

IEEE SOLI 2006

2006 IEEE International Conference on Service Operations and Logistics, and Informatics Proceedings



June 21-23, 2006

Shanghai, P. R. China



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Edited By

Robin G. Qiu, Ph.D.
General Conference Co-Chair

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GREETINGS FROM THE GENERAL CHAIRS

Welcome to IEEE SOLI 2006 and Shanghai, China!

Recent emphasis in business services has evolved from a more traditional labor-based business to sources of innovations and value creation. Intensive competition has forced companies to seek differentiators through business and technology innovations. The role of services science as a discriminator as well as its ability to impact value and profit has increased the focus on research and education of services. However, there remains a significant research and educational gap, which a co-evolution of industry with academics would help fill. The IEEE SOLI Conference is dedicated to accelerating the most relevant research and education in this pivotal area to develop the knowledge and skills required in a services-led economy. It is one of the first international conferences that integrates and promotes services sciences, management, and engineering research and education. This conference has selected 211 papers from over 340 submissions. We would like to thank all of you for your participation at this conference to collaborate and exchange outstanding research and educational works.

We are very grateful for the support of the IEEE Intelligent Transportation Systems Society, the Natural Science Foundation of China, the National Science Foundation of the United States of America, Services Science Global, IBM, Sun Microsystems, and Shanghai Jiao Tong University. Our thanks also go to our world-renowned speakers, Prof. Roland Rust, Prof. Richard Larson, Prof. Wei Zhang, Prof. Stephen Nash, Prof. Kathryn Stecke, Mr. Daniel Berg, Prof. Rajit Gadh, and Prof. François Sainfort. We are particularly grateful to Prof. Huizhang Shen, Program Chair, for his year-round hard work and leadership in organizing, preparing, and operating this conference. We would also like to thank the students from Penn State and Shanghai Jiao Tong University who spent long hours working with us to assure a smoothly-run conference. Last but not least, many thanks to all the paper reviewers. Without their hard work, we would not have been able to select such quality papers.

Our sincere gratitude goes to all the members of the Steering and Advisory Committees of this conference. And our deep thanks go to the many volunteers and staff members for the long hours, and all the hard work they generously gave to SOLI 2006. Finally, we would like to acknowledge the invaluable help and guidance we received from the Board of Governors of the IEEE Intelligent Transportation Systems Society.

Enjoy the conference and have a great visit in Shanghai.

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Plenary Speeches

1. *Understanding the Service Revolution*, Prof. Roland T. Rust, University of Maryland



Abstract: Service is creating a paradigm shift in marketing. This presentation provides the underlying causes of this paradigm shift and identifies the central role of technology. The implications of further technological development are explored and the consequences for the future of marketing are investigated.

Brief Biography: Roland T. Rust holds the David Bruce Smith Chair in Marketing at the Robert H. Smith School of Business at the University of Maryland, where he is Chair of the Marketing Department and is Executive Director of the Center for Excellence in Service. His lifetime achievement honors include the American Marketing Association's Gilbert A. Churchill Award for Lifetime Achievement in Marketing Research, the Outstanding Contributions to Research in Advertising award from the American Academy of Advertising, the AMA's Career Contributions to the Services Discipline Award, Fellow of the American Statistical Association, the Distinguished Marketing Scholar Award from SMA, and the Henry Latané Distinguished Doctoral Alumnus Award from the University of North Carolina at Chapel Hill. He has won best article awards for articles in Marketing Science, Journal of Marketing Research, Journal of Marketing (three times), Journal of Advertising, and Journal of Retailing, as well as MSI's Robert D. Buzzell Best Paper Award (twice). His book, *Driving Customer Equity* (written with Valarie Zeithaml and Katherine Lemon) won the Berry-AMA Book Prize for the best marketing book of the previous three years. He is the founder and Chair of the AMA's annual Frontiers in Services Conference, and was founding Editor of the Journal of Service Research. He is currently Editor of the Journal of Marketing. He has consulted with many leading companies worldwide, including such companies as American Airlines, AT&T, Chase Manhattan Bank, Comcast, Dow Chemical, DuPont, FedEx, IBM, Nortel, Procter & Gamble, Sears, Unilever, and USAA.

2. *Services Research in China*, Prof. Wei Zhang, NSF, China

3. *Services: The Other 75% of the Economy!* Prof. Richard Larson, President of INFORMS, MIT



Abstract: As nations grow and develop more as knowledge-based economies, services industries become a higher and higher fraction of the GDP. In the USA and some European economies, services comprise 75% of the GDP. While those figures do not yet represent most Asian economies, some of the fastest growing businesses in China, India and elsewhere in Asia are services businesses. In this presentation we focus on how a broadly-based engineering analysis of services, buttressed by principals of social sciences and management science, can lead to vastly improved designs and

operations of services industries. We provide as illustrations various services in health care, technology-enabled education (including e-learning) and catastrophe response (including natural disasters such as hurricanes and typhoons, earthquakes and influenza pandemics).

Brief Biography: Dr. Larson received his Ph.D. from MIT where he is Mitsui Professor in the Department of Civil and Environmental Engineering (CEE) and in the Engineering Systems Division (ESD). He is founding director of the Center for Engineering System Fundamentals (CESF). Much of his career has focused on operations research as applied to services industries, primarily in the fields of technology-enabled education, urban service systems, queueing, logistics and workforce planning. He is Immediate-Past-President of INFORMS, INstitute for Operations Research and the Management Sciences. He has served as consultant to many organizations including the World Bank, the United Nations, Rand Corp., the Kuwait Foundation for the Advancement of Science, Hibernia College, Hong Kong University, the U.S. Department of Justice, the U.S. Postal Service, and the City of New York. Dr. Larson served as Co-Director of the MIT Operations Research Center. He is a member of the National Academy of Engineering, an INFORMS Founding Fellow, and a recipient of the INFORMS President's Award, Lanchester Prize and its Kimball Medal.

From 1995 to 2003, Dr. Larson served as Director of MIT's CAES, Center for Advanced Educational Services. CAES brought technology-enabled learning to students living on campus and to those living far from the university, perhaps on different continents. His center produced an ambitious point-to-point distance learning program, the Singapore MIT Alliance. He has given lectures on the future of technology-enabled education in testimony before the House Committee on Science (Washington, D.C.) and in North and South America, Asia, Africa and Europe. Four years ago he created LINC, Learning International Networks Consortium, an MIT-based international project that has held three international symposia and sponsored a number of initiatives in Africa, China and the Middle East. From 1999 through 2004, Dr. Larson served as co-director of the Forum the Internet and the University.

