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Christoph Peters
University of St. Gallen, christoph.peters@unisg.ch

Paul Maglio
University of California

Ralph Badinelli
Virgina Tech University

Robert R. Harmon
Portland State University

Roger Maull
University of Surrey Business School

See next page for additional authors

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Authors
Christoph Peters, Paul Maglio, Ralph Badinelli, Robert R. Harmon, Roger Maull, James C. Spohrer, Tuure Tuunanen, Stephen L. Vargo, Jeffrey J. Welser, Haluk Demirkan, Terri L. Griffith, and Yassi Moghaddam

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Christoph Peters
Institute of Information Management, University of St. Gallen, St. Gallen, Switzerland and ITEG, University of Kassel, Kassel, Germany
christoph.peters@unisg.ch

Paul Maglio
School of Engineering, University of California,, Merced, and IBM Almaden Research Center, San Jose, CA, US

Ralph Badinelli
Department of Business Information Technology, Virginia Tech, Blacksburg, VA, US

Robert R. Harmon
School of Business Administration, Portland State University, Portland, OR, US

Roger Maull
University of Surrey Business School, Guildford, Surrey, United Kingdom

James C. Spohrer
IBM Almaden Research Center, San Jose, CA, USA

Tuure Tuunanen
Department of Computer Science and Information Systems, University of Jyväskylä, Jyväskylä, Finland

Stephen L. Vargo
Shidler College of Business, University of Hawai'i at Mānoa, Honolulu, HI, US

Jeffrey J. Welser
IBM Almaden Research Center, San Jose, CA, US

Haluk Demirkan
Milgard School of Business, University of Washington, Tacoma, WA, US

Terri L. Griffith
Leavey School of Business, Santa Clara University, Santa Clara, CA, US

Yassi Moghaddam
International Society of Service Innovation Professionals, CA, US

Abstract:

This paper examines emerging digital frontiers for service innovation that a panel discussed at a workshop on this topic held at the 48th Annual Hawaii International Conference on System Sciences (HICSS). The speakers and participants agreed that that service systems are fundamental for service innovation and value creation. In this context, service systems are related to cognitive systems, smart service systems, and cyber-physical systems and depend on the interconnectedness among system components. The speakers and participants regarded humans as the central entity in all service systems. In addition, data, they saw personal data in particular as key to service systems. They also identified several challenges in the areas of cognitive systems, smart service systems, cyber-physical systems, and human-centered service systems. We hope this workshop report helps in some small way to cultivate the emerging service science discipline and to nurture fruitful discussions on service innovation.

Keywords: Service Innovations, Cognitive Systems, Smart Service Systems, Cyber-Physical Service Systems, Human-centered Service Systems, Service Systems Engineering, Personal Data, Service Transformation.

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1 Introduction

Service innovation includes novel ways of configuring service operations and novel ways of creating customer value that often depend on using new technology and new information. Here, we explore the frontier of service innovation and develop a set of relevant innovation directions and trends that span the service lifecycle and the multiple perspectives of individuals and systems. Specifically, we examine emerging frontiers of service innovation that a workshop held at the 48th Annual Hawaii International Conference on System Sciences (HICSS) on this topic identified. In bringing together researchers with different backgrounds, we identified service systems as the fundamental theoretical construct for service innovation, and we identified value co-creation as the fundamental innovation process. In particular, the workshop predominantly discussed cognitive systems, smart service systems, and cyber-physical systems. And, in all these service systems, the workshop saw people as the central components that all other system components are orchestrated around. The workshop also discussed data, especially personal data, as a key concept in the future of service innovation.

Consider the automotive sector: over the past two decades, automobile manufacturing firms have moved toward more service-oriented business models because their traditional business models, which rely on high-quality products, superior after-sales service, and efficient logistics, have suffered from intense competition and commoditization. Value chains have become value networks, which has created network- and system-oriented business models in the automotive industry. These service systems integrate vendors and providers (e.g., IT and Internet providers, car rental providers, and manufacturers), customers and users. Many new offerings have emerged to support individual drivers (e.g., through value-adding services), to support manufacturing companies (e.g., through data analytics and better insights into how people use their cars), and to support new players in establishing disruptive business models (e.g., around mobility concepts or autonomous driving). More generally, to differentiate themselves from competitors, manufacturers have explored transforming to focus on service as a means of improving their market position and increasing sales and margins—a shift from a goods-dominant logic (GDL) to a service-dominant logic (SDL) (Vargo & Lusch, 2008); see also (Maglio, Nusser, & Bishop, 2010).

In this paper, we explore service and service system innovations. We report on the workshop's presentations and discussion, which discussed two main questions: 1) "what are the emerging digital frontiers in service and service system innovation?", and 2) "what are the research challenges that we will face in advancing this frontier?". This paper proceeds as follows. In Section 2, we provide background information on service, service systems, and service innovation. In Section 3, we discuss the opportunities and challenges in advancing service innovation. In Section 4, we summarize the discussion and outline a future research agenda.

