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# A curriculum of MOS (Management of Service) course based on knowledge science and information science

**Michitaka Kosaka**

Japan Advanced Institute of Science and Technology, Japan (kosa@jaist.ac.jp)

## ABSTRACT

Innovations can improve the productivity and quality of services and lead to new services. The importance of education to such services innovation has been a focus of discussion all over the world. The Japan Advanced Institute of Science and Technology (JAIST) has established a new education course for services innovation called MOS (management of service). The curriculum of the MOS course is based on the recognition that services in the 21st century are dependent on knowledge science, information science, business science, and transdisciplinary science and technology. In particular, knowledge science including ethnography and brain science and information science that studies the Internet and data management can enhance service quality. This paper describes the concept of JAIST's MOS course and outlines its curriculum.

*Keywords*: services innovation, knowledge science, information science, transdisciplinary science and technology

## 1. INTRODUCTION

The importance of innovation and scientific investigation in the service industry has been discussed all over the world. Innovation in services should have an affect on productivity and quality and lead to new services. The importance of education in services innovation has been also discussed. In particular, the Japanese Ministry of Education, Science and Technology (JMEST) started the "Program of Education for Service Innovators" in 2007 and selected 13 universities for developing an education program in services innovation. The Japan Advanced Institute of Science and Technology (JAIST) proposed a new education services management course, called MOS (Management of Service), that is related to its MOT (Management of Technology) course, and the proposal has been implemented at one of the 13 universities selected by JMEST.

In Japan, the importance of education, management, and science to services and services innovation has been recognized, and subjects from these fields have been taught at the MBA level. Furthermore, IT service technologies are now subjects taught in many information science departments. Despite these encouraging developments, though, we should realize that successful innovation in the 21st century will also involve technologies related to human behavior. People in this century will have to adapt to new technologies like the Internet and ubiquitous information environment and deal with new issues such as globalization and global warming. We at JAIST believe that knowledge science, such as ethnography and brain science, and information science studying the Internet and data management can be exploited to enhance the quality of services. In fact, to ensure that society benefits from the new services that will appear in the future, JAIST has developed a new curriculum of service innovation and education based on knowledge science and information science.

This paper describes the concept of our new MOS course and outlines its curriculum. The curriculum is based on knowledge science, information science, business science, and transdisciplinary science and technology.

## 2. TRENDS IN SERVICE SCIENCE EDUCATION AND CONCEPT OF MOS

### 2.1 Trends toward Service Science Education

The topic of how to educate people in service science has been discussed all over the world. According to a survey [1], services marketing and services management are being taught at the MBA level in United States, and IT services such as Web services and SOA (service oriented architecture) are topics in the country's information science departments. Many universities are trying to integrate services education and information science into the curricula of their MBAs in order to create a new education field of service science (Fig. 1).
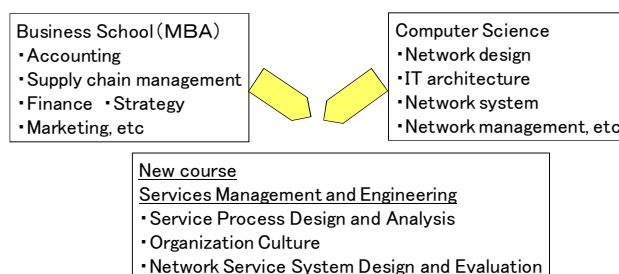


Fig. 1 Example of service education course (North Carolina State University)

Recently, UC Berkeley presented a new service science discipline concept that considers the service life cycle

and transdisciplinary activities [2]. Moreover, the trend in Europe is the same as in the U.S. Institutions in these countries recognize the importance of practical experience in services education, and they design their higher level courses by including lectures in services engineering management and seminars involving case studies and IT technology. They also offer internships [3]. Moreover, several major universities in China are collaborating on services science education. Peking University [4] offers an IT services engineering course that focuses on IT planning, IT service technology, data management, IT service management, and IT resource management.

