Service Science, Management, and Engineering

Theory and Applications

Intelligent Systems Series

Gang Xiong
Zhong Liu
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Preface

With the fast development of the service sector in the national economy, it is observed that the employees in this sector account for a great proportion of the labor force. For example, in some developed countries such as the USA, the labor force in the service sector is over 50% nowadays. Generally speaking, service has played an important role in our daily lives and work. We even could say everyone is surrounded by kinds of services. However, there still lacks in-depth research on this newly-emerged sector. This motivates academics to pay more attention to service sector research, which further gives impetus to the subject Service Science, Management and Engineering (SSME). As an emerging discipline, SSME has no unified theory as yet. In general, SSME focus on the related research around services, such as service system design, improvement of specific industry services, software and hardware implementation of service, and many other issues. In short, the research of service is aimed at building a general theory of service including problems, tools, methods and practical applications.

The concept of SSME was first introduced by IBM, based on research of service marketing, service quality, service innovation etc. This research has been well-developed and provided the foundations for SSME. Unlike that research, SSME emphasizes the multi-disciplinary aspects. However, it is still an open question as to which disciplines are involved in SSME. There are many kinds of science related to SSME, such as natural science, social science, and technology etc. In order to promote the development of SSME, there are some conferences and workshops, for example the IEEE International Conference on Service Operations and Logistics, and Informatics (SOLI) is one of them.

This book is a follow up effort after the publications of IEEE SOLI 2011. The seventeen chapters in this book are written by experts from different research fields and addresses problems and methods of SSME from different viewpoints. Most of them are extensions of the papers published at IEEE SOLI 2011.

This book includes two parts, namely theory and applications. The former includes five chapters while the latter consists of twelve chapters.

This book starts with a review chapter on SSME, given by Zhen Shen, Dong Shen, Gang Xiong and Fei-Yue Wang. Some important topics are addressed in this chapter. The topics include: what is SSME, why is it important and how do you apply it? Chapter 2 by Yong Lin, Yongjiang Shi and Shihua Ma presents servitization strategy based on the analysis of two PC industry cases and secondary documentation research. Two types of servitization strategy are compared from different points of view. In Chapter 3, Miao He, Changrui Ren, Qinhua Wang and Jin Dong discuss the concepts and modeling for supply chain finance, where approximate dynamic programming (ADP) is used as a basic tool to deal with multi-period problems under uncertainty. In Chapter 4 by G.R. Gangadharan, Anshu N. Jain and Nidhi Rajshree, a methodology for participatory service design for emerging markets is addressed, based on real world case studies. The issues of lack of transparency and the existence of corruption are the primary focus. In Chapter 5, Xinxin Bai, Jinlong Wu, Haifeng Wang, Meng Zhang, Jun Zhang, Yuhu Fu, Xiaoguang Rui, Wenjun Yin and Jin Dong develop recommendation algorithms for implicit information. A new similarity measure and rating strategy for neighborhood models are suggested to obtain better recommendation accuracy.

In Chapter 6, Dennis Güttinger, Eicke Godehardt and Andreas Zinnen compare several online approaches for optimizing the emergency supply after a major incident. The authors show that the combination of a greedy strategy and a subsequent application of a workload adapted version of Simulated Annealing works well for the given online assignment problem. Fenghua Zhu, Zhenjiang Li and Yisheng Lv in Chapter 7 evaluate traffic signal control systems based on Artificial Transportation Systems (ATS). The effectiveness of the evaluation method is verified by two practical applications, which may be difficult to carry out by traditional methods. In Chapter 8, the problem of optimizing police patrol activities is addressed by Li Li, Zhongbo Jiang, Ning Duan, Weishan Dong, Ke Hu and Wei Sun. The authors integrate a spatial pattern identification approach with an efficient route optimization algorithm to produce randomized optimal patrol routes. A case study is provided to illustrate the proposed approach. In Chapter 9, Wei Wei and Changjian Cheng propose a novel emergency management framework of Parallel Emergency Management, based on an ACP (Artificial System, Computational Experiments, Parallel Execution) approach for the problem of how to insure the effectiveness of emergency rescue. Two case studies are given to show the rationality and feasibility of the ACP approach. In Chapter 10, Feng Li, Hongbin Lin, Yu Yuan, Changjie Guo, Wanli Min and Lei Zhao discuss the problem of bus arrival prediction and trip planning for better user experience and services. The bus travel pattern is first classified into eight clusters based on a linear model, and then a system and several algorithms for bus trip planning services are proposed. Chapter 11, by Gang Xiong, mainly proposes a kind of mass customization manufacturing solution, which has been applied by a global mobile phone manufacturer successfully. The four main phases (Marketing, R&D, Production and Purchasing), especially the customized order processing, process quality assurance, statistical process control and the solution's architecture, are proposed

