

**Service Innovation:
A Service-Dominant (S-D) Logic Perspective**

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ABSTRACT

We offer a broadened view of service innovation—one grounded in *service-dominant logic*—that transcends the tangible–intangible and producer–consumer divides that have plagued extant research in this area. Such a broadened conceptualization of service innovation emphasizes (1) innovation as a collaborative process involving a diverse network of actors, (2) service as the application of specialized competences for the benefit of another actor or the self and as the basis of all exchange, (3) the generativity unleashed by increasing resource liquification and resource density, and (4) resource integration as the fundamental way to innovate. Building on these themes, we offer a tripartite framework of service innovation: *service ecosystems*, which offer an organizing structure for a network of actors to come together to exchange resources and co-create value; *service platforms*, which serve as the venue for innovation by facilitating easy access to appropriate resource bundles; and *value co-creation*, which views value or experience as co-created by the service offer(er) and the service beneficiary (e.g., customer) through resource integration. In discussing these components of our framework, we consider the role of information technology—both as an *operand* resource and as an *operant* resource—and then examine the implications for both research and practice in digitally enabled service innovation.

Keywords: Service innovation; S-D logic; Platforms; Ecosystems; Value co-creation; Collaboration; Resource integration; Institutions; Architecture.

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INTRODUCTION

How enterprises view the nature and process of innovation has undergone radical shifts in the past decade. No longer are innovations (and even the ideas they emerge from) developed from within the confines of an organization but instead evolve from the joint action of a network of actors ranging from suppliers and partners to customers and independent inventors—that is, a *network-centric focus* (Chesbrough 2006; Nambisan and Sawhney 2007a). In addition, the focus of many innovations is no longer only on tangible goods but also on associated or stand-alone intangible offerings in which the extent of information content is high—that is, an *information-centric focus* (Glazer 1991). Finally, focus has shifted distinctly from the features and attributes of the innovation output to the value (or the experience) that is co-created with other actors in the use of innovations and other market offerings—that is, a *value- and/or experience-centric focus* (Prahalad and Ramaswamy 2004; Vargo and Lusch 2004).

Together, these shifts have not only transformed the landscape of innovation but also, importantly, expanded the role of information technology (IT) in it. As early as the 1930s, Schumpeter (1934), in his writings on the role of innovation in economic development, identified the importance of intangible innovations. However, it took the digital revolution to spark these shifts, as witnessed by the recent, largely intangible breakthrough innovations of Facebook, Amazon.com, YouTube, Google, Twitter, and Second Life. Other innovations of an intangible nature have focused on the development of new processes and user experiences in established industries—for example, Starbucks (coffee), Build-a-Bear Workshop (toys), and Apple (mobile

phones)—or on the removal of the tangible as a key offering—for example, Netflix (movie rental) and cloud computing and software as a service (enterprise IT). In all these innovations, the role of IT has been central and, in many cases, has made the innovations technically feasible and economically viable. These innovations can largely be termed “digital” or “digitally enabled innovations,” which involve new combinations of digital and physical components to create novel market offerings (Yoo, Henfridsson, and Lyytinen 2010).

The theme of this special issue, “Service Innovation in a Digital Age,” suggests the need for a broader conceptualization of service and the development of new ideas and frameworks to explain the potential impact of IT capabilities on how people experience and innovate with service. In this article, we contribute to this need by (1) offering a broadened view of service innovation—one grounded in the emerging service-dominant (S-D) logic (Vargo and Lusch 2004, 2008a)—that transcends the tangible–intangible divide and reflects the three innovation shifts and (2) examining its implications for the deployment of IT to facilitate both the creation and the delivery of innovative service offerings.

Prior research has emphasized the importance of dominant mental models or institutional logics (Friedland and Alford 1991; Lounsbury 2007; Lounsbury and Crumley 2007) in shaping how organizations and entrepreneurs interpret and learn about new opportunities and their associated payoffs (North 1994). The dominant mental model that has shaped the thought processes of inventors, entrepreneurs, and others involved in innovation so far has largely been the goods-dominant (G-D) logic (Vargo and Lusch 2004, 2008a). G-D logic reflects the production of tangible goods by employing a high division of labor in the factory (or specialization), separating the factory from the customer to gain control and efficiency in producing standardized goods, and then inventorying these goods and transporting them to a

place and at a time demanded by customers. In short, G-D logic focuses on the separation and control of actors to optimize and manage tangible outcomes of economic processes (Vargo and Lusch 2004, 2008a).

In contrast, S-D logic (Vargo and Lusch 2004, 2008a) views what a firm does not primarily as the production and offering of tangible goods or, for that matter, any output (tangible or intangible) but rather as the *exchange of service* that occurs by one actor using its skills and capabilities for the benefit of another actor; that is, S-D logic focuses on the processes of serving rather than on the output in the form of a product offering that is exchanged. Initial research using the S-D lens shows that collaborative competences, dynamic capability of customer orientation, and knowledge interfaces influence innovation outcomes and firm performance (Ordanini and Parasuraman 2011). The focus on competences and processes in S-D logic is consistent with the thinking of the word “computing” as a verb or a *service* rather than the word “computer” as a noun or a *good* (Yoo 2010). S-D logic provides the foundation on which to create a service-oriented enterprise that leverages IT for “service and to serve many communities” (Khoshafian 2007). It involves applying the capabilities and skills of the actors in the enterprise to the needs and desires of others; very simply, it is “service” centric and not “firm” centric (Khoshafian 2007; Vargo and Lusch 2008b).

S-D logic allows the inventor, entrepreneur, and innovator to view service as a transcending mental model for all types and forms of innovation (tangible or intangible). Indeed, perhaps the distinction between “service innovation” and “product (goods) innovation” is no longer relevant, since from the S-D perspective all product innovations are service innovations (products being only a mechanism, medium or vehicle for delivering value). Such a broadened

and transcending view of service innovation—centered on both tangible and intangible market offerings—is timely as the digital era moves away from G-D logic.

