A SERVICE SCIENCE PERSPECTIVE ON THE ROLE OF ICT IN SERVICE INNOVATION

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Abstract

Information and Communication Technology (ICT) is often considered the main enabler of service innovation. The unique role of ICT in service innovation, however, is not fully understood and advancing knowledge in this area emerged as the top research priority in the fields of service science and information systems research. To date, substantial insights regarding the role of ICT in service innovation are not available, and new theoretical lenses and perspectives are needed to develop these. In this conceptual paper, we define service innovation as service system reconfiguration, which allows us to classify the role of ICT in this process more succinctly and ultimately overcome the shortcomings in the existing body of literature. Specifically, we deconstruct and extend previous views of ICT as a "black box" in service innovation research, and focus on the actual innovation process and its mechanisms. We define and delineate these as resource shifting and resource access, explain the role of ICTs in each, and outline further research opportunities that result from these new insights.

Keywords: Service innovation, service science, reconfiguration, ICT.

1 Introduction

Information and Communication Technology (ICT) is often considered the main enabler and facilitator of innovation in service contexts (Sheehan, 2006; Bitner, Zeithaml and Gremler, 2010). Examples include the consulting industry where ICTs such as video conferencing enable process innovations (Breidbach, Kolb and Srinivasan, 2013), or new digital business models such as Apple's iTunes ecosystem, which consists of hardware, software and service (Johnson et al. 2008). However, the role of ICT in service innovation remains ambiguous, and investigating its implications currently represents *the* top research priority for the progression of service science (Ostrom et al., 2010). Correspondingly, Information Systems (IS) scholars also called for research at the intersection of ICT and service (Rai and Sambamurthy, 2006).

To advance our understanding of today's global, digital, service-oriented economy, new theoretical lenses and perspectives are necessary (Maglio and Breidbach, 2014). This is especially true when attempting to study the role and impact of ICT on service innovation, a research area that went through substantial change in recent years (Ostrom et al., 2010; Lusch and Nambisan, 2014). For example, IS researchers typically explored service innovation as an output, created by firms, which is relevant to IT managers (Nambisan, 2013). However, such a firm-centric and output-oriented perspective on ICT and service innovation seems unsuitable to today's highly dynamic innovation landscape, which is characterized by integrative innovation approaches that span traditional firm boundaries (Chesbrough, 2003; Nambisan and Sawhaney, 2007). In this context, service-dominant (SD) logic (Vargo and Lusch, 2004) gained momentum as a novel lens to explore service innovation, as it extends focal firm boundaries by including customers, as well as changes in customer-firm interactions into the discourse (Michel, et al., 2008; Ordanini and Parasuraman, 2011). Specifically, SD logic shifted the traditional firm-centric and output-oriented perspective toward an understanding of economic exchange that is centered on service itself (Drejer, 2004; Gadrey and Gallouj, 2002; Lusch and Nambisan, 2014).

Here, we argue that both, the service *and* firm-centric perspectives are fundamentally constrained in their ability to advance our understanding of service innovation generally, and of the role of ICT in service innovation specifically. Neither lens answers the most fundamental questions of how new ICTs emerge and evolve, what constitutes service innovation, and how such innovation may be designed. Service innovation research is stuck in an ideological conflict that is centred on diverging and increasingly narrow perspectives, and new means to investigate and understand the intersection of ICT and service innovation are needed (Maglio and Breidbach, 2014). Our goals are first, to introduce a service science lens as an alternative perspective to understand the role of ICT in service innovation into IS research, and second, to re-conceptualize the process of service innovation accordingly.

We define service innovation as *service system reconfiguration*, which helps to avoid the inconsistencies of existing service innovation perspectives. Our argument, rooted in Arthur's (2009) view of technology evolution, is that recombination of individual operand (e.g., tangible) and operant (e.g., intangible) resources is the sole driver of innovation. This approach allows us to deconstruct the view of ICT as a "black box" that is common in the nascent IS literature, to broaden the output-oriented lens on service innovation, and to focus on the actual innovation process. Specifically, we propose two core innovation mechanisms, *resource shifting* and *resource access*, and highlight the role of ICT in each. Our work thereby contributes to the current discourse on the role of ICT in service in both, the service science and IS literatures; specifically, the extant firm-centric (Bitner, Zeithaml and Gremler, 2010) and service-centric (Michel, et al., 2008; Ordanini and Parasuraman, 2011; Nambisan and Lusch, 2014) streams that dominate existing work in this area.