in detail. In Chapter 12, Xiwei Liu, Xiaowei Shen, Dong Fan and Masaru Noda give plant human machine interaction evaluation methods based on ACP theory. It is shown that Fault Detection and Isolation (FDI) performance can be improved by comparing the evaluation results of different plants' human machine interaction design schemes. Timo R. Nyberg, Gang Xiong and Jani Luostarinen in Chapter 13 address topics on "cloud of health" for connected patients. The health problems of the 21st century lifestyle are analyzed and three drivers are identified that will change the health services landscape and the mindsets of patients, public and clinicians. Then the concept "cloud of health" is introduced to describe the new and emerging application of the Internet, mobile and wireless technologies to connect patients with expert advice, other patients and devices. Also, the Short Messages System (SMS) is also discussed in-depth. In Chapter 14, Gang Xiong, Xisong Dong and Jiachen Hou present the problem of how to construct artificial power systems based on an ACP approach. As an application case study, the artificial power grid model is constructed with actual data from North China Power Grid, and its vulnerability is tested under random, dynamic and static attacks. Thus the proposed approach could provide theoretical guidance and practical support for the security and stability, quality and economical operations research of power grids and the smart grid. In Chapter 15, Sven Schulze, Christian Engel, and Uwe Dombrowski discuss the influence of electric vehicles on the after sales service. Specifically, the chapter analyzes after sales service in the automotive industry, changes due to the increasing market share of electric mobility and the impact on stakeholders. In Chapter 16, Sheng Liu, Gang Xiong and Dong Fan present service modeling optimization and service composition QoS analysis. An easy-to-use BPEL4WS modeling method and tool is designed to encapsulate computer terms and convert business models to BPEL4WS models directly. Then the number of modeling elements can be cut by more than 85 percent, the modeling time can be saved by 80 percent, and the model running speed can be accelerated by more than 40 percent. So it enables the enterprise to create and run its business processes more quickly than other methods. In the last chapter by Dong Shen and Songhang Chen, a basic framework of an urban traffic management system based on ontology and a multi-agent system is proposed. The ontology of an Urban Traffic Management System (UTMS) is discussed in detail, and a three-level architecture is proposed for an agent-based distributed traffic control system.

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Gang Xiong, Zhong Liu, Xi-Wei Liu, Fenghua Zhu & Dong Shen

Contents

Preface ..... *xiii*

Chapter 1: Overview of Service Science, Management, and Engineering *1*

1.1 What Is SSME? 1
1.1.1 Information and Communication Technology 2
1.1.2 ACP Theory 3
1.2 Why Do We Need SSME? 4
1.3 How Do We Benefit from SSME? 5
1.3.1 Transportation System 6
1.3.2 Logistics System 6
1.3.3 Health Care System 6
1.3.4 E-Commerce System 7
1.3.5 Financial System 7
1.4 Summary 8
References 8

Chapter 2: Servitization Strategy: Priorities, Capabilities, and Organizational Features *11*

