Forrest. We wish to thank them all.

Introduction

This book outlines systems evaluation methods and models. The qualitative assessment methods of nominal group technique, brainstorming, and Delphi are presented. The methods for building an evaluation index system, common evaluation methods and models of comparative evaluation, the logical framework approach, the analytic hierarchy process (AHP), and data envelopment analysis (DEA) for evaluating relative efficiency are presented as well. Several new grey systems evaluation models including the generalized grey incidence model, models based on different visual angles of similarity and/or closeness, cluster evaluation models based on end point and center point triangular whitenization functions, and multi-attribute target decision models are introduced. We cover empirical studies based on reality including postevaluation of road–bridge construction projects, efficiency evaluations of scientific and technological activities, the evaluation of energy saving efforts in China, and the evaluation and selection of international cooperation projects for Jiangsu Province.

This book is unique in its emphasis on the practical application of systems evaluation methods and models. We attempt to explain intricate concepts in an easily understandable way utilize step-by-step explanations of methods and models. The book is suitable as a text for postgraduates and senior undergraduate students specializing in economics and management. It is also intended as a reference for those interested in the methods and technology of complex assessments.

Authors

Sifeng Liu earned a B.S. in mathematics in 1981 from Henan University, an M.S. in economics in 1986, and a Ph.D. in systems engineering in 1998 from Huazhong University of Science and Technology, both in China. He served as a visiting professor at Slippery Rock University in Pennsylvania, De Montfort University in England, and Sydney University in Australia. At present, he is the director of the Institute for Grey Systems Studies and the dean of the College of Economics and Management at Nanjing University of Aeronautics and Astronautics (NUAA) and a distinguished professor, academic leader, and doctor tutor in management science and systems engineering. His research focuses on grey systems theory, systems evaluation, and prediction modeling. He has published over 200 research papers and 19 books.

Over the years, Dr. Liu received 18 provincial and national prizes for his outstanding achievements in scientific research and he was named a distinguished professor and an expert who made significant contributions to China. In 2002, he was recognized by the World Organization of Systems and Cybernetics. He is a member of the Evaluation Committee and the Teaching Direct Committee for Management Science and Engineering of the National Science Foundation of China (NSFC). Additionally, he currently serves as chair of the TC of IEEE SMC on Grey Systems, president of the Grey Systems Society of China (GSSC), vice president of the Chinese Society for Optimization, Overall Planning and Economic Mathematics (CSOOPEM), cochair of the Beijing and Nanjing chapters of IEEE SMC, vice president of the Econometrics and Management Science Society of Jiangsu Province (EMSSJS), and vice president of the Systems Engineering Society of Jiangsu Province (SESJS). He is the editor of *Grey Systems: Theory and Application* (Emerald, UK) and serves on the editorial boards of several professional journals including the *Journal of Grey Systems, Scientific Inquiry, Chinese Journal of Management Science, Systems Theory and Applications, Systems Science and Comprehensive Studies in Agriculture*, and the *Journal of Nanjing University of Aeronautics and Astronautics*. Dr. Liu was named a National Excellent Teacher in 1995, an Expert Enjoying Government's Special Allowance in 2000, a National Expert in 1998, and an Outstanding Managerial Person of China in 2005.

Naiming Xie earned a B.S. in 2003, M.S. in 2006, and Ph.D. in 2008 in grey systems theory at Nanjing University of Aeronautics and Astronautics in China. His research interests include grey systems theory and management science. He is an associate professor of the College of Economics and Management at the university. He also serves as the secretary-general of the Grey System Society of China (GSSC) and published 2 books and more than 20 papers.

Chaoqing Yuan earned a B.S. in 2000, M.S. in 2004, and Ph.D. in 2010 in economics and management science from the Nanjing University of Aeronautics and Astronautics in China. He is an associate professor in the College of Economics and Management at the university and is a member of the Grey System Society of China (GSSC). His main research interests are technological innovation management and energy policy. He has published 11 papers.