2 Background

2.1 Service and Service Systems

One can name many examples of services; for instance, transportation services such as airlines and taxis, hospitality services such as hotels and restaurants, infrastructure services such as power and communications, and expert services such as doctors or lawyers. Though these examples differ substantially from one another, they all share some common characteristics: for instance, they all rely on providers and customers working together for mutual benefit. Many researchers agree that service has become a key driver in the information systems discipline (Rai & Sambamurthy, 2006); (Satzger et al., 2010); (Buhl, Heinrich, Henneberger, & Krammer, 2008); (Leimeister, 2012); (Böhmann, Leimeister, & Möslein, 2014). Although no commonly agreed-on definition of service exists (Alter, 2012a), most at the workshop favored the view that service is "the application of specialized competences (knowledge and skills) through deeds, processes, and performances for the benefit of another entity or the entity itself" (Vargo & Lusch, 2004), which includes providing resources that others may use (Alter, 2010). The key to understanding service is to understand value creation: "Value is always co-created by multiple actors, including the beneficiary. Value co-creation is coordinated through actor-generated institutions. Value is in the minds of the people" (Vargo & Lusch, 2016). Thus, value is created by cooperation and in context (Böhmann et al., 2014), which makes service a process in which one creates value by aligning and customizing resources across organizational boundaries (Edvardsson, Tronvoll, & Gruber, 2011).

Following this service-dominant logic (SDL), Vargo and Lusch (2004) view service as the fundamental basis of economic exchange (Vargo & Lusch, 2004); (Vargo & Lusch, 2008); (Vargo & Lusch, 2016) and is based on cooperation involving multiple agents in a process of interactive value creation (also known as value co-creation). In this view, one creates valuable goods and services by using them (value in use) and embedding them in application (value in context) or by bringing them into alignment with an organization's environment (Edvardsson et al., 2011). Key to value co-creation is resource integrators, which include customers and providers. In fact, all economic and social actors are resource integrators, which implies that networks of networks (of resource integrators) comprise value creation's context.

Service systems are configurations of people, technologies, organizations, and information that create and deliver value to all stakeholders in the system (Maglio, Kwan, & Spohrer, 2015); (Maglio, Vargo, Caswell, & Spohrer, 2009); (Vargo & Lusch, 2008). Thus, systems rely on other systems and may be nested in one another. Service systems are complex, socio-technical systems that allow interactive value co-creation (Böhmann et al., 2014). These systems are aligned to value propositions their entities offer. Service systems focus on value propositions by allowing the system participants to interactively create value through appropriate configurations of actors and resources. Typically, actors include mainly human agents (with knowledge and skills) that participate in value co-creation (Maglio & Spohrer, 2008); (Alter, 2012b); (Böhmann et al., 2014). Increasingly, service systems depend on technology, with physical goods' and services' fusing into product-service-systems or hybrid products (Leimeister & Glauner, 2008); (Böhmann et al., 2014). In addition, service systems depend on institutions—"structures or mechanisms of social order and cooperation governing the behavior of a set of individuals within a given human community" (Vargo & Lusch, 2016). Institutions are socially created schemas, norms, and regulations (Scott, 1995)—so-called "rules of the game". They are routinized ways of thinking and acting that are (partially) shared and enable and constrain human behavior (Berger & Luckmann, 1966). Language, symbols, knowledge, laws, traditions, and culture are all examples of institutions. Figure 1 summarizes the main ideas behind the SDL view of service, especially in the context of service systems.

Service science is an emerging discipline that aims to understand, improve, and innovate complex service systems (Maglio & Spohrer, 2008). Service science may require methods and theories from other disciplines including operations, industrial engineering, marketing, computer science, psychology, information systems, design, and more (Maglio, 2013). Traditionally, many different disciplines have studied service. For instance, operations research (OR) often links to service issues as do other areas such as service-oriented architectures and service systems engineering. Service systems engineering focuses on systematically designing and developing service systems (Böhmann et al., 2014). In any event, work in service science generally takes a service system perspective: Service providers and service clients, whether individuals or organizations, form relationships to co-create value, and providers' typically taking responsibility to transform some state of the world and clients' typically having ownership or control of that to-be-transformed part of the world (Spohrer, Maglio, Bailey, & Gruhl, 2007). Of course, successful value creation in service systems often requires much more complicated arrangements of actors and resources.