We aim to make two broad contributions in this paper. First, we offer an integrated framework—one built on S-D logic and that brings together diverse theoretical themes and concepts in innovation management—that explicates the nature and structure of a broadened view of service innovation. Our framework draws on the four meta-theoretical foundations of S-D logic—namely, actor-to-actor networks, resource liquification, resource density, and resource integration. Specifically, it incorporates three inter-related elements: (1) *service ecosystems*, which offer an organizing structure for a network of actors to come together to exchange resources and co-create value; (2) *service platforms*, which serve as the venue for innovation by facilitating easy access to appropriate resource bundles (knowledge, capability, and skill); and (3) *value co-creation*, which views value or experience as being co-created by the service offer(er) and the service beneficiary (e.g., customer) through resource integration.

Second, drawing on this framework, we develop a rich and fruitful agenda for future research in IT that emphasizes its dual roles—as a facilitator (operand resource) and as an integral component (operant resource)—in service innovation. IT enables the establishment of a value network as well as the sharing and integration of resources and knowledge in that network, thereby fostering service innovation. In addition, the gradual digitization of varied elements of new offerings reflects the emerging role of IT as an integral component of the innovation itself.

Next, we provide a broadened view of service innovation by first reviewing extant literature on service innovation and IT service innovation. We then elaborate on the perspective offered by S-D logic.

SERVICE INNOVATION

In the past decade, the body of scholarly research on service innovation has grown considerably. The number and diversity of such studies underscore the significance given to service innovation in different fields, including marketing (Berry et al. 2006; Nijssen et al. 2006; Oliveira and Von Hippel 2011), economics (Cainelli et al. 2006; Gallouj 2002; Gallouk and Savona 2008), information systems (Alter 2008; Lyytinen and Rose 2003; Rai and Sambamurthy 2006), operations (Edvardsson and Olson 1996; Fitzsimmons and Fitzsimmons 2000; Metters and Marucheck 2007; Oke, 2007), and strategy (Dörner, Gassmann, and Gebauer 2011). Two schools of thought are reflected in much of these studies. The first assumes that significant differences exist between product innovation and service innovation, and as such, newer sets of theories and models of service innovation are required (e.g., Edvardsson and Olson 1996; Fitzsimmons and Fitzsimmons 2000). This perspective is also reflected in the emphasis on individual firms as service *producers* and customers as service *consumers* (i.e., the producer–consumer divide) (e.g., Berry et al. 2006; Thomke 2003) and that on innovation in business processes (e.g., Davenport 2005; Sheehan 2006), which has largely retained the distinctions in the nature of innovation in products and processes (i.e., the product–process divide).

The second school of thought deemphasizes the differences between product innovation and service innovation and focuses on adapting existing innovation theories and models to fit the service innovation context (e.g., Nijssen et al. 2006). The insights derived from both schools are valuable but have been criticized as being too narrow, ad hoc, piecemeal, and biased toward technology-based innovations (Ordanini and Parasuraman 2011; Symanski et al. 2007). Following this, recent studies have called for adopting an integrated or synthesis approach in studying service innovation (Gallouj and Savona 2009; Ordanini and Parasuraman 2011).

Literature on service innovation in the information systems field has followed a different path largely because of its primary focus on software as the central artifact. This literature can be traced to Swanson's (1994) work on developing a typology of IS innovations, that is, the tri-core model comprised of functional, administrative, and technological IS innovations. Although Swanson's focus was not on service innovation *per se*, Lyttinen and Rose (2003) extended Swanson's typology to identify four types of IT service innovations (administrative process, technological process, technological service, and technological integration innovations). These typologies have largely served in studying the drivers of or the contextual factors associated with each type of IS innovation. More recent studies in this stream have focused on examining the impact of specific types of IT service innovation on firm performance (e.g., Ordanini and Rubera 2010) and on adapting these models of IT service innovation to fit particular application contexts. Though valuable, these studies narrowly focus on IT applications and process innovations (albeit affecting different "cores" of an organization) and thus ignore the broader perspective of service (and the associated themes) that we propose.

A more nascent stream of research in information systems has begun acknowledging the broader impact of IT on service innovation. These studies do not explicitly focus on (or even use the term) service innovation; however, the perspectives they adopt—for example, digital innovation (Yoo et al. 2010), digital infrastructure (Tilson et al. 2010), and software-based platform (Tiwana et al. 2010)—reflect some of the concepts (e.g., digitization, ecosystems) underlying the broader conceptualization of service innovation proposed herein. At the same time, the lack of focus on service innovation has led to a more narrow treatment of the related IT concepts in these conceptual studies.

Thus, extant literature on service innovation both in the broader management field and in IT indicates some critical gaps in understanding. First, the product–service (or product–process) distinctions still affect much of these studies, needlessly limiting the wider relevance and applicability of the insights offered. Second, there has been limited recognition or incorporation of the key transformations that have emerged in the innovation landscape—networks, co-creation, information centrality, and experience focus. This is true even in recent studies that have adopted a more integrative or synthesis approach with regard to service innovation. For example, Gallouj and Savona (2009, p. 164) attempt to advance a general theory of innovation for goods and services by considering both “material and immaterial technical characteristics” but situate it largely in the traditional context of innovation involving a producer and a customer.

The adoption of S-D logic enables us to devise a framework to overcome these limitations, enhance the generalizability of future study findings, and identify a much broader set of innovation opportunities—opportunities that are inherently network centric, value, and experience focused and that span the tangible–intangible divide. Early efforts to apply S-D logic to understand service innovation largely focused on one or more specific constructs or concepts. For example, Ordanini and Parasuraman (2011) examine the role of three specific drivers of service innovation: collaborative competencies, customer orientation, and knowledge interfaces. Similarly, Michel et al. (2008) consider the drivers of discontinuous innovation from an S-D logic perspective. Our objective here is to propose an overarching framework of innovation, one that is rooted in S-D logic and embraces and builds on many recent studies. Toward that end, we offer a review of S-D logic and identify its meta-theoretical foundations.