This paper is structured as follows. First, we review established perspectives on service innovation, highlight the role of ICT taken in each stream, and identify shortcomings. Second, we demonstrate how a service science lens helps to reconceptualise service innovation as service system reconfiguration. Finally, we discuss future research directions that result form this perspective.

2 Perspectives on Service Innovation

Existing service innovation research can be classified into two distinct schools of thought: *technologist* (or assimilation) and *demarcation* approaches (de Vries, 2004; Drejer, 2004; Gadrey and Gallouj, 2002). The technologist approach essentially reduces service innovation to the adoption of ICT in the so-called "service economy." Technologists thereby link service innovation to growing ICT-related competencies of firms, or to overall ICT developments (Gallouj and Savona, 2009). Examples in the IS literature include Swanson's (1994) typology of IS innovation archetypes that may result from the use of information systems, or institutional factors that influence IS innovation processes (Hsu, et al., 2012). Barras (1990), for example, argues that ICTs represent an enabler that can lead to process innovation, radical process innovation, and eventually, product innovation. The adoption of software, as a core ICT artefact, represents an enabler to innovation, for instance, in linking the adoption of spreadsheet software to innovation processes (Brancheau and Wetherbe, 1990). On this view, service innovation is therefore seen as a firm-centric and output-oriented process (Kleis, et al., 2012).

The demarcation approach to service innovation highlights perceived differences between service and product innovation (Drejer, 2004; Gallouj and Savona, 2009; Nijssen, Hillebrand, Vermeulen, and Kemp, 2006). Specifically, demarcation studies are grounded in the argument that some forms of innovation are service-specific, that services are distinct from goods, and that innovation-concepts unique to services are needed (Gallouj and Windrum, 2009; Nijssen, et al. 2006). Pavitt (1984), for example, create a taxonomy of distinct innovations across different types of service firms, whereas other empirical work typically explores innovation in select service industries only, including consulting (Gadrej and Gallouj 1998), tourism (Hjalagar 1997), or financial services (Niehans 1983). Furthermore, Gallouj and Weinstein (1997) identified ad-hoc innovation as a type of innovation considered to be prevalent in the consulting industry only. As such, advocates of the demarcation approach typically focus on the industrial context or product-service divide rather than on the role of ICTs when exploring innovation processes and patterns, for instance, by distinguishing between service and device (e.g. product) layers (Yoo, et al., 2010).

With the emergence of SD logic (Vargo and Lusch, 2004), service innovation research shifted its focus from service providers to service customers, aiming to understand the interactions between these two groups as a prerequisite to eventually understand customer needs (Sebastiani and Paiola, 2010), to manage innovation processes more effectively (Ordanini and Parasuraman, 2011), and to build theory (Peters et al., 2014). On this view, service innovation depends on understanding the roles that customers can play as cocreators of value (Michel, et al., 2008), and therefore diverged substantially from the established technologist and demarcation approaches (Ordanini and Parasuraman, 2011; Edvardsson, et al., 2010). Empirical studies testing the applicability of SD logic to service innovation research are limited, and there is some controversy as to what extent a pure SD logic lens can actually improve our understanding of service innovation. For example, Breidbach, Smith and Callagher (2013) applied SD-logic to innovation in professional service firms, and found that its foundational premises may not provide a complete understanding of the domain.

Within IS research, Lusch and Nambisan (2014) recently introduced SD-logic, and called for a new perspective of ICTs as operand and operant resources, thereby outlining resulting implications to understand innovation. Operand resources lie at the core of firm-centric thinking (i.e. the technologist perspective on service innovation), are physical objects on which actions can be performed (Vargo and Lusch, 2004), and can be exchanged for money to generate a benefit (Vargo and Morgan, 2005). Operant resources, by contrast, act on operand resources (Vargo and Lusch, 2004), embodying knowledge, skills, or information (Vargo, et al., 2010), and enable the generation of new operant resources, including new ideas or knowledge. As operand resources, ICTs can be a facilitator of innovation because they contain value and enable the sharing and integration of knowledge and resources in a network of economic actors. As operant resources, ICTs are generative and can themselves create new opportunities to integrate resources, thereby creating new knowledge. Viewing ICTs as operant re-

sources raises the question of how different arrangements of ICTs may enhance or diminish innovation opportunities, and suggests that ICTs may not only facilitate innovation (i.e. as an operand resource), but may become part of innovation themselves (i.e. as an operant resource) (Lusch and Nambisan, 2014).