4. *Service Operations & Logistics: Initiatives at the US National Science Foundation, Prof. Stephen G. Nash, Program Director of NSF, USA*



Abstract: The Service Enterprise Engineer program at the US National Science Foundation focuses on enterprises in the commercial service or public service sector. Research sponsored by the program extends the range of analytical and computational techniques addressed to service enterprise synthesis, design or operations. The speaker will outline the activities and goals of this program, highlighting research projects and topics related to service operations and logistics.

Brief Biography: Stephen Nash received a B.Sc. (Honours) degree in mathematics in 1977 from the University of Alberta, Canada; and a Ph.D. in computer science in 1982 from Stanford University. He is the Program Director for the Operations Research program at the National Science Foundation, on leave from George Mason University. Dr. Nash is a Professor of Systems Engineering and Operations Research in the School of Information Technology and Engineering, and is currently on leave from his position as Associate Dean of the School of Information Technology and Engineering. Prior to coming to George Mason University, he taught at The Johns Hopkins University. He has also had professional associations with the National Institute of Standards and Technology and the Argonne National Laboratory. His research activities are centered in scientific computing, especially nonlinear programming, along with related interests in statistical computing and optimal control. He has been a member of the editorial boards of *Operations Research*, *Computers in Science & Engineering*, the *SIAM Journal on Scientific Computing*, and the *Journal of the American Statistical Association*.

5. Using Mathematics to Solve Service Operations, Industrial, and Logistics Problems, Prof. Kathryn E. Stecke, University of Texas at Dallas, USA



Abstract: Mathematics has been called the language of science. Mathematics is used to solve many real-world problems in service operations, industry, logistics, the physical sciences, economics, social and human sciences, engineering, and technology, for example. We overview the many service, industrial, and logistics problems that have been solved using fuzzy logic technology, multiobjective metaheuristics, neural networks, tabu search, genetic algorithms, simulated annealing, mathematical programming, decision analysis, Petri nets, and queueing models. This overview could be useful for new faculty and Ph.D. students in Industrial Engineering, Operations Research, and Operations Management who are looking to solve some real problems. Future applications are also described.

Brief Biography: Dr. Kathryn E. Stecke teaches in Operations Management at University of Texas at Dallas. Previously she taught for 21 years at The University of Michigan Business School. She received an M.S. in Applied Mathematics, and an M.S. and Ph.D. in Industrial Engineering from Purdue University. She has authored numerous papers on various aspects of FMS planning and scheduling in numerous journals including The FMS Magazine, Material Flow, International Journal of Production Research, European Journal of Operational Research, IIE Transactions, IEEE Transactions on Engineering Management, Annals of Operations Research, Performance Evaluation, Management Science, Operations Research and several proceedings and book contributions. She is the Editor-in-Chief of both the International Journal of Flexible Manufacturing Systems and Operations Management Education Review. She is on the Editorial Board, Area Editor, or Associate Editor of many journals. She is Co-Chairperson (with Rajan Suri) of the First, Second, and Third ORSA/TIMS Conferences on Flexible Manufacturing Systems: Operations Research Models and Applications, held in Ann Arbor, Michigan in August 1984 (and 1986) and at MIT in 1989. She was Program Chair of INFORMS New Orleans in November 1995. She is Program Chair of INFORMS Seattle in October 2007 and is Plenary Chair of INFORMS San Francisco in October 2005. She was General Chair of the International INFORMS Conference in Maui in June 2001 and Program Chair of the

Intelligent Automated Manufacturing Conference in Dubai in March 2001. She's been an Adjunct Professor of the International Graduate School at the University of South Australia, Adelaide, since 1999. She served on the Board of Directors of INFORMS as Vice President from January 2003 to December 2004 and also served on the Board of Directors of INFORMS from January 1999 to December 2001. She spent months of 1997 at the Hungarian Academy of Sciences, Universiteit Groningen, and Pontificia Universidade Catolica do Rio de Janeiro, and 1996 at the Chinese University of Hong Kong. She spent part of 1989-1990 at the Fraunhofer Insitute in Stuttgart, part of 1987-1988 at Comau in Torino, Fall of 1985 at General Motors Research Laboratories, and Fall of 1984 at the Centre d'Etudes et de Recherches de Toulouse. She is a member of INFORMS, Decision Sciences Institute, POMS, and IFIP Working Group 5.7.

In February 2004, INFORMS compiled a list of 475 papers that have 50 or more citations from all papers published in the journal Management Science in the last 50 years. All of her Management Science papers are on this list. Then INFORMS selected 50 of these as those papers that "represented the most significant research" in the last 50 years. One of her papers is on that select list.

6. *IT as a Service*, Daniel Berg, CTO, Distinguished Engineer, Vice President & CTO Sun Services, Sun Microsystems



Abstract: As CTO of Sun Microsystem, Inc.'s Services business, Berg is seeing some significant shifts in the IT world. In this talk, he presents thought provoking themes that are driving the services business and concludes with the concept of "IT as a service." He asserts that the use and function of data centers as we know them today is changing as IT evolves to be a business asset, scaling technology to meet a customer's SLAs.

Berg notes the following four trends in IT:

- * Communitas as social software builders
- * Telemetry enabled innovation
- * Infrastructure Standards for operational maturity
- * Utility and Commodity Business Models

He views IT as a service that will evolve into networked containers and notes the trends that will shape applications of the future in regard to privacy, trust, and security.

Why delivering IT as a Service matters

- * Changes software economics, in trust models with suppliers
- * Application deployed on a network
- * Standardized, partner operated
- * Manufacturing applications: application assembly

Brief Biography: Daniel J. Berg is vice president and chief technology officer for global sales

and services at Sun Microsystems. In this position, Berg is responsible for the technical strategy and direction of Sun's services organization. Berg also holds the title of Distinguished Engineer. Berg has had a number of other technical and business roles at Sun, including positions in technical sales, professional services, engineering, and customer service.

Before joining Sun, Berg held positions at IBM and Honeywell. Berg is also best-selling author and has written a number of books on Sun technologies, including *Advanced Techniques for Java Developers*, *Multithreaded Programming with Java Threads*, and *Dot-Com & Beyond: Breakthrough Internet Based Architecture & Methodologies*, among others.

7. *Research on the Evaluative System of Service Quality*, Prof. Peng Tian, Shanghai Jiao Tong University



Abstract: Evaluative System of Service Quality plays an important role in Service Science. How to use the contemporary theories about human-machine interactivity, technology accept model (TAM) into study of service quality, user satisfaction and user loyalty of service field in China and combined the approaches of conceptual model construct with empirical testing, we obtain a deep insight of the formation mechanisms, antecedents and consequences of above-mentioned concepts.