THE S-D LOGIC PERSPECTIVE

S-D logic is based on a fundamental idea developed by the economic scholar Frederic Bastiat. According to Bastiat ([1848] 1964, pp. 161-162), “the great economic law is this: *Services are exchanged for services*.... It is trivial, very commonplace; it is, nonetheless, the beginning, the middle, and the end of economic science.” What Bastiat argued was that all actors in an exchange deploy skills and competences when making an offering of their service to one another. Thus, value is the “comparative appreciation of reciprocal skills or services that are exchanged to obtain utility; value [means] ‘value in use’” (Vargo and Lusch 2004, p. 7). This definition suggests that service should be viewed not as contradistinction from goods or devices but as a broadening concept of all exchange and a transcending concept on which all of economic science should be built.

Re-conceptualizing Service

Service in S-D logic means applying specialized competences (knowledge and skills) through deeds, processes, and performances for the benefit of another actor or the actor itself (Vargo and Lusch 2004). Put simply, service involves applying resources for the benefit of others or oneself. This mind-set is applicable to business organizations, government organizations, non-profit organizations, households, and individuals. It is also particularly consistent with service concepts from IT, such as service-oriented architecture, software as a service, and, more broadly, services computing (Zhao, Tanniru, and Zhand 2007).

S-D logic uses the singular term “service” to reflect the *process* of doing something beneficial for and in conjunction with some entity, rather than *units of output*—immaterial goods—as implied by the plural “services” (Vargo and Lusch 2008b). This is an important distinction. In S-D logic, goods and service are not alternative forms of products. Goods are *appliances* (tools, distribution mechanisms) that serve as alternatives to direct service provision.

Service, then, represents the general and universal case, the common denominator, of the exchange process; *service* is what is *always* exchanged. Goods, when employed, are aids to the service process. Consequently, computer software and hardware are only valuable to the extent they are aids in value propositioning and value co-creation.

Re-conceptualizing Resources

In S-D logic, not only is the concept of service(s) broadened, but so too is the concept of resources. Resources have historically been viewed as those things tangible that humans use for support (Constantin and Lusch 1994). As such, resources are often thought of in terms of static natural resources that are fixed or limited in supply (Vargo and Lusch 2004). However, S-D logic views resources as anything an actor can draw on for support (Vargo and Lusch 2004). These things can be tangible or intangible; furthermore, they can be internal to actors and under their control or external to actors but capable of being drawn on for support. For example, intangibles such as corporate culture can be considered resources, as can institutions such as justice, democracy, or intellectual property law if they can be drawn on for support. Resources are a function of human appraisal and thus are often dynamic and potentially limitless; resources are a function of how something (tangible or intangible) is or can be used and not a function of things *per se* (Constantin and Lusch 1994; Zimmerman 1951).

S-D logic makes a distinction between *operand* resources and *operant* resources. Operand resources are resources that an actor acts on to obtain support. Thus, operand resources are often tangible and static (e.g., natural resources). Operant resources are resources that act on other resources to produce effects—that is, they operate on other things rather than being operated on. Operant resources are often intangible and dynamic (e.g., a human skill, both physical and mental). The most pivotal resources are operant resources, which are often dynamic

and difficult to transfer and therefore are a source of sustained competitive advantage. Thus, the most fundamental operant resource is knowledge and the technology it fosters (Capon and Glazer 1987). Technology is the practical application of knowledge; thus, technology, innovation, and service are interlinked. What S-D logic emphasizes is the application of specialized knowledge and skills for the *benefit of another actor* or the actor itself. Service innovation is technology (operant resource based), but it also often creates new operand resources.

Re-conceptualizing Exchange

Why do actors exchange, or what is the fundamental basis of exchange? All individuals (or other economic actors) have two basic operant resources: physical skills and mental skills. Individuals both develop and apply these skills with the goal to become better off. What allows individuals to potentially benefit from this situation is the unequal distribution of both types of skills in the population. Each person's skills are not necessarily optimal for his or her survival and well-being. Largely because people specialize in particular skills, they (or other economic actors) achieve scale effects. That is, they enhance their well-being through specialization because, by specializing and then exchanging with others, they have more than if they did not specialize or were generalists.

The view of what is exchanged can vary dramatically between the goods-centered and the service-centered vantage points. Under the goods-centered view, the *output* (usually physical) from the performance of specialized activities is being exchanged. Under the service-centered view, the *performance* of the specialized activities is being exchanged. For example, when two actors jointly provide for each other's carbohydrate and protein needs by having one actor specialize in harvesting fish from the oceans and the other specialize in cultivating the soil, the

exchange can be considered one of fish for wheat or of the application of fishing skills and knowledge (fishing services) for the application of farming skills and knowledge (farming services). This has profound implications for industry and market definitions, which have largely centered on the outputs of firms.

Re-conceptualizing Value

Value added describes the process of firms transforming matter to change its form, time, place, and possession. Predictably, these transformations require costs, which are often labeled as “value added” and a source of utility. However, a firm’s offerings are not embedded with value (value-in-exchange), but rather value occurs when the offering is useful to the customer or beneficiary (value-in-use), and this is always in a particular context. The notion of context is important when discussing value-in-use. All actors are connected with other actors and other resources, and these connections provide the context for the actors to experience value (Chandler and Vargo 2011; Vargo, Maglio, and Akaka 2008). Importantly, actors are constantly dropping and forming new connections; contexts thus are always in flux and value experiencing is dynamic. Firms therefore cannot deliver value; they can only offer a value proposition as an invitation to engage with the firm (and potentially other actors) for the co-creation of value.

Meta-Theoretical Foundations of S-D Logic

S-D logic has four meta-theoretical foundations: actor-to-actor networks, resource liquification, resource density, and resource integration. IS literature has explored some of these or related concepts, albeit in different terms. Next we briefly discuss each and, when relevant, indicate related concepts in the IS area.