2.1 Introduction 11
2.2 Background 12
2.2.1 Context of the PC Industry 12
2.2.2 Definitions of Servitization 14
2.2.3 Benefits and Challenges of Servitization 16
2.3 Research Methodology 18
2.3.1 Case Study 18
2.3.2 Case Company A 19
2.3.3 Case Company B 19
2.4 Servitization Strategy for PC Industry 20
2.4.1 Strategic Priorities 21
2.4.2 Capability Requirements 23
2.4.3 Organizational Features 26
2.5 Managerial and Practical Implications 29
2.5.1 Strategy Priority Depends on Core Competence 29
2.5.2 Leadership and Top Management Support 29
2.5.3 Industry and Government Development Policy 30

2.6 Conclusions 30
Acknowledgments 31
References 31

Chapter 3: Supply Chain Finance: Concept and Modeling 37
3.1 Inefficient Financial Supply Chain 37
3.2 Introduction to SCF Solutions 38
3.2.1 Preshipment Finance 39
3.2.2 Transit Finance 39
3.2.3 Postshipment Finance 40
3.3 Mathematical Representations of Supply Chain Finance 41
3.3.1 A Survey 42
3.3.2 Approximate Dynamic Programming 44
3.3.3 A Three-Stage Supply Chain Finance Modeling Framework 49
3.4 Future Research 56
References 57

Chapter 4: Designing and Assessing Participatory Public Services for Emerging Markets 59
4.1 COCKPIT: A Participatory Service Design Methodology in a European Context 60
4.2 Challenges of Service Provision in Emerging Markets 62
4.2.1 Case Study: The National Rural Employment Guarantee Scheme 63
4.2.2 Case Study: The Targeted Public Distribution System 64
4.2.3 Existence of Corruption and Lack of Transparency 64
4.3 COCKPIT for Emerging Markets (CEM) 65
4.4 CEM Prototype and Implementation 67
4.5 Assessing Corruption in Public Services in Emerging Markets 68
4.6 Transparency Assessment of Public Services in Emerging Markets 71
4.7 Concluding Remarks 72
Acknowledgments 73
References 73
Appendix 74

Chapter 5: Recommendation Algorithms for Implicit Information 77
5.1 Introduction 77
5.2 Preliminaries 80
5.2.1 Notation 80
5.2.2 Recommendation Framework and Quality Metric 80
5.3 Neighborhood Models 81
5.4 Matrix Factorization Models 83
5.4.1 Matrix Factorization for Explicit Ratings 83
5.4.2 Weighted Matrix Factorization for Implicit Ratings 83
5.4.3 Weighted Matrix Factorization with Biases 85
5.5 A Hybrid Model of Implicit and Feature Information 87

5.6 Experimental Study 88
5.6.1 Data Description 88
5.6.2 Results 89
5.7 Conclusions 92
Acknowledgments 93
References 93

Chapter 6: Online Strategies for Optimizing Medical Supply in Disaster Scenarios 95

6.1 Introduction 95
6.2 Related Work 96
6.3 Experimental Setup 98
6.3.1 Triage Groups and Penalty Functions 98
6.3.2 Data 100
6.4 Algorithms for Optimization 102
6.4.1 Optimization Problem and Criteria 102
6.4.2 Optimization Algorithms 105
6.4.3 Relaxations 111
6.5 Experiments and Results 111
6.5.1 Training 112
6.5.2 Test 112
6.6 Conclusions 115
6.6.1 Summary 115
6.6.2 Future Prospects 115
References 116

Chapter 7: Evaluating Traffic Signal Control Systems Based on Artificial Transportation Systems 117

7.1 Introduction 117
7.2 Developing an Artificial Transportation System from the Bottom Up 118
7.3 The Evaluation Method 123
7.4 Building the Evaluation Platform 126
7.5 GreenPass System 128
7.6 Experiments 133
7.6.1 Scenario 1: Adverse Weather 133
7.6.2 Scenario 2: After the Building of a Shopping Mall 135
7.7 Conclusions 139
References 139

Chapter 8: An Approach to Optimize Police Patrol Activities Based on the Spatial Pattern of Crime Hotspots 141