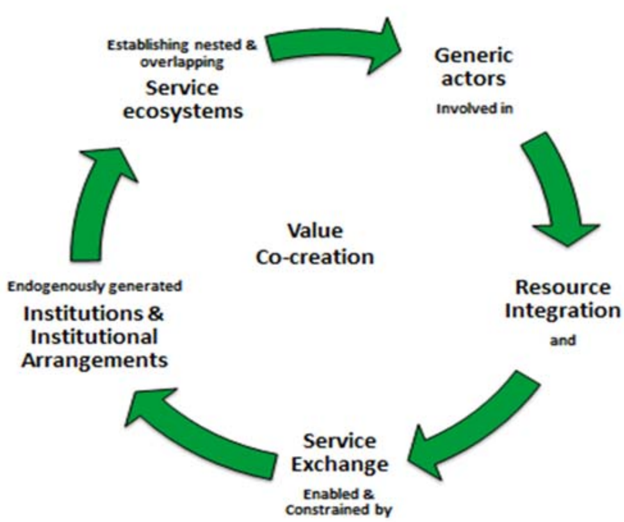

Figure 1. The Core Narrative and Processes of Service-dominant Logic (Vargo & Lusch, 2016)

2.2 Cyber-physical Systems, Cognitive Systems, and Smart Service Systems

Technology and information technology in particular are critical to contemporary service systems and to service system innovation. For instance, cyber-physical systems and services (CPSS) are "systems that enable value co-creation through the development and implementation of information and communication technology-enabled processes that integrate system value propositions with customer value drivers" (Tuunanen, Myers, & Cassab, 2010). Information systems (IS) research has focused on how organizations develop and use information systems. CPSSs represent a new frontier for IS research that melds the worlds of bits and atoms together. Infusing information communication technology (ICT) into services and the service-dominant logic thinking into ICT development has changed IS research by going beyond Web-based and digital services, such as smartphone apps and social media services, to include CPSS applications such as hardware-based sensors and real-time data analytics. The cyber aspects of such services include ICT infrastructure, computer hardware, software, and different kinds of sensors and actors (both humans and systems). The service and process data gained through networked CPSS and the ability to act on this data through control systems and actors enables novel ways of co-creating value. For example, consider self-driving cars and intelligent roadways: an intelligent roadway may have dedicated lanes for specific speed levels, such as 80km/h for the trucks and 120km/h and 140km/h for cars, and the CPSS would control the safe distances between cars and speeds. After arriving at a certain intersection, the driver, having had the car drive itself beforehand, would regain control, and, in an emergency situation, the road would clear certain lanes for emergency services (Geisberger & Broy, 2012).

The International Society of Service Innovation Professionals (ISSIP) has the mission to promote service innovations for our interconnected world. Cognition as a service (CaaS) augments and scales the performance of people via using cognitive assistants. CaaS creates opportunities for service providers to augment the capabilities of employees, customers, and other ecosystem partners. For instance, one could use IBM's Watston Services on Bluemix (one CaaS implementation) in the healthcare context to assist doctors, nurses, other caregivers, patients and their families, insurance providers, local pharmacies, and other ecosystem partners. One clear opportunity for CaaS is to augment human capabilities based on the job; for instance, cognitive assistants can help biochemists to keep up with the explosion of literature. A cognitive assistant can help one in gathering and analyzing raw data to derive information that serves as a basis for decisions (Demirkan et al., 2015). IBM Watson could potentially significantly change IS by transforming the decision process from one -based on opinion to one based on evidence. IBM Watson may counsel cancer patients and support clinicians in taking guided decisions. In general, cognitive systems "can provide customers with high-quality recommendations and help customers make better data-driven decisions" (Demirkan et al., 2015).

Like CaaS applications, smart services incorporate automation that handles some of the traditionally human functions in a service system (e.g., managing city traffic, diagnosing and treating patients, planning individual educational programs, preparing legal cases, designing personalized menus, optimizing corporate financial portfolios, assigning professional staff to projects). Such services may be types of knowledge-based intelligent services (KBIS) or knowledge-intensive business services (KIBS). Typically, smart service systems substitute technology for people.

2.3 Human-centered Service Systems and Personal Data

The people involved in service systems always determine value (Vargo & Lusch, 2004). Because people are critical to all service systems, some have begun to emphasize the human element by referring to service systems as human-centered service systems (HCSSs): configurations of people, information, organizations, and technologies that operate together for mutual benefit (Maglio et al., 2015). One can distinguish HCSS from other types of socio-technical systems in that they depend critically on sharing capabilities among distinct economic entities to create value. HCSSs include family households, apartment complexes, online social media platforms, global non-profit social enterprises and aid organizations, hotels, hospitals, shopping malls, office complexes, schools, universities, airports, and cities. All exhibit complex behaviors because of the people and relationships involved. HCSSs' performance depends not only on shared information, individuals' skills, infrastructure technologies, organizations and institutions, policies, and rules but also on interactions and independent behaviors, which together have emergent properties. To model, simulate, design, and engineer such complex interconnected systems will require new representations and formalisms. One can use models to identify what problems may arise, what conditions lead to instability, and which parameters to set to make changes effectively and efficiently (Maglio et al., 2015). As HCSSs evolve and as technology grows smarter over time, we will need ways to engineer improved systems to take advantage of new smart technologies (e.g., to modularize services in disciplines where researchers have conducted systematic engineering approaches in disciplines such as telemedicine services (Peters & Leimeister, 2013); (Peters, 2014), education services (Janson, Peters, & Leimeister, 2015) and crowdfunding services (Haas, Blohm, Peters, & Leimeister, 2015). The key to understanding (service) innovation in human systems (whether they are called service ecosystems, service systems, or human-centered service systems) is to understand that people can create complex institutional structures from relatively simple institutional building blocks (e.g., norms, rules, models, symbols, and other governance and heuristic mechanisms). These structures provide the glue that holds these systems together, which allows the service system participants to co-create value at the micro-level (e.g., firm-customer), meso-level (e.g., industry), and macro-level (e.g., societal) scales (Vargo & Lusch, 2016). We need more research on theory creation, data collection, mathematical and computational modeling, service system design, performance measurement, and education for human-centered service systems.