Actor-to-Actor Networks

S-D logic provides a telescopic lens to view actors not in their dyadic roles as producers and consumers but in a more generic sense as actors in a system of other actors co-creating value through resource integration and service provision (Vargo and Lusch 2011). This lens avoids the divide (and often the conflict) that arises when one actor is viewed as a producer and another as a consumer, which implies that one actor produces value and the other destroys or uses up value. The traditional perspective, or what has been referred to as the manufacturing or neoclassical economic perspective, viewed a dominating actor (the producer) as doing something to another actor (consumer) who is the passive recipient. This dominating actor was the source of knowledge and creativity and, thus, also the source of innovation. However, with S-D logic all actors are resource integrators in a network of other actors, and thus all actors are innovators or co-creators of value. Therefore, S-D logic has a network-centric perspective.

Resource Liquification

S-D logic draws on the concept of resource liquification, which refers to the decoupling of information from its related physical form or device (Normann 2001). For most of human civilization, information was embedded in physical matter (e.g., writings or drawings on stone and paper) and later in other tangible things such as devices. For information to be useful, it must be shared with others. When information is embedded in physical matter or devices, the ability to share the information is limited by the cost and time of physical transport. The emergence of digital computers enabled the digitization of information and the associated capability to decouple the information from the technologies (or devices) that store, transmit, or process it. Such digital de-coupling can reshape the nature of work itself; for example, it enables intertwining the virtual and material layers of work in different ways to enhance organizational performance (Gaskin et al. 2010; Robey, Schwaig, and Jin 2003). More important, the

sociotechnical processes accompanying such digitization (i.e. ‘digitalization’) have helped forge new social connections and cognitive models that unleash “generativity” and open up innovation opportunities (Tilson et al. 2011).

Resource Density

If S-D logic is the application of resources for the benefit of others or oneself, a central issue is whether resources can be quickly mobilized for a time/space/actor that will offer the desired service. The concept of *density* underlies this key issue. Maximum density occurs when the best combination of resources is mobilized for a particular situation (Normann 2001). Within the IS field, studies on knowledge engineering and ontologies have focused on techniques and algorithms to configure or model information in different ways so as to generate novel insights and knowledge (e.g., Benaroch 1998; Gruber 1995). The underlying principle of such techniques is the same—the need to mobilize contextually relevant knowledge (resource) in the most effective and efficient way (i.e., enhance resource density).

Resource Integration

S-D logic views all social and economic actors as resource integrators. Human actors integrate resources for two primary reasons. First, any resource an actor obtains can never be used in isolation but needs to be combined or bundled with other resources for usefulness or value. Many resources that are integrated are market facing, but many are also non-market facing, such as private resources (e.g., trust, knowledge) and public resources (e.g., societal institutions, public lands). Second, all innovation is the result of recombining existing resources (Arthur 2009). This seems counterintuitive, because it is common to think that there must be some maximum amount of possible innovation and humans will soon run out of things to invent. However, the logic that innovations are the result of recombining or re-bundling existing

resources suggests the opposite; the more humans invent, the more there is to invent. That is, each new innovation (invention) becomes a type of module that can be combined with other resources that, in turn, become a module for even more innovative possibilities.

A BROADENED VIEW OF SERVICE INNOVATION

If we revert to the longhand definition of service as the application of specialized competences (knowledge and skills) through deeds, processes, and performances for the benefit of another entity or the entity itself, by separating information from physical matter we can break down these deeds, processes, and performances into pieces and re-bundle them for improved density. Service innovation can then be considered the re-bundling of diverse resources that create novel resources that are beneficial (i.e., value experiencing) to some actors in a given context; this almost always involves a network of actors, including the beneficiary (e.g., the customer).

Such a conceptualization of service innovation offers several advantages, particularly in understanding the role of IT. First, it focuses on the value experienced by the beneficiary rather than the output delivered by a service provider, consistent with the recent call in IT for a greater focus on experiential computing (Yoo 2010). Second, it incorporates the beneficiary (e.g., customer) as an active (and required) participant in the innovation process, underscoring the critical role of IT in embracing diverse partners across the traditional producer–consumer divide. Third, it emphasizes access to the relevant bundle of resources at the location (or context) where the service exchange occurs, indicating that the opportunities for service innovation are only limited by the extent of digitalization (Tilson et al. 2011).

The meta-theoretical foundations of S-D logic imply the three key elements of our framework of service innovation: service ecosystem, service platforms, and value co-creation.

Specifically, actor-to-actor networks imply the significance of *service ecosystems*. Resource density and resource liquification imply the relevance of *service platforms*. Finally, resource integration implies the significance of the roles and processes underlying *value co-creation* and brings the focus on the mechanisms that can enhance such activities. These three elements together capture all the different concepts and issues that underlie the broadened view of service innovation. Figure 1 provides an overview of the connections of these three themes. Next, we examine each of these themes in greater detail (Table 1) and identify and expand on the research implications for IT (Table 2).

SERVICE ECOSYSTEMS

An ecosystem is a community of interacting organizations and individuals (including customers) that co-evolve their capabilities and roles around a common set of goals and objectives and depend on one another for their overall effectiveness and survival (Iansiti and Levien 2004; Moore 1993). Following S-D logic, we conceptualize service innovation as being embedded in an actor-to-actor network and begin with the notion of *service ecosystems*, which underscore the importance of common organizational structures and sets of principles to facilitate resource integration and service exchange among those actors. Specifically, we define a service ecosystem as a self-adjusting system of loosely coupled social and economic (resource-integrating) actors connected by shared institutional logics and mutual value creation through service exchange.