Brief Biography: Tian Peng received a Ph.D. in autocontrol engineering in 1993 from China Northeastern University and completed the postdoctoral research program in 1996 from Shanghai Jiao Tong University. He is the Secretary-general for Systems Engineering Program Committee of China Automatization Association and Director of China Systems Engineering Association. Dr. Tian Peng is a Professor of Management Science & Engineering in the School of Management and is the Director of Research Center for Applied Statistics and Decision Making, and Executive Dean of Management School in Antai College of Economics & Management, Shanghai Jiao Tong University. His research activities are centered in scientific computing, optimization, applied statistics and decision making.

Visionary Panel Speeches

1. *RFID – The Wireless Internet of Artifacts*, Prof. Rajit Gadh, University of California, Los Angeles



Abstract: The last twenty-five years have marked the coming of the personal computing and communication industry. Result: Individuals now carrying devices that are personal, mobile and always connected to the Internet. It is my belief that in the next twenty-five years, such information carrying and disseminating capability will extend from the "computing/communication devices" to real-world non-computing artifacts that we use in every day life such as clothes, utensils, furniture, packages, etc. These artifacts will collectively form what I refer to as the "Internet of Artifacts", an idea whose time has come. Like with any grand challenge, these artifacts will need to be uniquely identified (using technologies such as RFID), they will need to communicate with each other (wirelessly) and will gradually have the ability to take intelligent decisions first individually and then collectively.

At UCLA's WINMEC (Wireless Internet for the Mobile Enterprise Consortium), the Wireless "Internet of Artifacts" notion is being explored via a project called WinRFID (<http://winmec.ucla.edu/rfid>) -- which is the first generation of our implementation of this idea. RFID or Radio Frequency Identification is a technology that can embody the identity and other related information of an artifact within a chip called a tag that has no power source and make such information available to an RFID transceiver when the tag receives the RF transmission and its coupled energy. RFID tags are expected to eventually be embedded into every daily-life artifact. At UCLA, we are developing the WinRFID Middleware that allows efficient, intelligent and optimized networking and management of RFID readers, tags and sensors at the edge of the network. The WinRFID middleware is currently being used for several research and industrial-led projects at UCLA-WINMEC that include securing assets, asset tracking, managing object shipments in supply chains, factory wireless networks, etc.

Brief Biography: Dr. Rajit Gadh is a Professor at the Henry Samueli School of Engineering and Applied Science at UCLA where he heads the Wireless Internet for Mobile Enterprise Consortium (<http://winmec.ucla.edu>) of which major companies including Intel, HP, Sun, Siemens, Oracle, Computer Associates, Northrop Grumman, Hughes Network Systems, Qualcomm, TCS, Satyam, ISMB-Italy and several others are supporting members. Dr. Gadh works in the areas of Mobile/Wireless Internet, multimedia/graphics, RFID-middleware, RFID-sensor interface definitions, wireless enterprise security, multi-media content distribution over the internet, and multi-media over UWB, within the Wireless Media Lab (<http://wireless.ucla.edu/wml>). He has over 100 papers in journals, conferences and technical magazines.

He has a Doctorate from Carnegie Mellon University, a Masters from Cornell University and a Bachelors from IIT Kanpur. He has taught as a visiting researcher at UC Berkeley, has been a Assistant, Associate and Full Professor at University of Wisconsin-Madison, and did his sabbatical as a visiting researcher at Stanford University for a year. Prior to his academic career,

he has worked for two software startup companies. He has won several awards from NSF (CAREER award, Research Initiation Award, NSF-Lucent Industry Ecology Award, GOAL-I award), SAE (Ralph Teetor award), ASME (Kodak Best Technical Paper award), AT&T (Industrial ecology fellow award), Engineering Education Foundation (Research Initiation Award), etc., and other accolades in his career.

2. *Transforming Healthcare: Challenges and Opportunities*, François Sainfort, Georgia Institute of Technology, Director, Institute for Health Systems Engineering, Associate Dean for Interdisciplinary Programs, College of Engineering, William W. George Professor of Health Systems, Wallace H. Coulter Department of Biomedical Engineering



Abstract: Dr. Sainfort will present challenges and opportunities related to applying systems engineering and management sciences approaches to transforming health care delivery systems from a current ineffective, reactive, disease-focused system to a future cost-effective, proactive, health- and wellness-focused system. Dr. Sainfort will provide background on the healthcare industry, present possible solution approaches and describe challenges and opportunities.

Brief Biography: François Sainfort is the Associate Dean for Interdisciplinary Research Programs in the College of Engineering, the Director of the Health Systems Institute, and the William W. George Professor of Health Systems in the Wallace H. Coulter Department of Biomedical Engineering at Georgia Tech and Emory University School of Medicine. Dr. Sainfort holds joint faculty appointments in the School of Industrial and Systems Engineering and in the College of Management.

Dr. Sainfort's research and expertise focus on medical decision making under risk and uncertainty, health outcomes measurement and monitoring, and health-related performance measurement and analysis. Dr. Sainfort has received research funding from the federal government – the Agency for Healthcare Research and Quality, the Health Care Financing Administration, the National Institute of Aging, the National Library of Medicine, the Centers for Disease Control, the National Science Foundation, and the Department of Defense – as well as funding from industry. He served as principal investigator on more than \$12 million in contracts and grants.

Dr. Sainfort has published over 125 refereed publications, is a current or past editorial board member for several leading journals, and periodically reviews manuscripts for many other journals. He reviews research proposals for the National Science Foundation, serves on study sections and special review panels for the Agency for Healthcare Research and Quality, several programs at the National Institutes of Health, and the Department of Defense.

Dr. Sainfort is an expert consultant for the health care industry. His clients include health care delivery organizations, medical devices companies, clinical laboratories, pharmaceutical companies, insurance companies, and information technology companies.