Zhigeng Fang earned a master's in management science from Xi'an Science and Engineering University in 1996 and a Ph.D. in management science and engineering from the Nanjing University of Aeronautics and Astronautics in 2006. He is a professor and the deputy director of the Institute for Grey Systems Studies and also assistant dean of the College of Economics at the Nanjing University of Aeronautics and Astronautics. He is a vice president of Grey Systems Society of China (GSSC), director of the Chinese Society of Optimization, Overall Planning and Economic Mathematics, executive director of the Complex Systems Research Committee, and deputy director of Jiangsu Postevaluation Research Center, and a member of the Services Science Global and IEEE Intelligent Transportation Systems Council. Fang's main research interests are project management, post-project evaluation, and grey systems. He completed 26 academic and research projects for national, provincial, and municipal departments and published over 80 research papers and books. He has received several provincial and national prizes for his outstanding achievements in scientific research and applications.

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Contents

Preface ..... **xiii**
Acknowledgments ..... **xv**
Introduction ..... **xvii**
Authors ..... **xix**

1 Common System Evaluation Methods and Models **1**
1.1 Introduction 1
1.2 Qualitative Evaluation 3
1.2.1 A Summary on Qualitative Evaluation 3
1.2.2 Nominal Group Technique 5
1.2.3 Brainstorming 5
1.2.4 Delphi 8
1.2.4.1 Features 9
1.2.4.2 Methods Derived from Delphi 9
1.2.4.3 Preparing Questionnaires 12
1.2.4.4 Evaluation Process 15
1.2.4.5 Delphi Principles to Observe 15
1.3 Index System for Evaluation 17
1.3.1 Determining Structure of Index System 19
1.3.2 Statistical Analysis of Indicator Information 20
1.3.3 Determining Values of Indicators 21
1.3.3.1 Quantified Indicators 21
1.3.3.2 Normalization 22
1.3.4 Determining Indicator Weights 23
1.3.4.1 Least Squares Method 23
1.3.4.2 Eigenvector Method 23
1.3.4.3 Other Weighting Methods 24

1.4 Comparative Evaluation and Logical Framework Approach 24
1.4.1 Comparison Method for Main Indicators 25
1.4.1.1 Method 1 25
1.4.1.2 Method 2 25
1.4.2 Logical Framework Approach 26
1.4.2.1 Basic Concept 26
1.4.2.2 Goal Levels 27
1.4.2.3 Vertical Logic of Causality 28
1.4.2.4 Horizontal Logic 29
1.4.2.5 Verifying Indicators 29
1.4.2.6 Verification Method 30
1.4.2.7 Logical Framework Approach Used in Postevaluation 30
1.5 Analytic Hierarchy Process 32
1.5.1 Hierarchical Structuring 32
1.5.2 Constructing Judgment Matrix 33
1.5.3 Single Level Ordering and Consistency Check 34
1.5.4 Hierarchy Total Ordering and Consistency Check 36
1.6 DEA Relative Efficiency Evaluation 39
1.6.1 DEA Efficiency Evaluation Index and C^2R Model 39
1.6.1.1 DEA Efficiency Evaluation Index 39
1.6.1.2 C^2R Design 40
1.6.2 DEA Validity Judgment 42
1.6.3 Improving DEA Validity 43
1.7 Chapter Summary 44

2 Grey System Evaluation Models 45
2.1 Introduction 45
2.2 Generalized Grey Incidences Model 46
2.2.1 Absolute Grey Incidence Model 46
2.2.2 Relative Grey Incidence Model 50
2.2.3 Synthetic Grey Incidence Model 52
2.3 Grey Incidence Models Based on Similarity and Nearness 53
2.4 Grey Evaluation Using Triangular Whitenization Functions 54
2.4.1 Triangular Whitenization Function of Moderate Measure 55
2.4.2 Evaluation Model Using End-Point Triangular Whitenization Functions 56
2.4.3 Evaluation Model Using Center-Point Triangular Whitenization Functions 57
2.5 Multiattribute Grey Target Decision Model 58
2.5.1 Basic Concepts 58
2.5.2 Construction of Matrix of Uniform Effect Measures 60