The main challenge underlying Lusch and Nambisan's (2014) argument, however, is their perception that ICTs remain the sole driver and enabler of *all* innovation capacity. Other well-documented sources of innovation that are not related to ICTs, such as human capital (Breidbach et al., 2013), are thereby excluded. The approach suggested by Nambisan and Lusch thereby is equally constrained in its ability to understand and facilitate service innovation processes more holistically.

3 Rethinking Service Innovation

Here, we propose to rethink service innovation beyond the traditional firm-centric, as well as customer-centric perspective advocated by SD-logic. To date, the discourse on service innovation in the relevant marketing, management, and IS literature, has been dominated by a unidirectional debate about the advantages of SD-logic in comparison to existing alternative perspectives (i.e. technologist and demarcation approaches). Those advocating an SD-logic lens on service innovation criticize technologist and demarcation approaches for their firm-centric view, output orientation, and focus on ICTs as operand resource (Michel, et al., 2008; Nam and Lee, 2010; Sebastiani and Paiola, 2010; Ordanini and Parasuraman, 2011). Though technology or ICTs "may influence a firm's ability to craft a value proposition" (Michel, et al., 2008, p. 58) any information technology is merely a communication medium (Sundbo, 1997), and therefore a tool that facilitates actual value cocreation between service provider and customer (Bitner, et al., 2000). On this view, then, ICT is "not an innovative element *per se*" (Sebastiani and Paiola, 2010, p. 85). In contrast, Lusch and Nambisan (2014) view ICTs as *both* an operand *or* operant resource, and therefore as an enabler *and* inherent component of service innovation. Viewing ICTs as an operant resource, and therefore as a source of innovation, however, contradicts the traditional SD-logic worldview (Vargo and Lusch, 2004), which would classify ICTs as an operand resource. Furthermore, by emphasizing that ICTs represent the key unit of analysis, Lusch and Nambisan (2014) implicitly diverge from the broader perspective on innovation, and exclude all other economic actors and entities in a service system (Maglio and Spohrer, 2013).

To provide an example highlighting the existing challenges, we demonstrate how findings of a study on the role of ICT and service innovation would vary when different philosophical lenses are applied. Consider online education as an example of a service innovation (Waldrop, 2013). In particular, massive open online courses (MOOCs), which were popularized by initiatives such as Coursera, Udacity, and EdX, represent the basis for our thought experiment. Those taking a goods-centric (i.e. technologist) approach to understanding this new model for education might focus on technical innovation, such as streaming video on the web, and related provider-side technologies. A technologist would argue that these types of ICTs have driven the emergence of MOOCs. In contrast, those taking a demarcation approach to understanding MOOCs might identify types of innovation processes that are unique to MOOCs only, such as the new business models for education. Finally, those taking a service-centric approach might focus on the ways in which modern students prefer to interact with course material, instructors, and peers, and how this interaction creates value for students. Yet neither the technical side nor the student side can explain the sudden rise and popularity of MOOCs.

The existing schools of thought are fundamentally constrained, as they focus on select entities (i.e., customer *or* firm *or* ICT) as the unit of analysis. Furthermore, whereas technologists view ICTs as a "black box", SD-logic scholars typically *exclude* ICTs from any inquiry, as they would be considered operand resources, and therefore irrelevant to a discourse that perceives operant resources (i.e. knowledge and skills) as the key driver of innovation. With MOOCs, however, it may not be the technology, the information, the students, or the providers individually that make this service work: Ra-

ther, it may be the way in which each entity in a wider service system can arrange their resources for mutual benefit. Put differently, it is not *only* the entity of the service system that matters, but also the interactions of *all* entities using *all* resources available to them that matter. Therefore, to explain the role of ICT in service innovation, we must acknowledge that ICTs play only a small role in any service system, and that the combination of its multiple technical and non-technical resources, of which ICTs is only one, may be the driver of innovation.

The current discourse on service innovation research is stuck in an ideological conflict that is centred on diverging and increasingly narrow perspectives. Advancing understanding of service innovation therefore requires a "reassessment of established theories and models, and the development and testing of new theories and models" (Gallouj and Windrum, 2009, p. 141). Neither the firm-centric nor service-centric lens can provide an answer for the most fundamental questions of how new ICTs emerge and evolve, what constitutes service innovation, and how innovation may be designed. Advancing our understanding of the role of ICT in service innovation may not only require a reassessment of established theories and models of innovation, but also a conceptual shift in thinking of what ICTs embody. We think a service science lens can help. Building on the view of technology and innovation laid out by Arthur (2009), we propose a conceptualization of service innovation as service system reconfiguration, and show how this perspective can help address these fundamental questions.