Unlocking personal data’s economic and social value in ways that encourages innovation and helps individuals create insights and make better decisions without diminishing their rights requires developing a new market for personal data. Today, firms collect personal data (both content and metadata) primarily in silos for their own benefit (e.g., utility companies collect data on energy use and water use, auto manufacturers collect data on driving habits, retailers collect data on purchases, and medical-device makers collect data on physical activity and blood pressure). Firms collect this data often with little knowledge of the data’s context. By focusing on personal data and the contexts of use (i.e., where and when the data are collected), opportunities exist to create the “market of one” in which individuals are responsible for and own their own data. Though more and more people say they want to protect their data, behavior often shows otherwise (e.g., when not configuring their Facebook privacy settings accordingly). However, as a result, an opportunity exists for new business models based on individuals’ owning their own data. Individuals then can consider ownership independently of the organizations that collect, curate, manage, and manipulate data for commercial or societal purposes. Currently, organizations that provide technology solutions, applications, or data services collect and analyze data to profit directly or indirectly through trading data and analyses with others. However, new business models based on individuals’ owning their own data are also possible. For instance, the U.K. Government funded the “Hub-of-All-Things” (HAT) project (www.hubofallthings.org), which aims to develop a market in personal data where individuals own their own data (Ng et al., 2015). With six experimental sites (homes) that collect sensor-based and ethnographic data on product usage, the project aims to roll out to over 10,000 homes in the near future. The HAT is the first ever personal data platform (HATPDP) created to hold individuals' data for their own personal use. Individuals can acquire their own data, which comes from connected objects and services, and which the HATPDP may transform so that individuals can contextualize it and make it meaningful and useful for their own purposes. As such, the HAT is a personal data platform for firms to offer individuals services for their data in a scalable way but that allows individuals to personalize the data to their own needs. Most importantly, individuals own both collected and transformed data.

In general, business models bridge technological and market innovations (see Figure 2). As we note earlier, service-oriented business models can increase competitive advantage by augmenting goods, opening new markets, and strengthening customer interactions that can improve financial performance (Lusch & Nambisan, 2015).

Nowadays, new business models have emerged with new units of analysis, and business models emphasize a system-level, holistic approach to explain how firms “do business”. In business models, focal firms’ and their partners’ activities play an important role in value co-creation. Business models also aim to explain how value is created, not just how it is captured (Zott, Amit, & Massa, 2011). In this context, frameworks that allow one to analyze, describe, and classify business models, to identify white spots for future business opportunities, and to identify patterns for successful business models can play a substantial part in helping one understand and develop new business models (Peters, Blohm, & Leimeister, 2015).