Past conceptualizations of ecosystems in the IS literature are relatively narrow, being largely limited to a technology platform and the components or modules associated with it (see Tiwana et al. 2010). Here, drawing on S-D logic, we focus on shared institutional logics that illustrate the broader role and functions of the ecosystem in facilitating a common environment

for value co-creation by a diverse set of actors. Such a perspective emphasizes the role of IT as an *operand resource*, specifically in the way digital infrastructures can help hold together diverse actors and enable collaboration in the ecosystem. To explore this role of IT further, we draw on networks literature and consider three underlying aspects of a service ecosystem: (1) a set of loosely coupled value-proposing social and economic actors who forge relationship with one another for service exchange and the ensuing tension between *structural flexibility* and *structural integrity*; (2) the need to maintain shared institutional logics, which allow for a shared worldview among a diverse set of actors with considerable *cognitive distance* among them; and (3) the need to implement and maintain a common set of rules and principles derived from the shared institutional logics or an *architecture of participation* in the ecosystem that coordinates actors and their service exchanges.

Structural Flexibility and Structural Integrity

A service ecosystem comprises a diverse set of loosely coupled social and economic actors who participate in service exchange and value co-creation. The phrase “loosely coupled” means that actors are relatively free to enter and exit and form collaborations or exchanges with other actors; as such, it emphasizes the need for both structural flexibility and structural integrity of the ecosystem.

Structural flexibility refers to the different ways of organizing actors to suit varied innovation opportunities in a network (Britto 2001). More specifically, here, it implies the ease with which different configurations of actors (and their roles and responsibilities) can participate in the ecosystem to adapt to new environmental stimuli and competitive pressures and, in turn, create new service innovation opportunities. For example, value can be co-created by two or more actors in the service ecosystem without the explicit involvement of a lead actor. Similarly,

new types of innovation intermediaries (Nambisan and Sawhney 2007b; Sawhney, Verona, and Prandelli 2005) may configure diverse actors to focus on a specific problem-solving and value co-creation opportunity. The broader objective of such configurations is to ensure that the overall system (solution) offers the best value-in-use for the user in a particular context.

The need for such structural flexibility and adaptability relates to the ongoing discussion in the IS field on digital infrastructure and the business agility it facilitates (Sambamurthy, Bharadwaj, and Grover 2003; Tilson et al. 2010). Digital infrastructures are highly scalable and, as such, support the constant evolution of actors within an ecosystem. Digital infrastructures also exhibit considerable upward and downward flexibility (Tilson et al. 2010) and enable dynamic connectivity and other functions to support service exchange. For example, when cities become “smart” by embedding digital signal processors and information networks into various physical service systems (e.g., water, sewage, traffic, energy), in turn these service systems become more adaptable and flexible, further generating opportunities for connecting new sets of actors and their service exchanges. An overarching issue for research then is determining how digital infrastructures can facilitate structural flexibility in service ecosystems or which specific aspects or elements of digital infrastructure generate or constrain the diverse forms of collaboration and service exchange in the ecosystem.

Structural integrity refers to the nature of ties or relationships that hold the diverse actors together in a network (Lewicki and Brinsfield 2009). This is an important issue because although being loosely coupled provides advantages, it can also result in costly changes to business relationships. From the S-D logic perspective, the social and economic actors of a service ecosystem are held together by a trinity of resources: competences, relationships, and information. A service ecosystem has structural integrity because each entity (economic and

social actor) has competences (used to offer and provide service to others), relationships (with other actors), and information that is shared through common standards and protocols (Evans and Wurster 1997; Lusch, Vargo, O'Brien 2007; Normann and Ramirez 1993; Vargo and Lusch 2004). Value propositions are then used to connect one actor with other interested actors within that service ecosystem. To this end, the enterprise that develops the most compelling value proposition (offers a connection between competences and relationships) will perform the best; however, this relative performance advantage will be fleeting unless the organization learns to revise its value propositions in response to changing customer, supplier, and other stakeholder requirements.

Invitations to engage through value propositions in a digital world have few or no industry or geographic limits and increasingly arise from enterprises outside the markets in which they operate. Thus, IT needs to support the actors (e.g., firms) in devising and communicating different value propositions to (and based on a continued dialog with) potential exchange partners. Digital infrastructures can enable dynamic construction of value propositions (based on changing environmental stimuli) and their wide dissemination among different sets of actors. Digital infrastructures (for example, digital auctions) can also facilitate the search for and identification of appropriate value propositions—all of which help strengthen the ties among actors (structural integrity) in the ecosystem.

Structural flexibility and structural integrity are both important but may potentially conflict with each other—for example, an increase in structural flexibility could erode structural integrity (Lorenzoni and Lipparini 1999). Thus, an important research issue is how well digital infrastructures can help mediate the resulting tension between the two (e.g., by enhancing network transparency, by enabling rapid formation of trust among actors). This line of inquiry

may also reflect the trade-off between exploitation (resource exchanges that solidify structural integrity) and exploration (resource exchanges that necessitate novel connections among actors and enhance structural flexibility) (March 1991). Thus, another issue for inquiry pertains to the potential role of digital infrastructures in helping a service ecosystem become more ambidextrous (O'Reilly and Tushman 2008)—strengthening both structural flexibility and structural integrity.

Cognitive Distance and Shared Worldview

A service ecosystem must be self-adjusting, and this often occurs by actors spontaneously sensing and responding to their continued market relevance and viability/sustainability (Lusch, Vargo, and Tanniru 2010). As more content is digitized, it becomes easier for actors to share information quickly and gain advantage through better IT-based sense-and-respond strategies. However, a critical challenge for an ecosystem to achieve such capabilities is the *cognitive distance* among the actors.

Organizational research advances the notion of cognitive distance to capture the differences in knowledge and skills or cognitive frames between two entities (Hendriks-Jansen 1996; Weick 1995). Cognitive distance can be measured along multiple dimensions, including technological, marketing, and organizational. Prior studies on inter-firm alliances have investigated the impact of technological distance among alliance partners on different aspects of performance, including innovation (e.g., Gilsing et al. 2008; Wuyts et al. 2005).

