

# Service Science: Research and Innovations in the Service Economy

## **Series Editors**

Bill Hefley

Wendy Murphy

This section of the series, “Global Perspectives on Service Science,”  
is edited by James C. Spohrer and Stephen K. Kwan

More information about this series at <http://www.springer.com/series/8080>



Stephen K. Kwan • James C. Spohrer  
Yuriko Sawatani  
Editors

# Global Perspectives on Service Science: Japan

 Springer

*Editors*

Stephen K. Kwan  
College of Business  
San Jose State University  
San Jose, CA, USA

James C. Spohrer  
IBM University Programs World-Wide  
IBM Almaden Research Center  
San Jose, CA, USA

Yuriko Sawatani  
School of Computer Science  
Tokyo University of Technology  
Tokyo, Japan

ISSN 1865-4924

ISSN 1865-4932 (electronic)

Service Science: Research and Innovations in the Service Economy

ISBN 978-1-4939-3592-5

ISBN 978-1-4939-3594-9 (eBook)

DOI 10.1007/978-1-4939-3594-9

Library of Congress Control Number: 2016938512

© Springer Science+Business Media New York 2016

This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed.

The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

The publisher, the authors and the editors are safe to assume that the advice and information in this book are believed to be true and accurate at the date of publication. Neither the publisher nor the authors or the editors give a warranty, express or implied, with respect to the material contained herein or for any errors or omissions that may have been made.

Printed on acid-free paper

This Springer imprint is published by Springer Nature  
The registered company is Springer Science+Business Media LLC New York

# Foreword

The service industry not only accounts for a high relative importance in the economic activities of Japan, where 70% is said to be related to it, but it is a field that becomes even more important from a viewpoint that can support international competitiveness in a variety of industries, including the manufacturing industry.

On the other hand, service is a field where a scientific system of a concept and principle has yet to be developed in our country. Thus, the socio-economic value and the role and function that service has are not adequately understood.

For that reason, service tends to depend on “experience and perception”; to date the field has not necessarily been recognized as requiring a systematic understanding or necessitating the adoption of a scientific technique.

Because of this lack, the Ministry of Education, Culture, Sports, Science and Technology established a study meeting in 2008 that contributed to the development of the service industry in such a light. We tried to promote service by forming a proposal whereby, with a viewpoint to demand new possibilities from service as a field that is able to deal with various problems in society. We do not consider service a technique that is restricted solely for use within the service industry and instead understand it as a wider industrial, applicable technique and introduce scientific techniques into the study of service systems. As a result, JST-RISTEX was provided with the “Service Science, Solutions and Foundation Integrated Research Program” in 2010 and is currently fulfilling it.

As for the Fourth Science and Technology Basic Plan that was adopted at a Cabinet meeting in August 2011, the policy of Science, Technology and Innovation (STI) is defined as the “creation of intellectual/cultural values based on new knowledge obtained from scientific discovery, invention, etc., and the innovation to develop such knowledge into economic, social, or public value.”

Moreover, the Fourth Basic Plan has greatly changed the policy; now the priority lies in creating measures for achieving success in social issues via R&D to make strong cooperation between science and technology and innovation.

In addition, it has been reported that individual achievements did not necessarily lead to the solution of East Japan’s great earthquake disaster, but there are few specialists who understand this fact. It has also been reported that reasons not to be tied

to the solution of social issues include not grasping social needs accurately and not reflecting the need to have a research theme appropriately, and there is no systematization under way to realize such in the society from R&D.

Therefore, we must smoothly implement the outcome of R&D in society under effective R&D management so that the outcome is used in society appropriately and effectively based on the right focus for the social issues that we need to solve.

Under these conditions, service science needs to target R&D for the solution of social issues from the start. In addition, the R&D system of service science requires the participation of specialists in various areas as well as that of the community; in particular, researchers in human and social science, such as marketing or management, and science and technology are needed. It is essential to have both viewpoints and ultimately promote them in an integrated manner.

Service science is leading other science activities toward finding solutions to the issues that the Great East Japan Earthquake exposed. Through these service science actions, such researchers cooperate across their organizations and fields, and researchers beyond the specialized fields cooperate with the people and local community who are involved in the research theme by setting the stage.