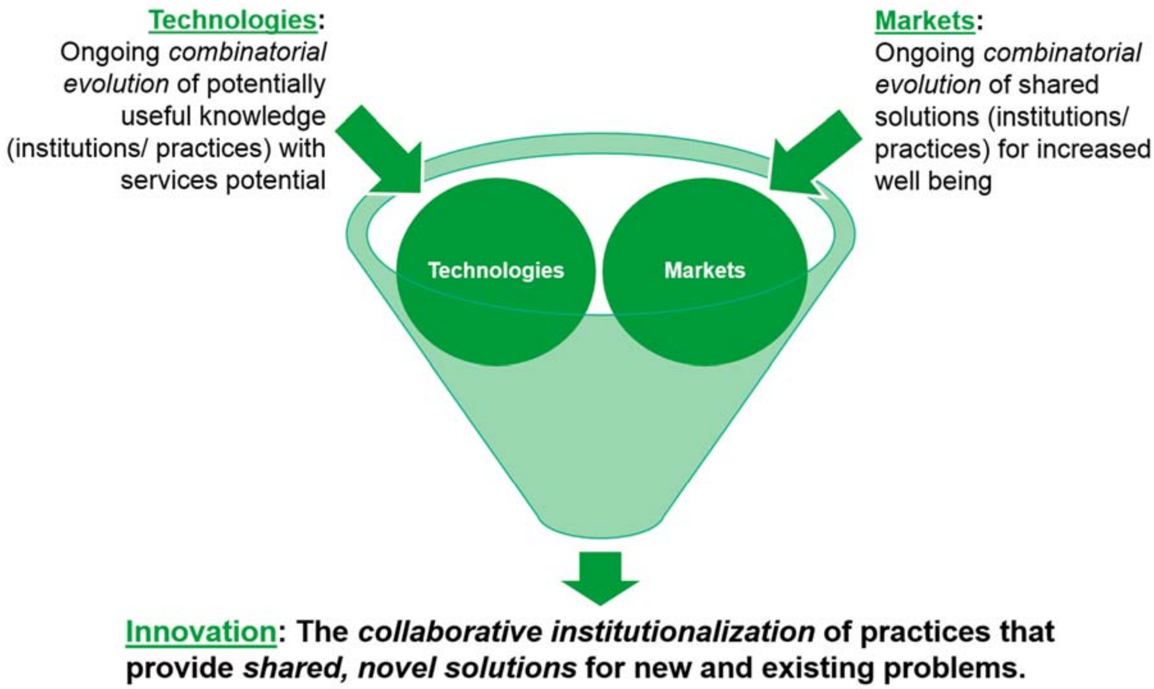

Figure 2. Innovation as Institutional, Combinatorial Evolutionary Processes (Vargo, 2014)

3 Emerging Digital Frontiers for Service Innovation

The workshop on emerging digital frontiers for service innovation held at the 48th Annual Hawaii International Conference on System Sciences (HICSS) aimed to:

1. Bring together scholars with different backgrounds to enhance interdisciplinary connections
2. Provide a forum for generating new ideas by grouping participants with different thoughts together to establish common ground and generate cross-disciplinary conversations, and
3. Help participants identify challenges and opportunities in the areas of cognitive systems, smart service systems, cyber-physical systems, and human-centered service systems.

In the workshop, we each gave presentations on the following topics that the workshop participants (see Appendix) discussed after they formed three different workshop groups in a roundtable setting:

- Position statement: cognitive systems and smarter service systems.
- Service dominant logic—an institution perspective on innovation in technology and markets.
- A Research agenda for human-centered service system innovation.
- How can we make service smart?
- Personal data.
- Service transformation: implications for product manufacturers.
- Cyber physical systems and services.
- IBM research perspective & priorities.
- Digital service platform orchestration.

By consolidating these discussions that occurred in these different groups, we summarize our results. To foster future discussions and encourage others to join the conversation in the emerging service science discipline, we directed our discussion to arrive at challenges for future research and practice, and we consolidate them below to seven core challenges.

Recently, Ostrom, Parasuraman, Bowen, Patricio, and Voss (2015) articulated a framework for service research that shows five major priority areas: strategic priorities, design/delivery priorities, value-creation priorities, outcome priorities, and cross-cutting priorities. Our report addresses these five service research priorities (specifically strategic priorities, cross-cutting priorities, and value-creation priorities), especially in discussing how to leverage emerging technology in a service-innovation context.

3.1 Challenge # 1: Developing and Using Cognitive Assistants

As we describe previously, cognitive assistants are computational processes that augment and scale the performance of people in service systems. Obviously, cognitive assistants have the opportunity to substantially improve the way complex service systems work. Questions include:

1. How can one more rigorously, scientifically, and cost-effectively develop cognitive assistants for all occupations in smart service systems?
2. How do requirements for cognitive assistants look like, and how can they inform the systematic and rigorous design of according service systems?
3. What policies can both stimulate investment in the use of cognitive assistants and ensure robust demand for workers across the spectrum of skills?
4. What are the best ways to organize mixed initiative teamwork in human-agent collectives (HACS) (Jennings et al., 2014)?
5. What policies can ensure high-levels of competence and responsibility in individuals and organizations and avoid systemic brittleness and concerns of cyber-attacks on infrastructure as society comes to use and rely on cognitive systems more?
6. How can cognitive computing systems identify and specify the decision model for a context-dependent service? How will value be judged? Where are the best opportunities for integrating human and technical capabilities? First, where are the best opportunities, and what is the best approach to be able to make it happen effectively?

3.2 Challenge # 2: Making the World Smarter: Smart Service Systems and Services

Creating smart service systems and smart services should make for better customer experiences and more overall value creation, but these advancements are not guaranteed. Issues include how to determine big data's value for supporting smart service systems. We need models about creating models for the decision that user has to make. We cannot model service unless we understand how to model value. There are differences in value perceptions between academia and practice; for example: what is the relationship between interaction and engagement? How do practitioners talk about value; how do academics talk about value? We must address the gap between practitioners and academics.