## 2.2 Basic Concept of JAIST's MOS course

The JAIST's MOS course is based on knowledge science and information science (Fig. 2). This course provides education related to services innovation for business people, whereas JAIST's MOT course is meant to reinforce innovators' abilities.
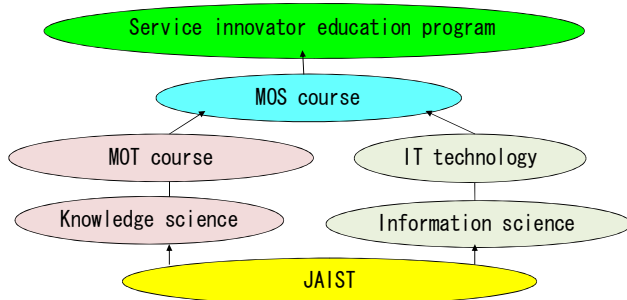


Fig. 2 Basic concept of JAIST's MOS course

As the name implies, services innovation fuses two methodologies. The first one focuses on innovation in current service industries. It aims to give students the means to improve productivity and quality in service industries such as hotel lodging, travel, and so on. The second methodology focuses on applying service concepts and individual service approaches. It emphasizes new value creation by using information technology to help customers in the 21st century. The rise of Google, Mobile phone services, and IC card applications are clear indication that such an emphasis is needed. In this sense, the MOS course is in step with this trend in the era of the Internet and globalization.

Specifically, the targets of the MOS course are as follows:
(1) Convergence of IT technology and services in the development and provision of new services
(2) Services in the manufacturing industry
(3) IT 'solution' services for various industries
(4) Services in the information industry

Service innovators should have skills in human science, social science, IT technology, and management. Their abilities range from conceptualizing a new service and being able to perform system integration to being able

empathize with service recipients to understand their needs. MOS students who are deem themselves to be innovators and have over three years experience in business should study the basic theory and successful examples related to services innovation and try to solve real problems in their business field.

## 3. FOUR DISCIPLINES FOR SERVICES INNOVATION

### 3.1 Integration of Four Disciplines for Services Innovation

The MOS course focuses on four disciplines that are important for services innovation.
(1) Knowledge science: Satisfaction is the most important factor for improving service quality. Knowledge sciences such as design, ethnography, and brain science, can be utilized for creating new services and for determining whether a new service will satisfy the intended recipients.
(2) Information science: Information science and information technologies provide the means for realizing new services. Internet technology, ubiquitous computing technology, data mining technology and so on can be utilized for services innovation.
(3) Business science: Services marketing, quality assurance, business model development, financing, and operations research methodologies are basic activities in the services business, and these subjects are taught in business schools.
(4) Transdisciplinary science and technology:
Transdisciplinary science and technology are, or will soon be understood to be, essential for creating new services. By transdisciplinary we mean a threefold idea of the integration of various technologies, extending concepts that are valid in one domain into concepts that are valid in various domains, and applying general methods for optimization and simulations to various problems.
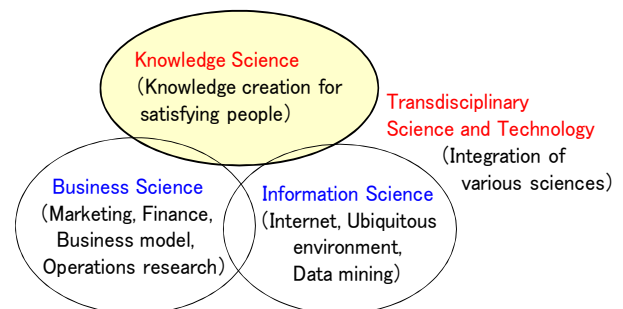


Fig. 3 Four disciplines for services innovation

### 3.2 Knowledge Science

There is a close relationship between knowledge science and service science. In examining this relationship we should consider three aspects.
(1) Service value and knowledge creation

Figure 4 illustrates the concept of the customers' total value, as defined by Kameoka [1]. Kameoka defines a "service" as actions which support activities for achieving objectives. In knowledge science, a "service" can be defined as a knowledge creation process for creating value for customers. A services business can be defined as a service providing knowledge to customers. Therefore, services are related to knowledge creation.
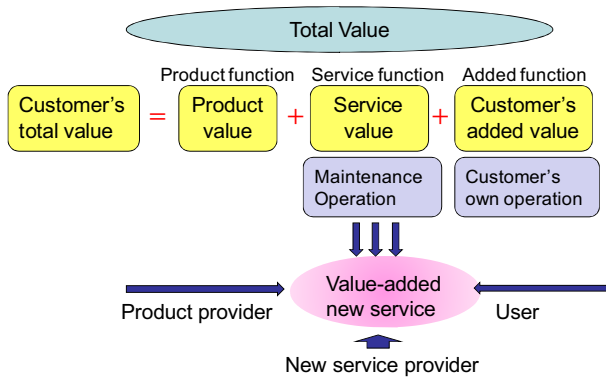