I strongly hope that service science develops with the Japanese economy and I wish for the establishing of new service and value co-creation through connecting “experience and perception” in Japanese service and scientific proof and technique based on continuous research in service science.

Takayuki Aso  
Ministry of Education, Culture, Sports, Science and Technology  
Chiyoda-ku, Tokyo, Japan

# Foreword

In order to achieve continuous economic growth in Japan, services, which utilize information obtained from contact points, will be an important factor. For example, if this service and continuous connection with customers can be used, the conventional profit structure will change from product sales to services using products, and moreover it can be expected that this change will result in continuous economic growth.

In order to improve the functions of services, which should be the key for economic growth, it is necessary to carry out simultaneously the action of reducing the cost for supplying services and the action of homogenizing and enhancing the quality of services.

In the Ministry of Economy Trade and Industry (METI), the utilization of an engineering and/or scientific approach (service engineering) is recommended to implement these actions. METI has promoted a research and development project for service engineering since 2008. Hereafter, I expect that the technical elements of service engineering will spread throughout industry, especially the service sector, and will play an important role in improving the productivity of the service industry.

Yasuhiro Maeda  
Service Affairs Policy Division  
METI, Chiyoda-ku, Tokyo, Japan



# Foreword

Society has been rapidly advancing toward a service-based economy. Approximately 70% of the entire economy is said to relate to the service sector. However, productivity in service industries is lower than that in manufacturing industries, and hence innovation and productivity improvements have become important issues (Ministry of Economy, Trade and Industry of Japan 2007). There has been a new movement toward the development of an interdisciplinary service science field (IfM & IBM 2007). Japan announced the Third Science and Technology Basic Plan in March 2006, to promote the growth of emerging and interdisciplinary domains. In the Fourth Science and Technology Basic Plan, the focus shifted from field-specific to issue-driven innovation in interdisciplinary domains of science and technology. For example, service science was specified as an important topic and was to serve as a forerunner of the issue-driven approach.

In April 2007, the Ministry of Education, Culture, Sports, Science and Technology (MEXT) began the Service Innovation Human Resource Development Program. MEXT further published a proposal concerning service innovation in 2009 (MEXT 2009), which resulted in the Japan Science and Technology Agency's Research Institute of Science and Technology for Society (JST-RISTEX) to start seeking R&D projects under its Service Science, Solutions and Foundation Integrated Research (S3FIRE) Program in April 2010. The S3FIRE program aimed to establish a common foundation for service science, including concepts, theories, technologies, and methodologies involved in services based on multidisciplinary approaches that integrate natural sciences, engineering, social sciences, and humanities. This will transform services based on experience and intuition to systematic approaches to solve issues by analyzing actual data and/or cases. Our focus is not only on creating new knowledge, but also on embedding such knowledge and technologies to society by promoting the growth of R&D and the practitioner community.

Japan has historically leveraged its strong engineering capabilities to stay competitive from a production standpoint. More than 20 years ago, Enomoto (Enomoto 1984) pointed out the creation of service engineering. The Center for Service Research (at the National Institute of Advanced Industrial Science and Technology, or AIST) was formed in April 2008 to promote service engineering in cooperation

with Service Productivity & Innovation for Growth (SPRING), which is a community linking R&D and business practitioners. We hope to contribute to service science by utilizing our strength, engineering, and collaboration with the related organizations. Fortunately, our work on service science is expanding more widely than expected, to fields such as math, physics, engineering, information technologies, service marketing, economics, management, other social sciences and humanities, as well as business and social practitioners. We anticipate that progress in service science will be applied to diverse services in the fields of environment, energy, education, welfare, etc., which will improve the productivity and quality of services and will contribute to service innovation.

Norihisa Doi  
Keio University  
Kohoku-ku, Yokohama, Japan

## References

- Enomoto H (1984) Service logic model: toward the establishment of service engineering (in Japanese)
- IfM & IBM (2007) Succeeding through service innovation: a service perspective for education, research, business and government. University of Cambridge Institute for Manufacturing, Cambridge. ISBN: 978-1-902546-65-0
- Ministry of Economy, Trade and Industry of Japan (2007) Towards innovation and productivity improvement in service industries. <http://www.meti.go.jp/english/report/data/0707SPRING.html>
- Ministry of Education, Culture, Sports, Science and Technology (2009) Seeking a new possibility of services: the proposal for a service innovation (Japanese document). [http://www.mext.go.jp/b\\_menu/shingi/chousa/gijyutu/012/houkoku/\\_icsFiles/afieldfile/2009/02/24/1246289\\_1.pdf](http://www.mext.go.jp/b_menu/shingi/chousa/gijyutu/012/houkoku/_icsFiles/afieldfile/2009/02/24/1246289_1.pdf)
- RISTEX (Research Institute of Science and Technology for Society). <http://www.ristex.jp/EN/aboutus/principle.html>