8.1 Introduction 141
8.2 Background 143
8.2.1 Police Patrolling 143
8.2.2 Crime Hotspots 145

8.2.3 Estimators of Spatial Autocorrelation 147
8.2.4 Route Optimization 149
8.3 Strategy for Near-Optimal Patrol Route Planning 151
8.3.1 Overview 151
8.3.2 Street Network-Based Patrol Route Model 152
8.3.3 Route Optimization Procedure 153
8.4 A Case Study 155
8.4.1 Study Site 155
8.4.2 Data and Analysis 156
8.4.3 Results 156
8.5 Conclusions and Prospects 160
8.5.1 Conclusions 160
8.5.2 Limitations and Future Directions 161
References 161

Chapter 9: Chemical Emergency Management Research Based on ACP Approach ... 165
9.1 Introduction 165
9.2 Problems and Challenges 167
9.3 A Research Framework: Parallel Emergency Management System 168
9.3.1 Artificial Emergency Systems 170
9.3.2 Computational Experiments 172
9.3.3 Parallel Execution 174
9.4 Case Study 175
9.4.1 Case Study 1: Chemical Early-Warning Research 175
9.4.2 Case Study 2: Chemical Emergency Response Plans Evaluation 180
9.5 Conclusions 186
References 186

Chapter 10: Bus Arrival Prediction and Trip Planning for Better User Experience and Services 189
10.1 Introduction 189
10.2 Literature Review 192
10.2.1 Bus Arrival Prediction 192
10.2.2 Bus Trip Planning 193
10.3 Bus Arrival Prediction 195
10.3.1 Factor Analysis 195
10.3.2 Linear Model and Parameter Calibration 198
10.4 Bus Trip Planning 202
10.4.1 System Overview 202
10.4.2 K-Transfer 203
10.4.3 Multiobjective Shortest Path 208
10.4.4 Path Patching 209
10.5 Prototype and Experiments 211
10.6 Conclusions 219
References 220

Chapter 11: Mass Customization Manufacturing and Its Application for Mobile Phone Production *223*
11.1 Introduction 223
11.1.1 Definitions and Analysis 224
11.1.2 Literature Review 225
11.1.3 Industrial Practices 226
11.2 Mobile Phone Production Process Description 228
11.2.1 Mobile Phone Production Processes 228
11.2.2 Mobile Phone Production Modes 231
11.3 Mass Customization Manufacturing Solution 233
11.3.1 Main Manufacturing Phases of Mass Customization 233
11.3.2 Order Processing of Mass Customization 234
11.3.3 Quality Control of the Solution 238
11.3.4 Technical Architecture of the Solution 239
11.3.5 Practice Results of the Solution 241
11.4 Conclusions 244
Acknowledgments 244
References 244

Chapter 12: ACP Approach-Based Plant Human–Machine Interaction Evaluation *247*
12.1 Introduction 247
12.1.1 Background 247
12.1.2 Related Research 248
12.2 Artificial Human–Machine System 250
12.3 Experimental Environment 251
12.3.1 Overview of Boiler Plant Simulator 252
12.3.2 Assumed Malfunctions 255
12.3.3 Alarm System 255
12.4 Design of Computational Experiments 258
12.4.1 Failure–Symptom Bipartite Graph 258
12.4.2 Abnormal-State-Supervising Procedure 260
12.4.3 Task Decomposition and Workload Estimation 261
12.5 Expected Effects 262
12.5.1 Example of FDI Track 262
12.5.2 Example of Workload Estimation 263
12.5.3 HMI Evaluation and Improvement 263
12.6 Conclusions 264
References 264

Chapter 13: Cloud of Health for Connected Patients *265*
13.1 Introduction 265
13.2 Drivers for Change in Health Care 266
13.3 Applications 267
13.3.1 Expert Knowledge—Websites 267