Fig. 4 Customers' total value as defined by Kameoka

(2) Knowledge for the purpose of satisfying service recipients

A service's quality is obviously related to the satisfaction felt by the recipient of that service. To improve service quality, we need to analyze human behavior, the service recipient's requirements, and characteristics about people in general. In doing so, we can employ methods and knowledge from the fields of ethnography, design, hospitality, brain science, etc. The knowledge and methodologies of such fields should be recognized as indispensable for service science in the 21th century, and JAIST's school of knowledge science puts an emphasis on them.
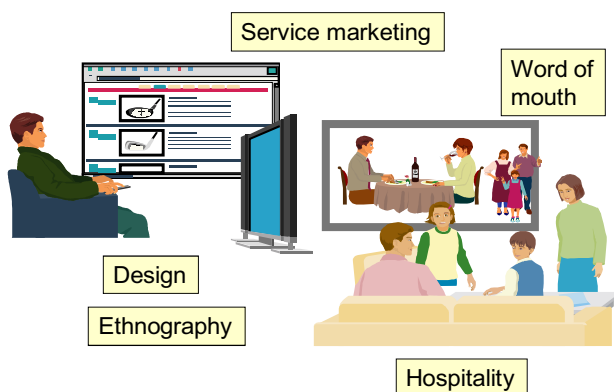


Fig. 5 Technologies for value creation

(3) Knowledge management and services innovation

Nonaka [6] proposed the SECI model for knowledge creation in an organization. The essence of innovation is the knowledge creation process. Only humans can create new knowledge, and knowledge workers perform the most important roles in innovation. Innovator education should provide the opportunity for acquiring excellent experience to students who have the ability of integrating theory and practice.

### 3.3 Information Science

Information science is important for services innovation in two ways.

(1) Information technology for service innovation

IT technology has become indispensable in various industries. In particular, various IT technologies have been utilized to improve service quality and enhance value. Figure 6 shows how IT can be utilized at the front stage, back stage, and in the network of the service system.
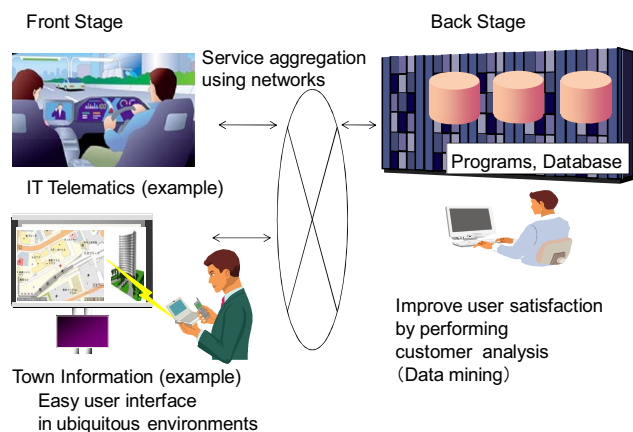


Fig. 6 Information technology for services innovation

(a) Front Stage

The front stage of a service system includes ubiquitous information terminals, such as car information systems and mobile phones, which provide user interfaces and a network service environment. People can utilize information services though the Internet anytime and everywhere. Self-service functions on terminals such as ATM machines in banks improve service productivity.

(b) Back Stage

In the back stage, various information technologies, such as data mining technology, are used to analyze customer data for marketing purposes. The results of these analyses can be used to raise customer satisfaction and improve quality of service.

(c) Network

The most important network is the Internet. The Internet aggregates various services and provides them to the world at a very low cost. Many new business models have been created by using the Internet, and the long tail business model is one such example.

(2) IT service technologies

IT businesses have been shifting from selling products to providing services such as system integration, consulting, and outsourcing. The Internet has also been the essential element to new information services such as Google, Yahoo, and YouTube. IT services can be categorized into five areas according to Tung [4]:

(a) IT planning, including user requirements analysis, value analysis, analysis of the relationship between IT and business functions,
(b) IT service software and architecture, including Web services, service oriented architecture (SOA), and enterprise information system architecture,
(c) Data management, including data mining, DBMS, customer relationship management (CRM), and data base marketing,
(d) IT service management, including Information technology infrastructure library (ITIL), service level agreements (SLA), outsourcing, and offshore services, and
(e) IT resource management, including quality assurance, IT asset management, and maintenance.