2.5.3 Construction of Matrix of Synthetic Effect Measures.....63
2.5.4 Steps of Multiattribute Grey Target Assessment Algorithm 64

3 Postevaluation of Road–Bridge Construction: Case Study of Lianxu Highway in China.....67
3.1 Introduction.....67
3.1.1 Postevaluation 67
3.1.1.1 Comparison of Feasibility Evaluation and Preevaluation 68
3.1.1.2 Comparison with Midevaluation.....68
3.1.1.3 Comparison of Acceptance and Audit 69
3.1.2 Lianxu Highway Project.....69
3.1.2.1 Overview of Project.....69
3.1.2.2 Design Parameters.....71
3.2 Process Evaluation.....71
3.2.1 Preliminary Work and Evaluation 71
3.2.2 Process Design 72
3.2.2.1 Blueprint Design and General Information 72
3.2.2.2 Preparation of Tender Documents.....73
3.2.2.3 Project Implementation and Start of Construction 73
3.2.2.4 Main Technical Indicators and Evaluation of Changes.....73
3.2.3 Implementation and Evaluation of Investment 73
3.2.3.1 Investment Changes 73
3.2.3.2 Analysis of Investment Changes 76
3.2.3.3 Financing Options..... 77
3.2.3.4 Analysis of Financing Costs..... 77
3.2.4 Operating Conditions and Evaluation 77
3.2.4.1 Forecast and Evaluation of Traffic 77
3.2.4.2 Analysis of Vehicle Speed.....79
3.2.4.3 Evaluation of Structural Changes in Traffic.....79
3.2.4.4 Evaluation of Traffic Safety Management.....79
3.2.5 Evaluation of Management, Support, and Service Facilities 80
3.2.5.1 Management.....80
3.2.5.2 Support and Service Facilities.....81
3.3 Traffic Forecasting.....81
3.3.1 Basis 81
3.3.2 Forecasting 82
3.3.2.1 Based on Trend of High-Speed Flow to Forecast 82

3.3.2.2 Based on Regional Transportation System High-Speed Flow to Forecast....82
3.3.2.3 Forecasting Impacts of Ports on Highway Traffic....82
3.3.2.4 Forecasting Impacts of New Roads....82
3.4 Financial and Economic Evaluation....84
3.4.1 Financial Evaluation....84
3.4.1.1 Main Parameters....84
3.4.1.2 Revenue and Costs....85
3.4.1.3 Financial Evaluation....85
3.4.2 Economic Evaluation....89
3.4.3 Comparisons of Feasibility Study and Postevaluation....90
3.4.3.1 Comparison of Financial Benefits....90
3.4.3.2 Comparative Analysis of Economic Benefits....92
3.5 Assessment of Environmental and Social Impacts....93
3.5.1 Environmental Impacts....93
3.5.1.1 Evaluation of Environmental Management....93
3.5.1.2 Implementation of Environmental Protection Measures....94
3.5.1.3 Conclusions of Survey....94
3.5.2 Social Impacts....94
3.5.2.1 Division of Area of Coverage....94
3.5.2.2 Economic Development Correlation of Highway and Line Side Areas....94
3.5.3 Economic Development....95
3.5.4 Macroeconomic Impact Analysis....96
3.5.4.1 Impact on Total Economy....96
3.5.4.2 Effects on Economic Structure....97
3.5.4.3 Effects on Environment and Society....97
3.5.4.4 Local Compatibility Analysis....97
3.6 Sustainability Evaluation of Project Objective....97
3.6.1 Effects of External Conditions....97
3.6.1.1 Socioeconomic Development....97
3.6.1.2 Highway Network Development....97
3.6.1.3 Transportation Development....97
3.6.1.4 Management System....97
3.6.1.5 Policies and Regulations....98
3.6.1.6 Supporting Facilities....98
3.6.2 Effects of Internal Conditions....98
3.6.2.1 Operating Mechanism....98
3.6.2.2 Internal Management....98
3.6.2.3 Service Status....98