Table of Contents

Services Design, Engineering, Operations, and Innovations

1	Prognostics in the Control of Logistics Systems <i>by L'opez De La Cruz, Adriana M.; Veeke, Hans P.M.; Lodewijks, Gabriel</i>	1
2	The Quality of Design Team Factors on Software Effort Estimation <i>by Wu, Simon I. K.</i>	6
3	A Cargo Transportation Security Tool <i>by Zhang, Ruijian</i>	12
4	Inventory Classification Enhancement with Demand Associations <i>by Liiv, Innar</i>	18
5	Service Innovation in Organizational Contexts: An Agent-Oriented Methodology <i>by SU, Ning; Levina, Natalia</i>	23
6	Reliable Description and Interactive Management of User Preferences in MPEG-21 <i>by Chen, Qiang; Chen, Hexin; Moussa, M. Bello; Liu, Shao; Sang, Aijun</i>	29
7	E-policy Making: A System Approach Based on Evaluating ICT's Impacts <i>by Mohamadian, Ayoob; Elahi, Shaban; Ghasemzadeh, Fereidoun</i>	34
8	Detail Service the Necessary Path for Re-engineering the Chinese Logistic Enterprises' Competitive Advantage in the Low Margin Age <i>by Liu, Weihua; Ji, Jianhua; Li, Lu</i>	40
9	Task Scheduling Using Parallel Genetic Simulated Annealing Algorithm <i>by Zheng, Shijue; Shu, Wanneng; Gao, Li</i>	46
10	Hurst Exponent Estimation Based on Modified Aggregated Variance Method <i>by Bao, Guo-ping; Ying, Yi-rong</i>	51
11	Service Reliability Analysis on Logistics Network <i>by Yi, Chun-guang; Ju, Song-dong</i>	57
12	The Design of Distribution System in the Environment of Time-based Competition <i>by Li, Yanhui; Shen, Dan; Ma, Shihua</i>	62
13	Study on Inventory in Supply Chain of South-to-North Water Transfer under Asymmetric Information <i>by Wang, Huimin; Zhu, Jiulong; Chen, Junfei</i>	68
14	Study of Hospital Management Based on Hospitalization Process Improvement <i>by Qi, Ershi; Xu, Gang; Huo, Yanfang; Xu, Xia</i>	74
15	Study on Methods of Interest Allocation for Participant Enterprises in Joint Distribution <i>by Juan, Zhicai; Fu, Zhongning; Wu, Fang</i>	79

16	Complementing AHP with Habitual Domains Theory to Identify Key Performance Indicators for Service Industry <i>by Chen, Tai-Liang; Lin, Kuo-Liang</i>	84
17	A Control System Designed to Address the Intangible Nature of Service Risks <i>by Dubosson, Magali; Fragnière, Emmanue; Milliet, Bernard</i>	90
18	Identifying the Key Success Factors of the TV Shopping Industries in Cross-Straits <i>by Pan, Ming-Chuan; Wu, Ji-Ting</i>	96
19	Simulation and Optimization of the Hospital Registration Process Using MedModel <i>by Su, Qiang; Yao, Xiaoyun</i>	102
20	Research On Loan-to-value Ratios of Inventory Financing <i>by Li, Yixue; Xu, Yu; Feng, Gengzhong; He, Guoliang</i>	107
21	Satisfaction and Service Contexts: The Mediation of Consumption Goals <i>by Wang, Charlie, C.L.</i>	113
22	Research on Classroom-Teaching Quality and Its Evaluation Index System of Higher Education <i>by Zeng, Zhenxiang; Huang, Chunping; Yue, Dawei</i>	118
23	Improvement to One Company's Outsourcing Glass Bulb In-warehouse Logistics and its Revelations <i>by Liu, Shulin; Ju, Zhihua; Liu, Xuejun; Liu, Jin</i>	123
24	Analysis of Logistics Financing Business Innovation in China <i>by Feng, Gengzhong; Su, Xiao</i>	127
25	Applying Rough Sets Theory to Corporate Credit Ratings <i>by Wang, Tien-Chin; Chen, Ying-Hsiu</i>	132
26	Management Pattern Exploration and Case Study of Highway Investment Control in Chinese Mountainous Area <i>by Wang, Jianping; Wang, Yuanxiao; Lü, Genyan</i>	137
27	Study of the Issues and Strategies on Freeways of China's West and Its Countermeasures <i>by Yang, Weihui; Wang, Jianping; Bai, Liang.</i>	145
28	A Game Theoretical Approach to Production Competition in a Duopoly Market <i>by Li, Chen; Zhang, Ying</i>	148
29	Analysis of the Dynamic Relation between Logistics Development and GDP Growth in China <i>by Liu, Wei; Li, Wenshun; Huang, Wendy</i>	153
30	FMEA Based Potential Risk Analysis of Lower Cost Region Sourcing <i>by Zhang, Jie; Zhu, Qiong</i>	158
31	Differentiated Lead Time and Price Quotation Management for Service Providers <i>by Zhao, Xuying; Stecke, Kathryn E.; Prasad, Ashutosh</i>	164
32	Analysis of One Hospital Using Simulation	170

	<i>by Ju, Yanbing; Wang, Aihua; Zhu, Fengchun</i>	
33	Study on Non-State-owned Capital's Involvement in Expressway <i>by Lü, Genyan; Wang, Jianping; Wu, Qizhi</i>	175
34	The Challenges for The Adoption of M-Health <i>by Yu, Ping; Wu, Ming X.; Yu, Hui; Xiao, Guo Q.</i>	181
35	Research on an Evaluation Model of Technique Innovation <i>by Zheng, Jinrong; Xu, Fuyuan; Hou, Yong</i>	187
36	Identifying Environmental Factors Affecting Bank Branch Performance using Data Envelopment Analysis <i>by Yang, Zijiang</i>	192
37	Modeling Business Diagnosis with Dynamic Workflow Construction <i>by Espinosa, Enrique; Bueno, Abel; Molina, Martín; Muñoz, Jesús</i>	197
38	Developing a Practical Competency Curriculum for Department of Marketing and Logistics Management in Technical University <i>by Chen, Su-Chang</i>	203
39	Evaluation of Public Service Maturity of E-government: A Case in Chinese Cities <i>by Li, Ying</i>	209
40	Software as Service Pricing: a Game Theory Perspective <i>by Tian, Chunhua; Zheng, Yan; Jiang, Zhongbo; Cao, Rongzeng; Sun, Wei; Ding, Wei</i>	215
41	Information Service Systems for Visually Impaired People <i>by Jiang, Zhe; Zhu, Xiaoyan</i>	219
42	A Study of E-Commerce Business Satisfaction Model to Measure E-Commerce Success in Service SMEs <i>by Gide, Ergun; Wu, Ming X.</i>	223
43	The Key Strategies for E-Commerce Success in Service SMEs in China <i>by Gide, Ergun; Wu, Ming X.</i>	229
44	Research on the Innovation of Supply Chain Management Based on the Enterprise's Strategic Alliance <i>by Feng, Ren De; Liu, Ze Jun</i>	235
45	Improvement of Government Organization Service Management <i>by Liu, Gang</i>	239
46	Knowledge Deployment and Knowledge Network: Critical Factors in Building Advantage of Business Incubator Knowledge Service <i>by Chen, Zhigao; Ma, Ling; Chang, Xiangyun</i>	244
47	Development of Hospital Information System Based on .Net Platform <i>by Rong, Zhijun; Xiao, Jinsong; Feng, Jie; Shi, Xinzhu</i>	250
48	A Network-Based Framework and Its Operation Model of Archival Knowledge Management	254

	and Service System <i>by Chen, Zhigao; Li, Ying; Li, Liqiao</i>	
49	Container Berth Expansion Planning with Dynamic Programming and Fuzzy Set Theory <i>by Jin, Chun; Gao, Peng</i>	260
50	Transitioning to Software as a Service: Realigning Software Engineering Practices with the New Business Model <i>by Olsen, Eric R.</i>	266
51	Identification and Promotion Strategy of Core Competency of Non-state-owned High-tech Enterprises based on Innovative SWOT Matrix ——A Case Study on Shanghai Garlen Environment Protection Company <i>by Xu, Fei; Chen, Jie; Hou, Jianrong</i>	272