### 3.4 Business Science

(1) Service marketing: Marketing in traditional service industries has been taught at the MBA level. C.L. Lovelock ［6］ and R. Fisk ［7］ have written good textbooks explaining the characteristics of services in terms of their process, productivity, royalties management, and pricing. The service theater model in service marketing theory can be applied to various services, including those associated with new technology.
(2) Business model: Not only new technologies but also new business models are important to innovation. Figure 7 shows how business models have progressed, according Teramoto ［8］. The 5th generation business model is for new businesses associated with the Internet or other new technologies.
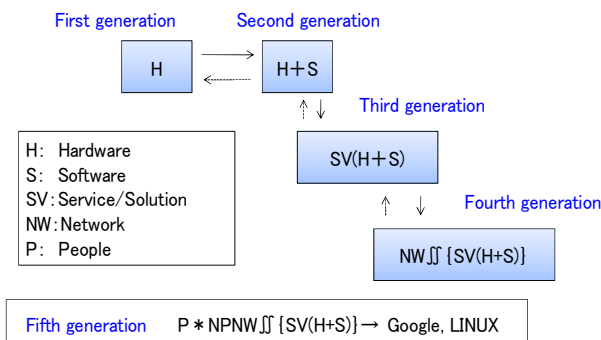


Fig. 7 Generations of business models

### 3.5 Transdisciplinary Science and Technology

(1) Transdisciplinary activities
  Many articles have asserted that service science and services innovation should be transdisciplinary or interdisciplinary. The characteristics of service science or services innovation are summarized as follows:
(a) They involve technology, human factors, and social science
(b) They place importance on value, experience, and knowledge
(c) They place importance on customer's needs



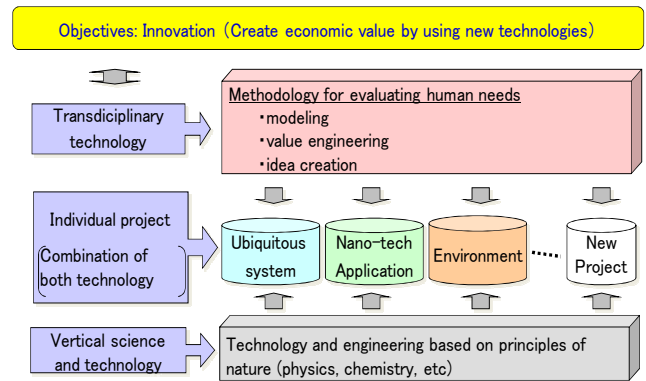Fig. 8 Role of transdisciplinary technologies in innovation

  Figure 8 shows the relationship between vertical technologies and transdisiplinary technologies that relate to determining human needs such as modeling, value engineering, and idea creation. Innovations arise by integrating vertical technologies with transdisciplinary technologies.
(2) Three types of transdisciplinary technology
  A transdisciplinary technology is a horizontal one that spans various disciplines. There is as yet no other concrete definition, so we can still ask, *what in fact is a transdisciplinary technology*? We believe that transdisciplinary technologies can be categorized into three types.
(a) Technologies that can be applied to various fields: i.e., simulations, optimizations, modeling, systems engineering, the KJ method, and so on,
(b) Applications of common concepts or metaphors: the autonomous decentralized system concept, the service-as-theater concept, field theory, and so on.
(c) Integration of various technologies for obtaining solutions to specific problems: T-shaped talent, fusion of knowledge science and systems engineering, knowledge space, and so on.
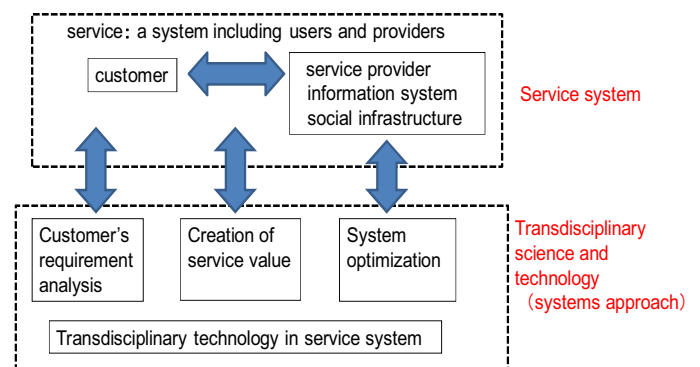  (3) Service systems including human factors



Fig.9 Service system and transdisciplinary technologies

  The three types of transdisiplinary technology are mapped to the service system shown in Fig. 9. The system includes the customer requirements analysis,

creation of service values, optimization of the service system, and integration of technologies.