4 Conceptualizing Innovation as Service System Reconfiguration

Service innovation is service system reconfiguration. We base this argument on two core premises: First, the *service system* is our basic unit of analysis (Maglio and Spohrer, 2008; Maglio, Vargo, Caswell and Spohrer, 2009). A service system is composed of multiple *entities* that interact to cocreate value. Service system entities are composed of four basic kinds of *resources*: people, technology, organizations, and shared information. Entities share access to resources within *value networks*, constellations of connected service systems (Spohrer and Maglio, 2010; Vargo, et al., 2010). When service systems integrate and apply resources within a specific context, *and* consider the improvements derived from the integration and application of resources beneficial, value emerges in the use or application of resources (Vargo and Lusch, 2006). Thus, firms only initiate value propositions, and entities create mutual value through sharing and accessing resources (Maglio and Spohrer, 2013). More generally, we define value as service system improvement, which is contingent on the evolution of the system itself (Spohrer, et al., 2008; Vargo, Maglio and Akaka, 2008). As a unit of analysis, the service system has a number of advantages when compared to the traditional firm- or service-centric perspectives. For one thing, we can see the system as seeking optimal solutions by rearranging resources across its entities. For another, we can see the system as seeking to share operations between entities, rearranging the ways in which others can access resources. Therefore, the system view has more explanatory power than an entity-level view that has dominated existing service innovation research.

Second, we distinguish between service innovation as an *outcome*, and service innovation as a *process*. When innovation is defined as an *outcome*, it may occur "when something is entirely new" (Levitt, 1966, p. 63), which may include "an idea, practice, or object that is perceived as new" (Rogers, 1983, p. 11). As an outcome, service innovation is the result of novel, positive changes to a service system: it is an improvement in the service system, as judged by the system. Conversely, when innovation is defined as a *process*, it may be seen as an act (Steiner, 1965) or activity (Myers and Marquis, 1969), and occurs only when change is adopted (Knight, 1967, p. 479). It is evident that the technologist perspective (e.g., Swanson, 1994; Barras, 1990) focuses on service innovation as an outcome only, whereas the SD-logic perspective (Michel, et al., 2008; Nam and Lee, 2010; Sebastiani and Paiola, 2010) neither explores outcome nor process but the interactions of customers with technology to generate better innovative outcomes.

Before we can expand our innovation perspective away from individual entities and toward whole service systems, we must first consider how individual entities innovate. Following Maglio and Spohrer (2013), entities create innovations by designing new value propositions. This implies that value propositions themselves are resources, which are created by entities who recombine existing resources within their service systems (i.e. people, technology, organizations, and information) or value network. As entities recombine resources internally, service systems evolve. This idea is rooted in the work of Arthur (2009), who explains that all technologies descend from prior technologies in a recursive process of technology combination. In our terms, every new resource is made of other existing resources that are recombined. Arranging resources to suit new purposes, and rearranging resources to better suit old purposes, are central to the process of innovation (Steiner, 1965; Myers and Marquis, 1969; Knight, 1967). Furthermore, the perspective of innovation as resource reconfiguration does not treat ICTs as a "black box". ICTs are merely one of many resources that can be combined to generate beneficial outcomes. Similarly, each type of ICT is itself a combination of multiple resources. A smart phone, for example, consists of an antenna, memory chips, display, and other parts. The display, in turn, is also made of various resources such as circuits. The same mechanism of resource reconfiguration can be applied to larger service systems and value networks. At a high level, this line of thinking suggests two basic mechanisms of service system innovation. Here, we distinguish between resource reconfiguration by *shifting resources* between entities in a service system, and resource reconfiguration by enabling *resource access* between entities as the two basic innovation mechanisms (see Figure 1).