# Contents

## Part I Introduction

- 1 **Introduction**..... 3  
Jim Spohrer, Stephen K. Kwan, and Yuriko Sawatani

## Part II Foundations

- 2 **Service Innovation in Japan and the Service-Dominant Logic**..... 17  
Teruyasu Murakami
- 3 **Context Management Approach to Value Co-creation:  
Toward Dynamic Process Model of Customer  
as Value Co-creator**..... 31  
Yoshinori Fujikawa, Satoshi Akutsu, and Joji Ono
- 4 **Human Behavior Observation for Service Science** ..... 49  
Haruhito Matsunami, Aya Kubosumi, and Kanako Matsumoto

## Part III Methods

- 5 **Community-Based Participatory Service Engineering:  
Case Studies and Technologies**..... 63  
Yoichi Motomura, Takeshi Kurata, and Yoshinobu Yamamoto
- 6 **Methodology of Workshop-Based Innovative System Design  
Grounded in Systems Engineering and Design Thinking** ..... 79  
Toshiyuki Yasui, Seiko Shirasaka, and Takashi Maeno
- 7 **Wants Chain Analysis**..... 91  
Takashi Maeno, Seiko Shirasaka, and Toshiyuki Yasui
- 8 **Interactive Service Design Method: Application to Aircraft  
Operations at Haneda Airport**..... 107  
Kazuo Furuta, Takanori Kaneko, Taro Kanno, Shigeki Yoshihara,  
and Takamichi Mase

**Part IV Engineering and Design**

**9 Service Design in Tourism: Encouraging a Cooperative Relationship Between Professional Design and Non-professional Design** ..... 119  
 Tatsunori Hara, Kazuhiro Aoyama, Yohei Kurata, and Naoto Yabe

**10 Value Co-creation Process and Value Orchestration Platform**..... 137  
 Kyoichi Kijima and Yusuke Arai

**Part V Technology**

**11 Formalizing Expert Knowledge Through Machine Learning** ..... 157  
 Tsuyoshi Idé

**12 Agent-Based Simulation for Service Science** ..... 177  
 Hideyuki Mizuta

**13 Temporal–Spatial Collaboration Support for Nursing and Caregiving Services** ..... 193  
 Naoshi Uchihira, Kentaro Torii, Tetsuro Chino, Kunihiko Hiraishi, Sunseong Choe, Yuji Hirabayashi, and Taro Sugihara

**14 Quest for Equation of Life: Scientific Constraints on How We Spend Our Time** ..... 207  
 Kazuo Yano

**Part VI Industry**

**15 The Spread of Services and Consumer Value Co-Creation** ..... 231  
 Makoto Usui

**16 Sustainability and Scalability in Japanese Creative Services** ..... 249  
 Yoshinori Hara, Yoshikazu Maegawa, and Yutaka Yamauchi

**17 Knowledge Structuring Tools for Decision Support Service: An Overview of Citation-Based Approach** ..... 261  
 Ichiro Sakata

**18 R&D Servitization in the Manufacturing Industry** ..... 277  
 Yuriko Sawatani and Yuko Fujigaki

**Part VII Education**

**19 MANGA-Case Training for Global Service Science**..... 293  
 Akiko Orita, Atsushi Yoshikawa, and Takao Terano

**20 Creation of Service Science Curriculum for Customer-Oriented Business Innovation** ..... 313  
Hideaki Takagi, Yukihiro Okada, Akiko Yoshise,  
and Maiko Shigeno

**Part VIII Future**

**21 Service Engineering Road Map of Ministry of Economy Trade and Industry in Japan** ..... 339  
Takafumi Kinoshita, Kazuaki Ibe, Mitsuru Kawamoto,  
Kitayoshi Tsumita, and Yasuhiro Maeda