## 4. DESIGN OF MOS CURRICULUM

### 4.1 Relationship between MOT and MOS courses

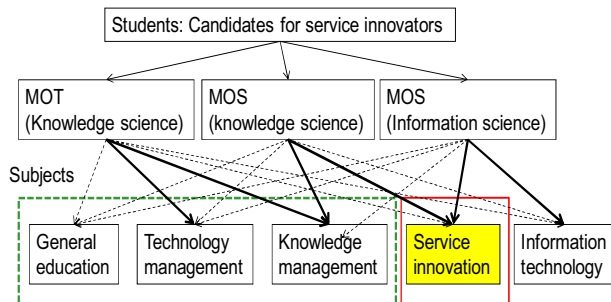JAIST offers two courses for business people, MOT and MOS. Figure 10 shows the relationship between them.



Fig. 10 Relationship between MOT and MOS courses

The target students are candidate innovators. Students who want to study innovation from the viewpoint of technology should take the MOT course. The MOS course belongs to the school of knowledge science and the school of information science in JAIST. Students can select to take either an MOS course in knowledge science or in information science. Figure 11 illustrates the policy of the curriculum. Some of the subjects related to innovation are shared with the MOT course, and 15 new subjects related to services innovation were developed for the MOS courses. Students must take more than ten subjects (20 credits), including six subjects on service innovation, and finish a master's thesis and research report (2 credits).
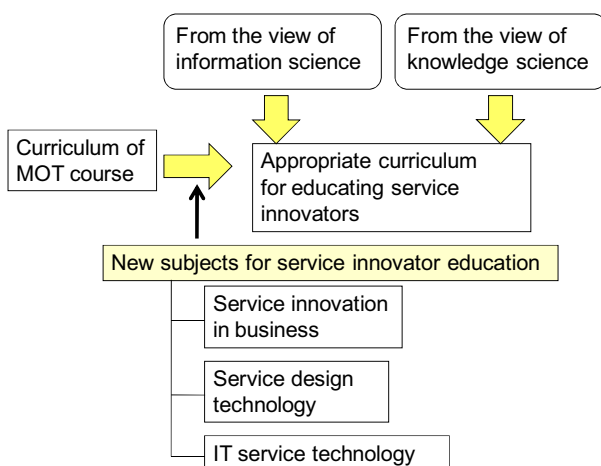


Fig. 11 Policy of MOS curriculum

### 4.2 Curriculum for Services Innovation

The 15 new subjects for innovators can be categorized as follows:

(1) Service innovation in business,
(2) Service design methodology, and
(3) IT service technology.
The following is a breakdown of the topics.
【Service innovation in business】
(1) Introduction to service innovation: service innovation and service science trends, MOS course orientation, outline of service marketing and IT services.
(2) Service creation methodologies: Methodologies based on hospitality management, service road mapping, and service value modeling.
(3) Marketing innovation: the importance of marketing based on services after the commoditization of products.
(4) Services in the manufacturing industry: examples of services in the manufacturing industry in Japan, business models, and infrastructure for services.
(5) Service risk management: investment risk, financial risk, risks of R&D in the service business.
【Service design methodology】
(6) Transdisciplinary technologies for services: significance of transdisciplinary technologies.
(7) Services engineering and its applications: service engineering methodologies and good service business examples.
(8) Networks and innovation: how network technologies can foster innovation.
(9) Design and service innovation: design methodology and service innovation.
(10) Ethnography for services: applications of ethnography to service innovation.
【IT Service technology】
(11) Services in the IT industry: evolution of business models in the IT industry and open source resources.
(12) Business system design based on IT technology: business design and IT governance, finance, and service innovation.
(13) IT service architecture: SOA, Web services, and system architectures.
(14) Internet service systems: new Internet technologies, such as information retrieval technologies, and their application and new business models
(15) IT service management: IT service management technologies such as ITIL and SLA and their application to outsourcing.

MOT subjects and MOS subjects are categorized to four disciplines: human science, social science, IT technology, and management science. MOS students must select more than 10 subjects from the subject list shown in Table 1, and they can choose according to their interests.