13.3.2 Self-Help 269
13.3.3 SMS 269
13.3.4 Measuring Device Linked by Personal Health Assistant to Expert Systems 271
13.3.5 Medical Data on a SIM Card 273
13.3.6 Exercise and Rehabilitation 274
13.3.7 Links to Nutrition Information Expert Knowledge Systems 274
13.3.8 Epilepsy Alert 275
13.3.9 Body-Worn Sensors 275
13.4 Conclusions of Cloud of Health 276
13.5 Case Study of SMS Messaging in Health Promotion 276
13.6 Characteristics of SMS for Use in Healthcare Promotion 278
13.6.1 K1 Widespread Ownership of Mobile Phones and SMS Usage 278
13.6.2 K2 Convenience and Storage 279
13.6.3 K3 Personal and Private 280
13.6.4 K4 Social Communication 280
13.6.5 K5 Speed 281
13.6.6 K6 Cost 281
13.6.7 K7 Application Integration 282
13.6.8 K8 Ease of Administration 282
13.6.9 K9 Targeting 282
13.7 Conclusions of SMS for Use in Healthcare Promotion 283
References 284

Chapter 14: Construction of Artificial Grid Systems Based on ACP Approach 285

14.1 Introduction 285
14.2 ACP Approach 288
14.3 Complex Network Characteristics of Power Grids 291
14.3.1 Complex Network Theory 291
14.3.2 Complexity of Power Grids 293
14.3.3 Construction of Complex Power Grid Network Model 293
14.3.4 Some Results of Research on Power Grids Based on Complex Networks 294
14.4 Construction of Artificial Grid Systems 294
14.4.1 Artificial Grid Systems 295
14.4.2 Design and Construction of Artificial Grid Systems 296
14.5 A Case Study 300
14.6 Conclusions 302
References 303

Chapter 15: Influence of Electric Vehicles on After-Sales Service 305

15.1 Introduction 305
15.2 After-Sales Service in the Automotive Industry 307
15.2.1 Stakeholders of the Automotive Aftermarket 309
15.2.2 Typical Services in the Automotive Aftermarket 314

15.3 Changes Due to the Increasing Share of Electric Mobility 316
15.4 The Impact on Stakeholders 318
15.4.1 Decreasing Share of Mechanical and Moving Parts 318
15.4.2 Fewer Additional Units 319
15.4.3 Longer Service Intervals 320
15.4.4 Immature Battery Technology 320
15.4.5 Limited Self-Service Possibility 321
15.5 Future Perspectives 321
References 322

Chapter 16: Service Modeling Optimization and Service Composition QoS Analysis 325

16.1 Introduction 325
16.2 BPEL4WS-Based Modeling Optimization 327
16.2.1 Comparison of Modeling of SMEE and Mainstream Methods Based on BPEL4WS 327
16.2.2 Definition of SMEE 329
16.2.3 Research Method for Converting SMEE Model into BPEL4WS 329
16.2.4 Running Performance Evaluation for Generated BPEL4WS Model 330
16.3 Web Service Composition Quality Analysis with Stochastic Service Times ... 330
16.3.1 Problem Description 331
16.3.2 Analysis of the QoS of Each Kind of BPEL2WS Container 333
16.3.3 Analysis of the QoS of an Actual BPEL2WS Model 338
16.4 Conclusions 341
References 341

Chapter 17: Urban Traffic Management System Based on Ontology and Multiagent System 345

17.1 Introduction 345
17.2 Literature Review 348
17.2.1 Ontological Technology 348
17.2.2 Multiagent Technology 350
17.3 Ontology of Urban Traffic Management System 351
17.3.1 Road Network 351
17.3.2 Environment 356
17.3.3 Traffic Information 359
17.3.4 Traffic Facility 362
17.3.5 Vehicle 364
17.3.6 Algorithm 365
17.3.7 Time 368
17.4 Multiagent System Architecture 368
17.5 Conclusions 370
References 370

Index 373

CHAPTER 1

Overview of Service Science, Management, and Engineering

Zhen Shen, Dong Shen, Gang Xiong, and Fei-Yue Wang

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The economies of the world are shifting labor from agriculture and manufacturing sectors to service sectors, as measured by percentage of labor (jobs) (Maglio, Srinivasan, Kreulen, & Spohrer, 2006). This makes researchers pay more attention to the service sectors, and the concept of "Service Science, Management, and Engineering (SSME)" becomes more and more popular. IBM regards SSME as the next trend in college and professional education (International Business Machines Corporation [IBM], 2008). SSME is believed to play an important role in the future world. In this chapter, we try to explain the following: (1) what SSME is; (2) why it is important; and (3) how to apply SSME to several kinds of real world problems.