In a service ecosystem, the diverse actors who are cognitively distant from one another need shared institutional logics (Friedland and Alford 2001; Lounsbury 2007) that enable them to obtain a common perspective of their environment—that is, adopt a *shared worldview*—to ensure the ecosystem's survival. Such perspective might include a common set of business and

cultural assumptions, evaluation methods, and/or mental frameworks. The concept of a shared worldview can be traced to network-centric warfare in which the basic premise is that a robust network of geographically dispersed military forces makes it possible to translate informational advantage into warfare advantage (Department of Defense 2001). Higher levels of information sharing among units enhance the extent of “shared situational awareness.” Through information sharing, every unit—from infantry units to aircraft to naval vessels to command centers—“sees” the sum of what all other units “see.” This shared awareness facilitates self-synchronizing forces, virtual collaboration, and other forms of flexible operations.

The same principle can be applied to the innovation context (Nambisan and Sawhney 2007a). A shared awareness is critical for an ecosystem to capitalize on the synergies among the diverse set of expertise and capabilities of the actors in the network. For example, in the case of an open source software development community, the shared worldview may include how to interpret and share knowledge about competing and complementary technologies and offerings and how the software solutions being developed should be integrated with existing offerings.

From the perspective of a service ecosystem, a shared worldview ensures that actors can interpret resource integration opportunities coherently and come together quickly to exchange or integrate resources. The role of IT then is not just to enable the rapid sharing of information among diverse actors but also to facilitate the development of a coherent view of the changes in the environment. Thus, a critical area for future inquiry would be determining which characteristics of the digital infrastructure facilitate the development of a shared worldview among the diverse actors in a service ecosystem and whether certain institutional logics enable or hinder such a role of IT. Prior research on IT design principles that facilitate distributed cognition (Boland, Tenkasi, and Te’eni 1994) and on IT-based communication tools that

facilitate “perspective making and perspective taking” (Boland and Tenkasi 1995) might offer valuable insights in this regard. The primary objective here would be to enhance opportunities for service innovation in the ecosystem and to enable the service ecosystem to gain an advantage relative to other ecosystems during rapid and turbulent changes (technological and market) in the environment.

Architecture of Participation

Finally, a service ecosystem must provide an architecture of participation that brings clarity to the way collaborative value co-creation occurs (by diverse sets of actors) as well as the way the “rights” (or value) from the innovation are shared among the actors. In other words, the architecture of participation,¹ provides a road map for the different actors to come together and engage in service exchange. It also provides the mechanisms for participants’ contributions to be coordinated, integrated, and synchronized in a coherent way (Nambisan and Sawhney 2007a). Thus, the architecture of participation is largely determined by shared institutional logics or the means and rules that actors use to coordinate their actions.

The values, norms, and governing principles that guide business transactions are an important part of the institutional logic and can vary by geopolitical area and industry. For example, in some countries and cultures, high value is placed on integrity and trust even when dealing with relative strangers, but in other countries, integrity and trust are bound to a tighter network of friends and family. In some countries and cultures, the norm is to negotiate on price and terms of trade, but in other countries, these terms are more fixed. Similarly, in some countries and industries, all agreements are codified in a written contract, but in other settings, the contract is soft or implicit. The key challenge then in a global service ecosystem pertains to

¹ This is a term coined by Tim O’Reilly (2004)

the mix of many cultures and industries because discordant norms and governing principles may be common. A common, explicit architecture of participation for the service ecosystem helps overcome this challenge. In addition, as service ecosystems become more global, global norms for value co-creation and rights will emerge.

Two key aspects of such architecture of participation are important here. The first involves the implementation of transparent rules of exchange to facilitate the coordination of actor contributions and their interactions. This has implications for the adoption of open business processes and standards in the service ecosystem and therefore raises important research questions for IT. For example, in what ways can workflow technologies be integrated with such actor-to-actor (or business-to-business) open processes and standards? How should business processes be implemented in service-oriented systems? How should such service-oriented systems adapt to the demands for highly dynamic business processes (changes in the environment leading to the infusion of new types of actors and interactions) (Von Ammon et al. 2010)? More broadly, how should the digital infrastructure be architected to facilitate the easy incorporation of diverse and dynamic business processes and standards (or dynamic rules of exchange)?

The architecture of participation also defines the means by which the participants will realize value from the exchange (or be “rewarded” for their contributions). This could range from establishing different types of incentives that drive participation in certain networks (e.g., customer communities) to designing new value appropriation methods for sharing the proceeds among the participants (for example, Creative Commons licensing system). IT can enhance the transparency of value creation thereby clarifying “who contributed what” and enabling an equitable sharing of the value that is co-created. For example, IT-based marketplaces such as

iTunes (Apple) and AppExchange (Salesforce.com) provide a structure for transparent value appropriation. At the same time, newer forms of ecosystems in which a community of actors co-create value on proprietary platforms without the direction of a central actor beg the question of how IT can facilitate value appropriation in such community-based, decentralized service exchanges. A broader topic of inquiry would be how digital infrastructures might enable a wide range of value appropriation forums to fit the nature and form of service ecosystems and the different types of service exchanges possible within those.

SERVICE PLATFORMS

We define a “service platform” as a modular structure that comprises tangible and intangible components (resources) and facilitates the interaction of actors and resources (or resource bundles). A primary benefit of service platforms is that they leverage resource liquification and enhance resource density. Service platforms therefore serve actors in their day-to-day service exchanges. Importantly, however, these service platforms serve as a venue for service innovation because many interacting actors will seek or discover novel solutions to problems; that is, their resource exchanges may lead to innovative, scalable solutions

A central theme of S-D logic—indirect exchange masks the fundamental basis of exchange (Vargo and Lusch 2004)—underlies this conceptualization. It suggests that enterprises should design their offerings—goods or non-goods—as primarily a service platform that enables service exchange and value co-creation. This reflects the ability of goods (or devices) to become the distribution mechanism or medium for service provision. Tangible goods or matter can be “informed” with embodied knowledge or the physical embodiments of one or more competencies (Prahalad and Hamel 1990; Vargo and Lusch 2004)—that is, the embedding of the good with structure or information that enables the actor to perform a self-service. Essentially,

the properly informed market becomes the distribution mechanism for skill application (i.e., service) (Gummesson 1995). Importantly, goods provide service not only directly but also indirectly by serving as a platform for meeting higher-order needs (Rifkin 2000). Goods are “artifacts, around which customers have experiences” (Prahalad and Ramaswamy 2000, p. 84). The concept of offerings as service platforms reflects this. For example, Apple’s iPhone, iPad, and other innovations are not gadgets *per se* but rather service platforms that promise to fulfill both lower- and higher-order benefits.