Logistics & Supply Chain Management

52	Analysis on Purchase Expenses Based on E-business and Sole Supplier <i>by Cui, Herui; Zheng, Jiangbo</i>	278
53	Optimization of Fuzzy Inventory Model with Backorder <i>by Li, Qunxia; Zhang, Qun; Shen, Haifeng</i>	282
54	An Integrated JIT Inventory Model for Supply Chain Management: Single Supplier-Single Buyer with Multiple Product <i>by Mehdizadeh, Esmaeil; Tarokh, Mohammad J.</i>	288
55	Reverse Logistics Model for Mobile Phone Industry <i>by Chan, Felix T. S.; Chan, H. K.; Zhang, J.</i>	294
56	Supply Chain Risk by Structure <i>by Zhang, Cunlu; Huang, Peiqing</i>	300
57	Coordination and Information Sharing in a Closed-Loop Supply Chain with Two-Part Tariff <i>by Ge, Jing-yan; Huang, Pei-qing; Wang, Zi-ping</i>	304
58	Modeling and Analysis of Container Terminal Logistics System by Extended Generalized Stochastic Petri Nets <i>by Zhang, Hailin; Jiang, Zhibin</i>	310
59	A Study on Returns Logistics Operating Mode in E-business Environment <i>by Feng, Changli; Xie, Lili</i>	316
60	Supply Chain Coordination Using Role Based Mobile Agent <i>by Tarokh, M.J.; Bagherzadeh, M.; Kahani, N.</i>	322
61	A Refined Multi-path Traffic Assignment Method Considering Delayed Response <i>by Ma, Junlai; Wang, Wei; Zhu, Haidong; Bian, Yang</i>	328
62	Supply Chain Sub-Coordination with Options in Two Different Markets with Transaction Cost	334

	Considered	
	<i>by Wang, Ziping; Huang, Peiqing; Yao, Dong-Qing</i>	
63	Developing a Modern Distribution Chain: A Three-Pronged Approach	340
	<i>by Davidrajuh, Reggie; Ma, Hongze</i>	
64	Logistics Outsourcing in China: A Supplier Perspective	346
	<i>by Wu, Yen-Chun Jim; Peng, Yiu-Ming</i>	
65	A Multi-Period Inventory Model of Component Commonality with Lead Time	352
	<i>by Lin, Yong; Ma, Shihua; Liu, Liming</i>	
66	A Principal-Agent Approach to Incentive Mechanisms in Supply Chains	358
	<i>by Zhang, Ying; Li, Chen</i>	
67	A Grammar-Based Modeling of Supply Chain Process	364
	<i>by Yan, Jianyuan; Qin, Fan; Yang, Jian; An, Liping; You, Dapeng</i>	
68	Key Determinants of Performance Assessment for U.S. TPL: DEA and Cluster Analysis	370
	<i>by Cheng, Ming-Jen; Wu, Yen-Chun Jim</i>	
69	DISPDESK: A Logistic Constraint Programming System for Construction Machinery	376
	<i>by Zheng, Yujun; Yang, Junwei; Zhu, Yuling; Xue, Jinyun</i>	
70	Modeling and Simulating for A Distribution System Based on Fuzzy Systems to Forecast Demand	382
	<i>by Gao, Jun-jun; Wang, Ying-jun; Hu, Le-jiang</i>	
71	An Agent Based Fault Diagnosis Support System and Its Application	388
	<i>by Hu, Daiping; Xu, Weiguo; Dou, Huiming; Qian, Wei</i>	
72	A Set-based Scheduling Problem for Square Rack Automated Storage and Retrieval Systems	393
	<i>by Lee , H. Felix; Chung, Eunyong</i>	
73	Integrated Facility Location and Supplier Selection Decisions in a Distribution Network Design	399
	<i>by Tanonkou, Guy A.; Benyoucef, Lyès; Xie, Xiaolan</i>	
74	Exact and Approximation Algorithms for the Loader Problem	405
	<i>by Chen, Feng; Tang, Guochun</i>	
75	Study of Inventory Strategies for Recyclable Parts of Aviation Material with Limited Inventory Capacity	411
	<i>by Xie, Chunxun; Yao, Hongguang</i>	
76	Risk Management in Chemical Industry Supply Chain	415
	<i>by Liu,Liping; Ji, Jianhua; Fan,Tijun; Qi, Lili; Wu, Zhe</i>	
77	Supplier as a Newsvendor: An Analysis of Pull Contract	419
	<i>by Chang, Shiyan; Wu, Qizong</i>	
78	Supply Chain Management Information Systems Critical Failure Factors	425
	<i>by Tarokh, Mohammad Jafar; Soroor, Javad</i>	

79	Investigating Supplier Selection using Repertory Grid Technique <i>by Lin, Xiaoli; Purchase, Sharon</i>	432
80	Maintenance Logistics in the Dutch Dredging Industry <i>by Veenstra, Albert W.; Zuidwijk, Rob; Geerling, Bart</i>	436
81	Third Party Logistics Services Usage: A Case Study of Medium and Large Scale Chinese Firms <i>by Yan, Xiu-xia; Wang, Kan-chang; Sun, Lin-yan</i>	442
82	Supply Chain Simulation Methods <i>by Tarokh, M. J.; Golkar, M.</i>	448
83	DEA-Based Measures on the Operational Efficiency of the Third-party Logistics Providers in China <i>by Zhou, Gengui; Xu, Chao; Cao, Zhenyu; Cao, Jian</i>	455
84	The Logistics Cost of Two Distribution Patterns: A Case Study <i>by Li, Yanhui; Tang, Jianyu; Ma, Shihua</i>	460
85	Modeling and Values of Vendor Managed Inventory in the Retail Supply Chain <i>by Xie, Meiping; Olson, David L.</i>	465
86	Large-System's Harmonious Control and Applications of Supply Chain Operation <i>by Liang, Xiaobei; Zhu, Daoli; Tang, Bingyong</i>	471
87	A Heuristic Algorithm Based on DBR and MAS for Solving Container Loading Problem <i>by Liu, Yuan; Tian, Yajie; Sawaragi, Tetsuo</i>	476
88	Relational Analysis of Causes of Bullwhip Effect in a Multi-layer Model <i>by Fan, Lu; Zhou, Yinhua</i>	482
89	Analyzing Institutions related to the Logistics Enterprises <i>by Chen, Xiangdong; Juan, Zhicai</i>	488
90	Value Added on Food Traceability: a Supply Chain Management Approach <i>by Wang, Xiaojun; Li, Dong</i>	493
91	Reverse Logistics of China's Publishing Industry- AHP Analysis <i>by Wu, Yen-Chun Jim; Cheng, Wei-Ping</i>	499
92	Bullwhip Effect in Supply Chain System Based on Traditional Internet /WSRF in Grid Environment <i>by Kang, Shiyong; Kang, Yan; Li, Yongxiang</i>	505
93	Analysis of Mobile Agents considering the Fan Out --Mobile Agents for Autonomous Logistics <i>by Becker, Markus; Sayyed, Gulshanara; Wenning, Bernd-Ludwig; Görg, Carmelita</i>	511
94	Improve Yield in Public Transport -- A Focus on ICT Capability <i>by Li, Ting; Heck, Eric van; Vervest, Peter; Rooijmans, Paul</i>	516
95	The Approach of Automated Guided Vehicle Systems	522