3.3 Challenge # 3: What Affects the Development of Cyber-physical Systems and Services?

Contemporary cyber-physical systems and services (CPSSs) raise many questions that research has not yet fully studied. For instance, we do not know how one can apply service-dominant logic (SDL) in CPSSs and, more specifically, how value or utility is co-created for and with these systems and services. Questions include:

1. What is the impact to hardware-based sensors and real-time analytics of data?
2. Which methods, models, tools, and so on can one use from disciplines dealing with CPSS and how do they need to be adapted for systematically designing and evaluating CPSS?
3. How does the nature of CPSS affect use? Are there differences between digital natives and immigrants? What is the impact on co-creation of value for such systems and services? This is also a great opportunity to look at the differences in triggers for sensemaking given different backgrounds (Griffith, 1999).
4. What is the impact of hardware-based sensors and real-time analytics? Can we use real-time analytics and so on to detect unintended consequences? If so, when should a system provide feedback and how does that affect what users do? How does the cyber-aspects of such systems and services impact ICT infrastructure, computer hardware, software, and different kind of sensors and actors (both humans and systems)?

5. How does the infusion of ICT into services and service-dominant logic thinking impact CPSS development? There are many combinations: business to consumers (B2C), business to business (B2B), machine to machine (M2M), machine to business (M2B), machine to consumers (M2C), consumers to consumers (C2C).

3.4 Challenge # 4: Understanding Human-centered Service Systems

How can we best understand and improve human-centered service systems? The research agenda for HCSS comprises the following topics: theory, data, modeling, design, measurement, and education. Questions include:

1. Are all service systems HCSSs? The way we transform human-centered service system (HCSS) is different from manufacturing-centered services (MCS). The degree of human involvement may rather be a continuum: a high degree for medical services and a low degree for high-frequency stock trading.
2. Which methods, models, tools, and artefacts can facilitate the design, engineering, and management of HCSSs?
3. How can we define the term data and how can we manage it? Is it necessary to have humans in the system to co-create value?
4. How can we measure the experience in HCSSs?
5. How do different philosophical perspectives influence our perspective of HCSS? Can everything be measured (positivistic)? Should everything be measured (critical realism)?
6. What is the role of interfaces? Technical services are often well designed because they can be controlled and measured.
7. As we come to need more interdisciplinary work, we need to include psychologists or behavioral scientists into service research to understand HCSSs. As such, how can we do so successfully?

3.5 Challenge # 5: Leveraging the Potential of Personal Data

Two new topics have emerged about using personal data: the first concerns using data ethically to drive decision making. When mixing and combining data, one creates socio-technical systems. Data accumulates in the systems, and one can use this data in different contexts, which may pose problems. One may use data in the future in contexts that do not exist yet. The key is to understand and improve service systems in gathering data about them. The second topic concerns new forms of leaderships in socio-technical systems. Who takes care of the human side of service, such as in healthcare and education? There are ethical concerns in healthcare that relate to overusing resources. Questions include:

1. What rights should exist for responsible use of data?
2. How can we guarantee data privacy given that one can share it in many ways?
3. What are the challenges in regards to personal data in the context of personalized advertising (e.g., using face recognition)?
4. How can we connect open data and crowdsourcing to personal data?
5. How can service concepts be systematically designed and managed that include the use of personal data by-design in an adequate manner?
6. What are the challenges in creating new multi-sided platforms (MSP) whose data belongs to users?
7. What implications do organizations have in extending their services into the home?
8. How do we incentivize users to provide their data?
9. Who does what and who gets what in these new MSPs?
10. What are the implications of using personal data on a citizen level?
11. How can we develop systems that enable users and encourage “bottom-up” structures?
12. The key question is an economical one: who uses data in which way and who benefits from this use of personal data?

3.6 Challenge # 6: Designing Institutions

How can we design institutions effectively to support the kinds of systems we discuss here? Specific questions include:

1. Is an institutional language the appropriate way to talk about socio-technical structuration? Institutions become coordination functions, but we have little understanding about how each level works and how the levels interact. How can we study these levels? How do they differ from practices, patterns, culture?
2. How do institutions emerge and how can one alter them?
3. What is an institutional boundary? How can we define them?
4. What is the role of technology in the institution?
5. How can service systems be linked to institutions? Are institutions part of a service system?
6. Can systems interact with systems to co-create value without individuals' being in the direct interactions? How much can one automate co-creation? We could reach higher-level opportunities for people if the technology can do more.