Recent studies in the IS field have examined digital service platforms (Tiwana et al. 2010); however, they have adopted a relatively narrow interpretation of what constitutes a platform (borrowing ideas primarily from product development literature; e.g., Gawer and Cusumano 2002; Iansiti and Levien 2003). Our conceptualization of service platforms offers a broader interpretation of the role of platforms in service innovation. We begin by discussing how the nature of modularity shapes how well the platform leverages resource liquification and enhances resource density for service innovation. We then consider how a set of rules bring clarity to the indirect service exchange enabled by the platform. In discussing these, we portray the role of IT as an operant resource.

Modular Architecture and Resource Density

As noted previously, a higher level of digitization has enabled resource liquification. However, resource liquification is not enough to promote service innovation. Actors in the ecosystem must gain access to a suitable combination of resources—for example, skills, knowledge, and technological assets—that match the problem context. In other words, equally important for service innovation is the level of resource density.

We suggest that the structure of a service platform shapes the ease with which actors can access diverse resources for resource integration and service innovation. More specifically, we suggest that a layered–modular structure enhances the level of resource density more than an integrated structure (or even a simple modular structure). Layered–modular architecture is a hybrid between a modular architecture and a layered architecture (Adomavicious et al. 2008). In the modular architecture, all the components are derived from a single functional design hierarchy and, as such, have a fixed product boundary; that is, they are product specific (e.g., the different types of blades used in a particular food processor). In the layered architecture, each layer is associated with a different design hierarchy, and thus the multiple components across the different layers are not bounded by a single product; that is, they are product agnostic (e.g., the different components of Apple’s iPhone that connect with different functional hierarchies and enable usage in conjunction with a wide range of products) (Gao and Iyer 2006; Yoo et al. 2010).

Thus, in a layered–modular structure, the components represent a bundled set of specialized knowledge and skills appearing in the form of tangible or intangible components that easily interface with heterogeneous product forms and types. Such an architecture implies the potential for the service platform to facilitate service exchanges that involve components within a functional design hierarchy (leading to variations of a core value proposition) or across multiple design hierarchies (leading to completely different value propositions) (Baldwin and Clark 2000; Clark 1985). Thus, with regard to service innovation, layered modularity plays a similar function or role as that of division of labor and the extent of market (Arthur 2009). As the number of layers as well as the degree of modularity in each layer increases, the opportunity for innovative resource combinations expands and, thereby, the potential for service innovation as well.

Another aspect is the granularity (size or scale) of the exchange (or task). While a higher degree of modularity enables better coordination of service exchange and creates more opportunities for value co-creation, a higher degree of granularity allows a diverse set of actors to participate in such service exchange. IT can support highly granular service exchanges among a large set of actors that eventually could lead to the co-creation of value for the user. It allows coordinating, sequencing, and integration of virtual tasks and activities, thus facilitating innovation with different resources (i.e., of different granularity).

More broadly, we propose two roles for IT—as an operant resource and as an operand resource—in enhancing resource density in a service platform. Here, the role of IT as an operant resource underscores how digitalization can unleash generativity and create novel opportunities for resource integration. The key task then is to examine how different modular arrangements of digitized resources may enhance or diminish such innovation opportunities. In other words, how should a firm design the structure of its digitally enabled service platform to enhance resource density and thereby maximize the opportunities for service innovation? Furthermore, given the possibility for actors to create value by integrating resources across multiple service platforms, how should a firm position its service platform in a market to bring clarity to the potential service exchange opportunities? As an operand resource, IT can facilitate a diverse set of actors to create connections between their respective resources in ways that trigger service exchange and value co-creation. This includes searching for appropriate resources, bundling resources in a location, and, more generally, supporting actors in the mixing and matching of resources within and across service platforms.

Protocols (Rules) of Exchange

As noted previously, a service platform provides a structure for indirect exchange. The protocols offer the set of embedded rules for indirect exchange and integration. The nature of the protocols or rules (how actors may interface) can affect the extent of service innovation. Specifically, in the design of the service platform, if the rules of engagement are clearly specified and the ability to interface is more open, the service platform will support a greater degree of resource integration and serve as a venue for more viable systems solutions. IT is essential to codify or implement the acceptable (or desired) behaviors and guide the interactions between actors and resources for service exchange. On the one hand, the inherent layered–modular structure of the service platform would incorporate a set of rules that shape or govern the nature of resource integration by actors. From this perspective, the key question is how a firm should regulate or control the digital interface specifications of the various components (resources) to facilitate faster, economical and effective resource integration. On the other hand, a firm also needs to define rules that govern unstructured interactions in the service platforms—specifically, how actors should access resources and what types of service exchanges are valid (or legal).

This implies the potential significance of a range of IT capabilities—from information security and privacy protocols to knowledge management protocols. Thus, the broader issue for future inquiry and research pertains to the role of IT in enabling the implementation of a diverse and dynamic set of rules and protocols (i.e. institutional structure of the ecosystem) that would help validate and verify both structured and unstructured interactions between actors and resources through the service platform.

Service platforms are thus important to service innovation because they help unleash the generativity derived from higher levels of resource liquefaction and resource density. However, this requires enterprises to step outside the product form and view how users of the product and

other actors interact with it. In other words, rather than designing a device, firms should envision a platform for service innovation. For example, an automobile is made primarily of rigid and hard materials; however, behind all the tangible components is engineering and design knowledge as well as knowledge of how physical materials behave and interact with other materials. The more the automobile is designed to be a service platform, the easier it is for other actors (e.g., customers, suppliers) to adapt it to their particular uses and context—for example, GPS technology in conjunction with other internal and external knowledge components enables a host of service innovations, including usage-based insurance, real-time and anticipatory safety and maintenance advice, and so on (Henfridsson and Lindgren 2005). The overriding service platform objective is to serve as a venue for innovative, effective, and efficient service exchange.