1.1 What Is SSME?

The term "Service Science, Management, and Engineering (SSME)" was introduced by IBM to describe an interdisciplinary approach to the study, design, and implementation of a services system to provide value for others by suitable arrangements of people and technologies (Hefley & Murphy, 2008; IBM, 2008; Spohrer & Maglio, 2008), where an elementary concept "service" is involved. There are various definitions of "service," for example, "…a result that customers want," "…sometimes referred to as intangible goods; one of their characteristics being that in general, they are 'consumed' at the point of production," "…consumer or producer goods that are mainly intangible and often consumed at the same time they are produced… service industries are usually labor-intensive," "intangible products," "a set of intangible activities carried out on [the customer's] behalf," "any act or performance that one party can offer to another that is essentially intangible and does not result in the ownership of anything," "invariantly and undeviatingly personal, as something performed by individuals for other individuals," "…a change in the condition of a person, or of a good belonging to some economic unit, which is brought about as the result of the activity of some other economic unit…," and "economic activities that produce time, place,

Service Science, Management, and Engineering.

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form, or psychological utilities" (Sampson & Froehle, 2006). We take the viewpoint of Vargo and Lusch and define "service" as the application of competences (such as knowledge and skills) by one entity for the benefit of another (Vargo & Lusch, 2004, 2006, 2008; Vargo, Maglio, & Akaka, 2008). Around the concept of "service," "science" means "what service systems are and how to understand their evolution," "management" means "how to invest to improve service systems," and "engineering" means "how to invent new technologies that improve the scaling of service systems" (Spohrer, Maglio, Bailey, & Gruhl, 2007).

In national economic statistics, the service sector usually refers to those that are not in the agriculture or manufacturing sectors. In contrast to providing goods in the agriculture and manufacturing sectors, knowledge and skills are provided from one party to another in the service sectors. Examples of service sectors are many, such as tailoring a suit for a customer, teaching a class, and consulting. It appears that the service sector plays an important role in the national economy while a country develops. According to the study by Spohrer and Maglio (2008), in the year 2003, 50% of the labor force of China was in agriculture, 15% in goods production, and 35% in services. When compared with the year 1978, the percentage change of the labor force of China in service sectors was increased by 191%. Nevertheless, in the United States, the labor forces in agriculture, goods production, and services were 3%, 27%, and 70%, respectively, in the year 2003. Over the past three decades, service sectors have become the largest part of most industrialized nations' economies (Spohrer et al., 2007). According to a report of the National Academy of Engineering of the United States (US National Academy of Engineering, 2003), the service sector accounted for more than 80% of the US GDP in the year 2003 (Spohrer et al., 2007).

With the rapid development of service economics, related topics on service deserve more and more study. This is why many researchers turn to develop a general theory for SSME. There is no doubt that SSME is important for our daily life. Here, we want to give more descriptions on some specific points, which may play a significant role in the research of SSME.

1.1.1 Information and Communication Technology

The first point that we want to emphasize here is about information and communication technology (ICT). It is believed that ICT will play an important role in SSME. ICT is often used as an extended synonym for information technology (IT), but it stresses the integration of telecommunications, computers, middleware, and necessary software, storage, and audiovisual systems. It is a term that includes any communication device or application, such as radio, television, cellular phones, and computer and network hardware and software. Because of the development of ICT, the spread of knowledge and skills becomes much faster and easier. The provision of service has low cost. One example is the search engine, which makes companies such as Google and Baidu very successful. Another example is the