3.7 Challenge # 7: Service Transformation

The service transformation literature has matured to a point where we understand the foundations of the service-transformation process. However, the literature has gaps that offer opportunities for improved clarity and further topic development. Questions include:

1. What is the difference between service transition and service transformation? Research often uses the terms interchangeably.
2. Do service infusion and servitization refer to the same process? How are they related to service transition/service transformation?
3. The academic literature is virtually silent on service platform strategy. What defines a service platform and how might services integrate with a product platform?
4. Hybrid services that combine products and services represent a logical evolution on the service transformation continuum from product dominance to service dominance. What dimensions or factors characterize the threshold where product dominance gives way to service dominance? Can one predict and effectively roadmap this point of transformation?
5. What impact will new technologies that can drive asymmetric service innovation such as 3D printing, robotics, autonomous capabilities, cognitive computing, energy harvesting devices, smart systems, smart sensors, and the Internet of things (IoT) have on product manufacturing companies?

4 Summary and Conclusions

In this paper, we present the results of the workshop on "Emerging Digital Frontiers for Service Innovation" held at the 48th Annual Hawaii International Conference on System Sciences (HICSS) in January 2015. Participants identified several challenges in the areas of cognitive systems, smart service systems, cyber-physical systems, and human-centered service systems. In this paper, we provide background on cyber-physical systems, cognitive systems, smart service systems, human-centered service systems, and personal data. We also summarize our results by presenting challenges concerning emerging digital frontiers for service innovation. We hope to continue focus on this emerging topic, which is relevant to the IS community. We encourage the community to join the discussion.

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Appendix: Full List of Workshop Contributors

Haluk Demirkan (University of Washington—Tacoma) (Workshop Co-chair)

James C. Spohrer (IBM) (Workshop Co-chair)

Terri Griffith (Santa Clara University) (Workshop Co-chair)

Yassi Moghaddam (ISSIP) (Workshop Co-chair)

Anna Wiedemann (NTT DATA, Munich, Germany)

Anssi Smedlund (Aalto University, Finland)

Christoph Breidbach (University of Melbourne)

Christoph Peters (University of St. Gallen / Kassel University)

Erik Rolland (University of California, Merced)

Helmut Krcmar (Technische Universität München)

Jeff Welser (IBM Almaden Research Center)

Joseph Taylor (Washington State University)

Keskin Tayfun (University of Washington)

Masashi Ono (Tokyo Institute of Technology)

Olivera Majanovic (The University of Sydney Business School)

Paul Maglio (UC Merced and IBM Almaden Research Center)

Ralph Badinelli (Pamplin College of Business of Virginia Tech)

Roger Maull (University of Surrey)

Robert R. Harmon (Portland State University)

Steve Vargo (University of Hawai'i at Mānoa, Honolulu)

Tuure Tuunanen (University of Jyväskylä)

About the Authors

Christoph Peters is a postdoctoral researcher and project manager at the Institute of Information Management, University of St. Gallen, Switzerland, and at the Institute of Information Systems, Kassel University, Germany. He graduated from University of Mannheim, Germany, and holds a Ph.D. from Kassel University. He has been a visiting researcher at the Service Research Center (CTF) at Karlstad University, Sweden, and the Recanati Business School of Tel Aviv University, Israel. He coordinates several research projects and heads a research group which focuses on two streams of research: 1) the engineering and management of services and service systems, their digitization and corresponding business models; 2) digital work, how work is changing and new work scenarios can be designed in times of digital transformation.

Paul Maglio is a Professor of Technology Management at the University of California, Merced, and a research staff member at IBM Research, Almaden. He holds a bachelor's degree in computer science and engineering from MIT and a Ph.D. in cognitive science from the University of California, San Diego. Paul is the Editor-in-Chief of INFORMS *Service Science*, serves on the editorial board of the *Journal of Service Research*, and was lead editor of the *Handbook of Service Science* (Springer). He has published more than 100 papers in computer science, cognitive science, and service science.

Ralph Badinelli is a professor in the Department of Business Information Technology of the Pamplin College of Business of Virginia Tech. He holds a Ph.D. and M.S. degrees in Management from the Krannert Graduate School of Business of Purdue University and a M.S. degree in Physics from Purdue University as well as a B.S. degree in Mathematics and Physics from Hofstra University. Furthermore, Ralph worked as Production Planning Supervisor for the optics division of a west-coast laser manufacturer. He has consulted companies on planning, forecasting, and software development for decision support. Ralph has taught many executive-development seminars on the subjects of project management, quality improvement, production and inventory control, and business strategy. He has published refereed articles across a wide range of topics including inventory control policies, revenue management, probability estimation, decision analysis and optimization.

Robert R. Harmon is Professor of Marketing and Service Innovation and Cameron Research Fellow at Portland State University. He has served as Director of the Strategic Marketing Area in the School of Business and as a joint faculty member of the Division of Management in the School of Medicine, Oregon Health & Science University. Robert holds a Ph.D. in marketing, information systems, and psychology from Arizona State University. In addition, he holds a B.S. and MBA in finance from California State University, Long Beach. He worked as a financial analyst for a Fortune 500 pharmaceutical company and has held the senior marketing executive position for firms in water transmission infrastructure, IT portfolio management software, and mobile payments software industries. Robert's current research includes the development of enterprise business models for service innovation, sustainable IT services, and intangible value as a driver of product and service design.