## 5. EVALUATIONS USING QUESTIONNAIRES

The MOS course was started in October, 2009. From October in 2009 to March in 2010, ten new subjects were taught and every subject was evaluated by students and lecturers. We drew up questionnaires with 16 questions for students and 13 questions for lecturers. These questions evaluated the content of new subjects from the following viewpoints.

Table 1 Subjects in MOT and MOS

| Human subjects | Scientific philosophy,History of science | Technology subjects | Transdisciplinary technologies for services |
|---|---|---|---|
| | Philosophy・ethics | | Service engineering and its applications |
| | Knowledge management theory | | Network and service innovation |
| | Cognitive science (introduction) | | IT service management |
| | Technology management, Leadership | | IT service architecture |
| | Venture business(practice, theory) | | Business system design based on IT |
| | Ethnography for services | | Knowledge system theory |
| | Service creation methodologyies | | Scientific measurement theory |
| | Design and service innovation | | System science methodology |
| Social subjects | Services in manufacturing | | Verifiable and evolvable e-society |
| | Services in IT industry | Management subjects | Service management |
| | Internet service system | | Service risk management |
| | Introduction to service innovation | | Marketing innovation |
| | Introduction to innovation | | Organization management theory |
| | Comparative knowledge system theory | | Strategic road mapping methodology |
| | Social knowledge theory | | R&D management |
| | Enterprise science | | Management strategy theory |
| | Practical social survey methodology | | Industry-university cooperation |
| | Knowledge management policy | | Project management |

(1) Up-to-date knowledge on service innovation
(2) Practicability in real service businesses
(3) Basic knowledge of service technology
(4) Advanced ideas for services innovation
(5) Necessity of services innovation education
. The results of the questionnaires are summarized in Table 2.

Table 2 Summary of questionnaire results

| | Very poor | Fairly poor | Fairly good | Very good |
|---|---|---|---|---|
| Up-to-date knowledge | 2% | 13% | 26% | 49% |
| Practicability | 0% | 20% | 56% | 24% |
| Basic Knowledge | 3% | 8% | 49% | 40% |
| Advanced ideas | 0% | 11% | 32% | 57% |
| Necessity | 0% | 2% | 49% | 49% |

By analyzing the questionnaires' results, we found that the MOS course seems to provide up-to-date and practical knowledge for service innovators. "Services in the manufacturing industry" and "Services in the IT industry" courses were highly evaluated as useful for business people. We will continuously improve the course in order to create an excellent services education for business people.

## 6. CONCLUSION

The 20th century was the era of industrialization, and various industrial products such as consumer electronics, automobiles, chemical products, and so on enriched people's lives. In the late 20th century, information technology in the form of the internet and personal computer began to satisfy our intellectual desires and new information services such as Google or Yahoo have since expanded all over the world. In the 21st century, the next frontier of civilization may be collectively services that satisfy us by combining industrial products, information technologies and new service concepts.

University engineering departments have and still turn out competent engineers, but the needs they fulfill are of the era of industrialization. More recently, they have incorporated information science departments and trained IT engineers. Advanced education will have to grow in this new era of service innovation. Universities need more MOS courses like the one we described in this paper, ones based on knowledge science and information science, if they are to help create the minds attuned to creating new businesses and creating a society for the happiness of all.

## REFERENCES

[1] A. Kameoka et al., Service Science (in Japanese) , NTS, 2007
[2] R.J. Glushko, "Designing a service science discipline with discipline", IBM System Journal, http://www.research.ibm.com/journal/sj/471/glushko.htm, 2008
[3] B. Stauss, K. Engelmann, A. Kremer, and A. Luhn, Service Science, Springer, 2008
[4] F.C. Tung, "A reference curriculum for service engineering", the Proceedings of IEEE Congress on Services (Peking University), 2008
[5] I. Nonaka and H. Takeuchi, The Knowledge Creating Company, Oxford University Press Inc., 1995
[6] L. Lovelock and J. Wirtz, Services Marketing sixth Edition, Pearson Prentice Hall, 2007
[7] R. Fisk, S. Grove, and J. John, Interactive Services Marketing Third Edition, Houghton Mifflin Company, 2008
[8] Y. Teramoto, N. Iwasaki, and M Kondo, Business Model Revolution (in Japanese), Seisansei-shuppann, 2007