	<i>by Schulze, Lothar; Wüllner, Alexander</i>	
96	Reliable and Invulnerable Supply Networks <i>by Ludema, Marcel W.</i>	528
97	Facility Layout Optimization with Stochastic Logistic Flows <i>by Liu, Fei; Dong, Ming; Hou, Forest; Chen, Feng</i>	534
98	Applications of Workflow in Supply Chain Management: A Case Study <i>by Sun, Dapeng; Zhang, Xiaoping; Yu, Ming</i>	540

Services Marketing & Sustaining

99	The Impact of Switching Barriers on Customer Loyalty in Professional Service Contexts <i>by Chen, Mei-Fang; Wang, Ling-Huei</i>	545
100	A Research on Improvement of Customer Service Systems in Mobile Telecommunication Enterprises: a Knowledge Classification Perspective <i>by Wang, Keyi; Qi, Liyun; Zhong, Qi</i>	551
101	Enhancing Service Quality Through Integrated Services Marketing <i>by Maritz, Alex</i>	557
102	Female Consumer Behavior in a Banking Environment <i>by Lin, Tzyy-wen; Yang, Hao-erl</i>	564
103	Relationship Marketing in Virtual Community: Antecedents and Consequences <i>by Chen, Liang; Jiang, Ling</i>	570
104	Brand Equity Management Based on Ability <i>by Zhuang, Hui; Gao, Song</i>	576
105	Consumer Choice of Digital Music Services from Quality Perceptions <i>by Kwong, SzeWan; Park, JungKun; Yang, Sujin</i>	581
106	Demand Control Chart <i>by Paik, SiHyun; Rim, SukChul</i>	587
107	The CRM Model Design Based On Rough Sets And Cluster <i>by Guan, Hongbo; Yang, Baoan</i>	593
108	An Equilibrium Analysis of Distribution Channel with Consideration of Advertising Competition <i>by Wang, Lei; Dai, Gengxin; Yu, Qingdong</i>	597
109	An Operational Model of Closed-loop Logistics Based on the End-customer's Willingness <i>by Ji, Jianhua; Gu, Qiaolun</i>	603
110	Why Customers Stay: An Analysis of Service Quality and Switching Cost on Choice Behavior using a Catastrophe Model <i>by Feng, Cheng-Min; Huang, Yu-Kai</i>	609

111	The Fixed Routes Assignment Considering Fluctuant Customer Demand <i>by Chiang, Chih-Ping</i>	615
112	The Research of SERVQUAL Instrument Applying in Chinese Higher Education <i>by Zhao, Yang; Liu, Yan-ping; Tan, Jie</i>	621
113	Measuring Customer Satisfaction Based on Neural Networks Partial Least Squares Approach <i>by Liu, Yan; Zhou, Changfeng; Chen, Yingwu</i>	627
114	Brand Equity and CRM: The Dual Roles of Corporate Reputation in Chinese Context <i>by Wang, Yonggui; Kandampully, Jay; Shi, Guicheng</i>	632

Services Management & Manufacturing

115	The Chinese Commercial Bank's Operational Risk Measurement Model on IE's Continuous Improvement <i>by Hu, Dan; Zhang, Chen</i>	638
116	Multi-agent Modeling and Shop-Scheduling of the Manufacturing Enterprise Logistics <i>by Chen, Yong; Lin, Feilong; Bi, Na</i>	644
117	Assets Specificity, Joint New Product Development and Relationship Performance <i>by Sun, Pi-Chuan</i>	649
118	Study on Integrated logistics Network Model and Network Design for Waste Electrical and Electronic Equipment <i>by Chang, Xiangyun; Huo, Jiazhen; Chen, Shiang</i>	654
119	Service Delivery Lead Time Model Based on Customer Demand Characteristics <i>by Liu, Lei; Luo, Hua; Tang, Xiaowo</i>	659
120	Study on Service Styles and Payoff Pattern of Listed Park Companies <i>by Huo, Yanfang; Qi, Ershi; Xu, Gang; Yang, Xiaofeng; He, Shuguang</i>	664
121	Using Genetic Algorithm for Better Route Arrangement - A Case of Taiwan Pelican Express Company <i>by Yang, Cheng-Liang; Chen, Yu-Kun</i>	669
122	An Analysis of Optimal Capacity under Three Different Scenarios <i>by Wen, Tao; Huang, Peiqing</i>	674
123	The Present State of and a Suggested Inserting Point for Biodiesel Production Industrialization in China <i>by Hou, Yong; Huang, Luke H.; Xu, Fuyuan</i>	679
124	Study of the Shifting Production Bottleneck: Possible Causes and Solutions <i>by Lu, Jiansha; Shen, Miaomiao; Lan, Xiuju</i>	684
125	Optimization of Planning and Scheduling for Phosphor-Chemical Enterprises <i>by Fan, Tijun; Li, Hongyu; Xi, Daizhao</i>	689