Roger Maull is a Professor of Management Systems at the University of Surrey. He is also a founding member of Surrey's Centre for the Digital Economy (CoDE). Until 2014, he was affiliated with the University of Exeter where he establishing the centre for Innovation and Service Research (ISR). His current research considers the implications of the Digital Revolution for businesses and society. His current research is informed by two major RCUK research grants NEMODE and the HAT. He believes strongly in empirical research and likes to work closely with industry. Furthermore, Roger is a Visiting Professor at the Australian Business School at UNSW. From 2010-2013 he was one of the editors of the *International Journal of Operations and Production Management* (IJOPM). He is currently External Examiner for the Said Business School MBA.

James ("Jim") C. Spohrer is Director IBM Global University Programs and leads IBM's Cognitive Systems Institute. Jim co-founded IBM's first Service Research group, ISSIP Service Science community, and was founding CTO of IBM's Venture Capital Relations Group in Silicon Valley. He was awarded Apple Computers' Distinguished Engineer Scientist and Technology title for his work on next generation learning platforms. Jim has a Yale PhD in Computer Science/Artificial Intelligence and MIT BS in Physics. His research priorities include service science, cognitive systems for smart holistic service systems, especially universities and cities. With over ninety publications and nine patents, he is also a PICMET Fellow and a winner of the S-D Logic award.

Tuure Tuunanen is a professor in the Department of Computer Science and Information Systems at the University of Jyväskylä, Finland. He is also a global faculty fellow of the Center for Service Leadership at Arizona State University. He holds a D.Sc. (Econ) from the Helsinki School of Economics. His research has been in the cross-sections of information systems, software engineering, and marketing science and is interested in multi-disciplinary research in the area of service innovation. His current research interests lie in the areas of value creation, service engineering, and IT enabled and digital services. Tuure's research has been published, e.g., *Journal of Management Information Systems* (JMIS), the *Journal of Association for Information Systems* (JAIS) and *Journal of Service Research* (JSR). More about his research can be found at http://www.tuunanen.fi and his publications are available at http://pubs.tuunanen.fi.

Stephen L. Vargo is a Shidler Distinguished Professor and Professor of Marketing at the University of Hawai'i at Mānoa, Honolulu. He holds a B.A. in Psychology and a M.S. in social psychology from the University of Oklahoma. His primary areas of research are marketing theory as well as thought and consumers´ evaluative reference scales. His articles have been published in highly ranked scientific journals and he is author or co-author of a series of best-selling books on marketing.

Jeffrey J. Welser is Vice President and Lab Director, IBM Research – Almaden in San Jose, California. He received his PhD in Electrical Engineering from Stanford University. He holds 21 US Patents and has published over 75 technical papers and presentations. He is a member of the IBM Academy of Technology, an IEEE Fellow, a member of the American Physical Society, Chairman of the Bay Area Science and Innovation Consortium and has served on numerous Federal agency and Congressional panels on advanced semiconductor technology.

Haluk Demirkan is a Professor of Service Innovation & Business Analytics at the Milgard School of Business, University of Washington Tacoma. His doctorate is in Information Systems and Operations Management from University of Florida, and his research in analytics, digital & service innovation and service-oriented technology & management have included recent industry-sponsored research projects with IBM, American Express, Intel and Teradata. He has almost 20 years of professional work experience on maximizing the return on the companies' resources by effectively implementing strategic data and analytic solutions for 40+ Fortune 500 companies. He has more than 150 publications and presentations. He is a board of director for the International Society of Service Innovation Professionals, and an advisory board member for the INFORMS Service Science Section.

Terri L. Griffith is Professor of Management in the Leavey School of Business. She received a B.A. at the UC Berkeley. In addition, she holds a M.S. and Ph.D. at the Carnegie Mellon University, GSIA - now the Tepper School of Business. Her research and consulting interests include the implementation and effective use of new technologies and organizational practices. Terri's recent field research includes two Fortune 100 tech companies, both focused on generating the greatest value from their teams in complex environments. Her research is published in journals such as *Organization Science*, *Information Systems Research* (ISR), *MIS Quarterly* (MISQ), *Organizational Behavior and Human Decision Processes* (OBHDP).

Yassi Moghaddam holds an MBA from Columbia University, an MSEE from Georgia Institute of Technology, and a BSEE from University of Oklahoma. She is the Executive Director of the International Society of Service Innovation Professionals. It´s a professional association whose mission is to promote service innovation for our interconnected world and advance the development of T-shaped professionals across the globe. Yassi is also Managing Director of Stradanet, a Silicon Valley-based consulting firm where she supports multimillion-dollar service innovation and transformation projects within Fortune 500 companies and service platform and ecosystem strategy development within startup companies.