3.6.2.4 Impacts of Highway Tolls....98
3.6.2.5 Impacts of Operation Conditions....98
3.6.2.6 Impacts of Construction Quality....98
3.6.3 Comprehensive Evaluation of Sustainability....99
3.6.3.1 Evaluation Index....99
3.6.3.2 Determination of Index Weight....99
3.6.3.3 Conclusion....99
3.6.4 Means for Realizing Sustainability....99
3.7 Problems and Recommendations....100
3.7.1 Problems....100
3.7.1.1 Defective Analysis of Effects on Transfer, Induced Traffic Volume, and Gap between Forecast and Actual Value....100
3.7.1.2 Inadequate Design Based on Engineering Survey of Local Roads: Increased Design Costs and Impacts on Progress....100
3.7.1.3 Inadequate Funding Programs and Municipal Matching Requirements....101
3.7.1.4 Unreasonable Standards for Service Facilities: Wastes of Resources....102
3.7.1.5 Preliminary Test Section....102
3.7.1.6 Inadequate Environmental Protection and Pollution....102
3.7.1.7 Land Waste Caused by Defective Selection Programs for Local Roads....103
3.7.2 Recommendations....103

4 Efficiency Evaluations of Scientific and Technological Activities....105
4.1 Introduction....105
4.2 Allocation Structure and Use Efficiency Analysis of Research Expenditures....106
4.2.1 Allocation of Funds for Science and Technology in China....106
4.2.2 Conclusions and Recommendations....113
4.2.2.1 Conclusions and Problems....113
4.2.2.2 Considerations and Recommendations....114
4.3 Efficiency Evaluation of University Scientific and Technological Activities Based on DEA Model....115
4.3.1 Index Selection....115
4.3.2 Evaluation....116
4.3.3 Evaluation of Use of University Research Funds by Region....118

4.4 Evaluation of Regional Scientific and Technological Strength: Jiangsu Province 118
4.4.1 Evaluation of Scientific and Technological Strength of China Provinces 121
4.4.1.1 Devising Evaluation Index System 121
4.4.1.2 Explanations of Indices 121
4.4.1.3 Concrete Values of Evaluation Indices for Scientific and Technological Strength of Provinces 123
4.4.1.4 Grey Clustering Evaluation of Scientific and Technological Strength of China Provinces 124
4.4.2 Evaluation of Scientific and Technological Strengths of Prefecture-Level Cities in Jiangsu Province 133
4.4.2.1 Designing Evaluation Index System 133
4.4.2.2 Explanations of Indices 133
4.4.2.3 Concrete Values of Evaluation Indices 135
4.4.2.4 Grey Clustering Evaluation 136

5 Evaluation of Energy Saving in China 141
5.1 Introduction 141
5.2 Energy-Saving Effects of Technological Progress 142
5.2.1 Extended Cobb–Douglas Production Function 142
5.2.2 Data 144
5.2.3 Empirical Research 148
5.2.4 Conclusion 151
5.3 Energy-Saving Effect of Industrial Restructuring 151
5.3.1 Decomposition of Energy Intensity 152
5.3.2 Changes of Energy Intensity Caused by Industrial Structure 153
5.3.3 Grey Linear Programming Model for Analyzing Industrial Restructuring Impact on Energy Saving 154
5.3.4 Industrial Restructuring 158
5.3.5 Conclusion 172
5.4 Energy-Saving Effect of Development and Use of Nonfossil Energy 173
5.4.1 Energy Consumption Structure 174
5.4.2 Energy Consumption Structure Forecasting 175
5.4.3 Conclusion 176
5.5 Evaluation of Energy Policy 176
5.5.1 Model 179
5.5.1.1 With and without Antitheses 179
5.5.1.2 Linear Regression 180

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