CO-CREATION OF VALUE

S-D logic motivates the exploration not just of the organization of the actors (ecosystem) and the venue for service exchange (platform) but also of the very process of value co-creation and service innovation—that is, the activities that underlie resource integration and the implied actor roles. S-D logic emphasizes that all social and economic actors integrate various types of resources to create value. Customers (actors) purchase a firm’s offering because they view it as an important part of a larger solution they need or want to integrate with other resources. Therefore, actors that benefit (customers) are always part of value co-creation. Note that all firms undertake the dual roles of “service offerer” (making offers of resources or service to other actors) and “service beneficiary” (they themselves are beneficiaries of other firms that supply them with service or resources).

Two broad implications ensue from this, both of which underscore the important role of IT in service innovation and raise issues for future inquiry. First, companies need to

acknowledge the different roles of actors (particularly beneficiaries) in resource integration and service innovation. Second, companies need to understand the process of value co-creation and proactively support it by establishing new organizational mechanisms and making appropriate changes to their internal business processes.

Actor (User or Beneficiary) Roles in Resource Integration

Considerable research exists on the engagement of beneficiaries (customers or users) in innovation and value co-creation (e.g., Christensen 1997; Leonard-Barton 1995; Rothwell, Freeman, and Townsend 1974; Von Hippel 1988). With the emergence of the Internet and other information and communication technologies, the scope and depth of customer value co-creation has undergone radical change (Prahalad and Ramaswamy 2004; Nambisan 2002; Sawhney et al. 2005).

Studies in strategic management and quality management have identified five roles for customers in value co-creation: resource, co-producer, buyer, user, and product (Kaulio 1998; Lengnick-Hall 1996). This stream of research has largely focused on the design and development of tangible goods (i.e., adopted a G-D view). S-D logic identifies three broad roles depending on the nature of service exchange and the type of resource integration achieved: ideator, designer, and intermediary. The first role—*ideator*—reflects the capability of beneficiaries of service offerings (i.e., customers) to bring knowledge about their needs and unique work context to the firm and then to integrate that with knowledge about how they use existing market offerings to envision new services. This role emphasizes the need to support knowledge conversion (e.g., from tacit to explicit) and to enable the sharing of the knowledge output with other actors in the ecosystem.

The second role—*designer*—reflects the capability of beneficiaries of service offerings to mix and match existing knowledge components or resources to configure (or develop) new services. This signifies the need for other actors to present their offerings in a way that facilitates such resource integration and to allow different interpretations of existing knowledge components. The third role—*intermediary*—reflects the capability of beneficiaries to cross-pollinate knowledge across multiple ecosystems and to serve as intermediaries in service innovation. In this role, actors help make non-obvious connections across ecosystems in ways that deliver value for themselves and others. This role emphasizes the need to facilitate exporting and importing knowledge across ecosystem boundaries as well as the ability to explore and/or discover connections among diverse resources.

These three roles offer actors as beneficiaries the opportunity to derive different types of value. In some instances, the value derived through such service exchange and resource integration may be utilitarian (or functional). However, from an experiential perspective, studies have revealed the relevance of four types of actor (customer) experiences in value co-creation in online environments—pragmatic experience, sociability experience, usability experience, and hedonic experience (e.g., Nambisan and Nambisan 2008). Recent research in IS has further empirically validated the significance of these four user experiences in co-creation (Kohler et al. 2011). Other studies have identified similar types of value appropriation by users or beneficiaries in different value co-creation contexts (Franke and Shah 2003; Jeppesen and Frederiksen 2006). These findings imply that the value an actor appropriates may not be directly related to the usage of the related offering; rather, it may pertain to the broader context in which such a role is enacted (e.g., the social setting with other actors in the service ecosystem). Future studies might

examine the relevance and extent of such value derived in the three different roles for beneficiaries identified here (ideator, designer, and intermediary).

In all these roles, actors integrate their knowledge resources with those obtained from one or more other actors, which leads to new service innovation opportunities. In what ways can companies promote or encourage these roles in value co-creation? Next, we explore some of these issues and their implications for IT in greater detail, particularly the role of IT as an operand resource.

Support for Value Co-Creation

Companies can create richer environments for value co-creation. Although the ecosystem (by providing an organizing structure for the actors) and platforms (by providing an organizing structure for the resources) contribute to this, the nature of the roles implies three additional areas of support.

Facilitating Interactions among Actors

Interactions among actors are important to understand because it is through interaction that information is shared and knowledge is generated (Berthon and John 2006). Whereas the protocols described previously reflect the rules and policies governing the interactions and service exchange (i.e., protocols are normative), interactivity as discussed here refers more to the actual mode of communication or exchange between actors and resources (i.e., interactivity is positive and not normative). The nature of the avenues provided for interaction and exchange directly affects service innovation. In other words, the easier it is for actors to access platforms and resources therein, the greater is the opportunity for resource integration. As this occurs, diverse actors learn from one another through interaction, and this, in turn, stimulates innovation.

Similarly, the more diverse the communication channels, the richer are the opportunities for knowledge integration and service exchange.

Companies could establish new communication mechanisms, both formal and informal. For example, formal communication methods, such as white papers, enable firms to share a common vision (or develop a shared worldview) with other actors in the service ecosystem and support their value co-creation activities. Informal mechanisms can be equally important. Social media and tools such as blogs and wikis facilitate interactions between a firm's internal experts and other actors (including users or beneficiaries); for example, Microsoft's Channel 9 promotes conversations between users and its employees with such an objective.

Another issue for research pertains to how IT can help actors obtain relevant unstructured knowledge resources (e.g., discussion and debates among other actors). Some companies are experimenting with content rating systems in online communities—for example, peer ratings and other social metrics that help actors gauge the depth and accuracy of knowledge in the interactions. