

Service Science, Management, and Engineering

Theory and Applications

Intelligent Systems Series

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



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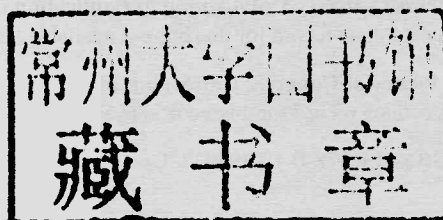
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Intelligent Systems Series

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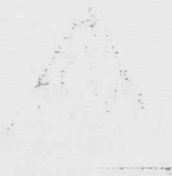
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Preface

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

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Overview of Service Science, Management, and Engineering

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

*State Key Laboratory of Management and Control for Complex Systems, Institute of Automation,
Chinese Academy of Sciences, Beijing 100190, China*

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,

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