126	AHP based Research on Segmentation Method of Customer's Value in Aviation Cargo Transportation <i>by Huang, Jianwei; Li, Cheng</i>	696
127	Study on Producer Logistics Service and Its Outsourcing from Manufacturing Firms: a Perspective of Industrial Cluster <i>by Liu, Wei; Cui, Aiping</i>	699
128	A Research into the Recycling System of Waste Electrical and Electronic Equipment in China <i>by Zhong, Yongguang; Yu, Qingdong; Wu, Peng; Wang, Guohong</i>	705
129	A Hierarchical Planning and Scheduling Framework for TFT-LCD Production Chain <i>by Lin, James T.; Chen, Tzu-Li; Lin, Yen-Ting</i>	711
130	Research on Information Service System for High-Tech SMEs <i>by Song, XinPing; Ding, YongSheng; Cao, RuZhong</i>	717
131	An Application Based on K-Means Algorithm for Clustering Companies Listed <i>by Ye, Qian</i>	723
132	Single Machine Scheduling with Common Due Date Based on PSO Integrated with Heuristics <i>by Wu, Xue-Jing; Zhou, Hong; Tan, Xiao-Wei</i>	728
133	Fundamental Behavior of Holonic System <i>by Sugiyama, Shigeki; Tharumarajah, Ambalavanar</i>	734
134	Management System of Outsourcing: Protection of Core Competence Perspective <i>by Wu, F.; Liu, C.; Li, P.P.</i>	740
135	A Cooperative Coevolutionary Algorithm with Application to Job Shop Scheduling Problem <i>by Zhou, Hong; Wang, Jian</i>	746
136	Statistical Process Control for Multistage Manufacturing and Service Operations: A Review <i>by Tsung, Fugee; Li, Yanting; Jin, Ming</i>	752
137	Scheduling Unrelated Parallel Machines to Minimize Total Weighted Tardiness <i>by Na, Dong-Gil; Kim, Dong-Won; Jang, Wooseung; Chen, F. Frank</i>	758
138	Fuzzy Theory and AHP Based Manufacturing Execution Systems (MES) Vendor Service Quality Evaluation Method Study <i>by Liang, Chao; Li, Qing</i>	764
139	An On-line Probabilistic Paradigm for Optimal Disassembly Planning <i>by Tang, Ying; Renner, Peter</i>	770
140	Influence of Different Forecasting Modes on Automobile Manufacturing Supply Chain <i>by Wang, Juxiang; Ren, Lijuan; Chen, Changju; Li, Guozheng</i>	775
141	The Method of Module Partition for Product Family Structure with Applications <i>by Xu, Yuqing; Xiong, Lihua; Wang, Yunfeng</i>	780
142	Analysis on the Costs of IT-Outsourcing <i>by Gan, Weihua</i>	785

143	Trust Issues in Service Oriented Environment <i>by Hussain, Farookh Khadee; Chang, Elizabeth; Dillon, Tharam S.</i>	790
144	An Equivalent Condition of Two-Machine System Scheduling With Robustness Under A Class of Linear Perturbation <i>by Ma, Jun; Yang, Qiu</i>	794
145	On Periodic Stability For A Class Of Process Perturbation And Non-Blocking Control System <i>by Yang, Qiu; Ma, Jun</i>	798
146	A Novel Embedded Conductive Detection System for Intelligent Conveyor Belt Monitoring <i>by Pang, Yusong; Lodewijks, Gabriel</i>	803
147	Research on Key Factor Method and Application of Brand Structure Selection <i>by Gu, Feng; Huang, Xiaohe</i>	809

Information Technology, Services, and Systems

148	SCM Security Solution Based on SSL Protocol <i>by Liu, Lanjuan</i>	814
149	Application of Data Warehouse Technique in Educational Decision Support System <i>by Dong, Ping; Dong, Junjun; Huang, Tiansheng</i>	818
150	Quality Services Need Quality Website: An Evaluation of Three Official World Expo Home Pages Using Web Diagnostic Tools <i>by Shi, Yuquan</i>	823
151	A Study of Logistics System Model Based on Multi-Agent <i>by Wang, Yan; Guo, YinZhang; Zeng, JianChao</i>	829
152	A Method to Evaluate Security Performance of Mobile Agent System <i>by Wang, Suzhen; Wang, Jiazhen; Peng, Deyun</i>	833
153	An Improved Algorithm of the Optimization Control Problem of Loss Systems <i>by Cai, Huaiping; Bu, XianJin; Chen, Yingwu</i>	839
154	The Effect of Information Technology on E-commerce and E-marketing in Iran <i>by Sarani, Ahmad; Noura, Abbas Ali; Akbari, Zahra Nejad</i>	845
155	Intelligent Anti-Money Laundering System <i>by Gao, Shijia; Xu, Dongming; Wang, Huaiqing; Wang, Yingfeng</i>	851
156	Knowledge-based System for Managing Business Processes <i>by An, Liping; Yan, Jianyuan; Wang, Na; Zhang, Lu; Yang, Jian</i>	857
157	Towards A Unified View of Service-Oriented Web <i>by Kumar, Pushpa; Song, Guanglei; Zhang, Kang</i>	862
158	Data Clustering using Hybridization of Clustering Based on Grid and Density with PSO	868

	<i>by Shan, Shi M.; Deng, Gui S.; He, Ying H.</i>	
159	The Design and Its Achieving Method on Multi-Dimension Data Warehouse of Medical Waste Management <i>by Huang, Chunping; Zeng, Zhenxiang; Yue, Dawei</i>	873
160	Collaboration E-business Model for the Dealer <i>by Zhang, Ding; An, Jingwen; Cheng, Zhongqing</i>	878
161	A Purchasing Sequences Data Mining Method for Customer Segmentation <i>by Wang, Hai; Wang, Shouhong</i>	883
162	Utilizing Mobile Web Services for Supply Chains <i>by Luo, Jianhong</i>	887
163	Research and Realization of Information Exchange and Share Platform for Municipal Government <i>by Li, Huaiming; Wang, Yanzhang; Ding, Feng; Ma, Tian</i>	893
164	Rule-based Reasoning in Onboard Devices: An Intelligent Route Guidance System <i>by Guo, Wu B.; Hu, Xiang P.; Liu, Jia</i>	897
165	IT Organizational Integration : Innovation for E-Business <i>by Huang, Jie</i>	902
166	Scheduling of Scientific Workflows using Niche Pareto GA for Grids <i>by Benedict, Shajulin; Vasudevan, V.</i>	908
167	Knowledge Procurement Strategy of Firms: Collaboration with Public R&D Institutes <i>by Shichijo, Naohiro; Shimizu, Satoshi; Nakajima, Kazuto; Baba, Yasunori</i>	913
168	E-business and Information Integration in Supply Chain Management <i>by Zhao, Xiaofeng; Zhao, Hui; Hou, Jianrong</i>	919
169	Image Semantics Segmentation Using Watershed Algorithm <i>by Miao, Chengliang; Xie, Shengli; Yu, Weiyu</i>	925
170	A Model of Structural Semantics of Image <i>by Yu, Weiyu; Jiang, Yuanjiao; Yu, Yinglin</i>	931
171	Study on Multistage Decision-Making Problem with Transiently Chaotic Neural Network for Dynamic Selection of Composite Web Services <i>by Gao, Yan; Dai, Yu; Zhang, Bin; Yang, Lei</i>	936
172	Reward-based Peer-to-Peer Digital Cinema Distribution Model <i>by Nakaizumi, Takuya; Sonehara, Noboru</i>	942
173	Feature Selection and Weighting Method Based on Similarity Rough Set for CBR <i>by Jin, Tao; Shen, Huizhang</i>	948
174	The Coordination Mechanism of Inter-Organizational Transaction in Electronic Commerce Environments <i>by Liu, Zhenyu; Yu, Yongjun</i>	953