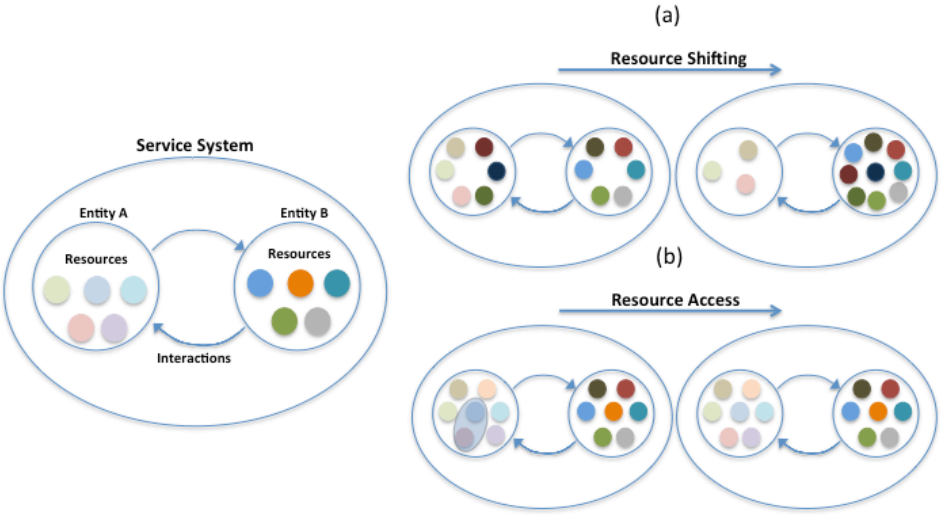

Figure 1. Service Innovation Mechanisms

4.1 Resource Shifting

Resources may shift between service system entities (see Figure 1a). For example, a client company may decide to outsource its existing IT operations to specialized IT provider. Subsequently, resources such as IT systems and employees that were part of the client may move entirely to become part of provider. Resource shifting means changing ownership of individual resources within the service system, and represents a combinatorial process at the system level (cf. Arthur, 2009). Shifting gives the provider access to the client's IT staff, and is a viable solution to the problem of incorporating domain expertise into the outsourced service. Resource shifting is beneficial whenever the cost of cross-entity interaction outweighs the benefit of interaction. The provider alone may not be able to optimize its operations because they depend critically on the client's expertise: By shifting resources between entities, the system as a whole may come to a better solution than individual entities alone. By taking the system as the unit of analysis, we can see resource shifts *between* entities as innovation, much in the same way as rearrangements of resources *within* entities can be seen as innovation.

4.2 Resource Access

Service system entities may decide to make internal resources available to other entities (see shaded region in Figure 1b). For example, web-based airline check-in depends on providing customer access to previously internal airline computer systems. By opening up its internal resources, airlines can improve operations (e.g., require fewer employees at the airport, or better anticipate the number of booked passengers on a flight). By accessing these resources, customers can improve their operations as well (e.g., bypassing the line at the ticket counter). The set of operations to be accomplished overall did not change – passengers still need boarding passes – but the way this is accomplished did. A customer side resource, the passenger, is now interacting with a provider side resource, the check-in computer system, in a new way. Resource access can also be viewed as a kind of search through the space of ideal resource combinations at the system, rather than entity level (cf. Arthur, 2009). By taking the system as the unit of analysis, we can see changes in resource access *between* entities as innovation, much in the same way traditional approaches to innovation can see changes to access *within* entities as innovation.

5 Discussion and Research Implications

Taking a service system view allows us to assess and understand service innovation effectively and comprehensively. Here, we have shown that service system entities are configurations of resources that create new value propositions by accessing or shifting resources to other entities for mutual benefit. Service systems operate effectively when entities can access and make use of the resources other entities have offered (Prahalad and Ramaswamy, 2004). Consequently, on the service system view, innovation results from reconfiguration of resources. Effective service system reconfiguration requires understanding all service system entities, including customers and providers, to identify useful and value-creating configurations. Innovation is not limited to changes in operand or operant resources with entities, but depends on changes to the configuration of resources across multiple entities in a system (cf. Normann and Ramirez, 1993). In this way, the process of service innovation can be seen as a kind of search for the optimum configuration through the space of possible service system configurations (Maglio and Spohrer 2013).

In this short paper, we suggested a conceptual shift in thinking that results in multiple directions for future research: Exploration of service system reconfigurations through resource shifting or resource access as a key mechanism for service innovation. We started to compare the system view with the traditional entity view given by advocates of a technology perspective, advocates of demarcation theories, and advocates of SD logic, arguing that system-level innovation can cover more cases than entity-level innovation. Conceptualizing service innovation as service system reconfiguration helps IS scholars to overcome the boundaries of traditional thinking, extend the current level of analysis that is centred on the ICT artefact, and provide multiple avenues for future research. For instance, how can we measure service system improvement after resource reconfiguration? What are some heuristics for service system reconfiguration? How do service systems reconfigure resources, and how can this reconfiguration process be implemented and governed? How can we identify useful and effective configurations of resources given that the number of potential combinations in a service system may be very large? How do we assess and compare the quality of resources and their relationship to one another?

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