175	The association ends at the basis of a formal validation <i>by Bouabana-Tebibel, Thouraya; Belmesk, Mounira</i>	959
176	Robust Feedback Linearization Control for a Non Linearizable MIMO Nonlinear System in the Presence of Model Uncertainties <i>by Karimi, Hamid Reza; Jahed Motlagh, Mohammad Reza</i>	965
177	Reliability of RFID in Logistic Systems <i>by Lodewijks, G.; Veeke, H.P.M.; L'opez De La Cruz, A. M.</i>	971
178	Mobile Agent Based Layered Spatial Service Architecture for Mobile GIS <i>by Fang, Zhi-xiang; Li, Qing-quan</i>	977
179	Modeling E-government Administrative Processes Using Unified Modeling Language <i>by Yang, Dong; Tong, Lixin</i>	983
180	Architecting Information-sharing Platforms for Supply Chain Management <i>by Cai, Haohai; Zhang, Luning; Chen, Jingxian</i>	988
181	Design and Implementation of Shipping Operation Intelligent Decision Support System <i>by Chu, Liang-yong; Xie, Xin-lian</i>	994
182	Intelligent Transportation System (ITS) Information Fusion: Concept, Analysis and Implementation <i>by Wang, Zhengyou; Guan, Chunhua</i>	999
183	Study on A Vocabulary Learning System Based on Semantic Network <i>by Li, Mengyu; Hu, Daiping; Li, Zongming; Lei, Aizhong</i>	1004
184	Evaluation of Account Receivable Collection Alternatives with Fuzzy MCDM Methodology <i>by Hung, Chih-Young; Li, Yiming; Chiang, Yi-Hui</i>	1009
185	A Surgical Management Information System Driven by Workflow <i>by Qi, Jianhua; Jiang, Zhibin; Zhang, Guotong; Miao, Rui; Su, Qiang</i>	1014
186	Comparative Analysis of Trust and Security <i>by Hussain, Farookh Khadee; Chang, Elizabeth; Dillon, Tharam S.</i>	1019
187	Implementation of a Knowledge-Based System for Automatic Part Numbering in a Logistics Information System <i>by Hsu, Pang-Yen; Ma, Shao-Ping; Sun, Fu-Chun; Chung, Yun-Kung</i>	1024
188	Web Service for Distributed Communication Systems <i>by Liu, Feng; Wang, Gesan; Li, Li; Chou, Wu</i>	1030
189	Implementation of a Back-Propagation Neural Network for Demand Forecasting in a Supply Chain – A Practical Case Study <i>by Cheng, Yun-Hui; Liao, Hai-Wei; Chen, Yun-Shiow</i>	1036
190	Web Services for Production Planning and Optimization <i>by Tang, Xueqing; Knox, Malcolm; Martinez, Jose</i>	1042
191	The Role of RFID within EDI: Building a Competitive Advantage in the Supply Chain	1047

	<i>by Imburgia, Michael J.</i>	
192	A New Classification Algorithm for Large Scale of Chinese Texts <i>by Wang, Hongwei; Wang, Jianhui; Yi, Lei</i>	1053
193	An Integration Research on Service-oriented Architecture (SOA) for Logistics Information System <i>by Zhang, Luyang; Li, Jiaqi; Yu, Ming</i>	1059

Special Topics: Services Science, Management and Engineering

194	Port Supply Chains as Social Networks <i>by Lee, Peggy D.</i>	1064
195	Fault Injection-based Test Case Generation for SOA-oriented Software <i>by Zhang, Jia; Qiu, Robin G.</i>	1070
196	Role of Producer Services in Regional Economic Growth: A Study of Yangtze River Delta <i>by Liu, Wei; Cui, Aiping</i>	1079
197	The Effect of Producer Services upon Manufacturing Value Chain <i>by Yang, Chun Li; Yu, Ming</i>	1085
198	China's Producer Services: Growth, Structural Changes, and Effects <i>by Cheng, Da-zhong</i>	1091
199	Innovation Through Technological Outsourcing Services: Performance and the Determinants <i>by Su, Jing-qin; Yu, Jing-tao; Li, Zuozhi; Cao, Hui-ling</i>	1100
200	Effectiveness Evaluation Services for Small to Medium-Sized Manufacturing <i>by Ahmad, Norita; Qiu, Robin G..</i>	1106
201	Intelligent Middleware Service Framework <i>by Luo, Zongwei; Li, Jenny S.; Tan, C.J.; Tong, F. C.H.; Kwok, A.; Wong, E. C.; Wang, H.B.</i>	1113
202	The Case for the Business Process Engineer <i>by Leung, Ying Tat; Caswell, Nathan; Kamath, Manjunath</i>	1119
203	A Practical Approach to Enabling Service-Oriented Value Nets: An IBM SUR Project Overview <i>by Qiu, Robin G.; Dong, Jin</i>	1125
204	A SCOR-Based Framework for Supply Chain Performance Management <i>by Ren, Changrui; Dong, Jin; Ding, Hongwei; Wang, Wei</i>	1130
205	A Comparison of Business Process Modeling Methods <i>by Wang, Wei; Ding, Hongwei; Dong, Jin; Ren, Changrui</i>	1136
206	Workforce Management and Optimization using Stochastic Network Models <i>by Lu, Yingdong; Radovanović, Ana; Squillante, Mark S.</i>	1142

207	Balance of Product Greening Cost and Benefit <i>By Hu, Jiling</i>	1146
208	Symbiosis Relationship of Manufacturing and Producer Services: Multi-Cases Comparison Study of Pearl River Delta <i>By Xu, Xuejun Xu; Zhang, Hong; He, Laigang</i>	1151
209	A Decision-Support Model for Technology Roadmapping <i>By Yu, Jian; Yu, Ming</i>	1157
210	Design and Implementation of a Comprehensive Evaluation System Based on Workflow <i>By Wang, Hui; Yu, Ming; Zhang, Ao; Luo, Qian</i>	1163
211	Evaluating the Efficiency of Hospital's Departments Using DEA <i>By Wang, Ronggui; Yu, Ming</i>	1167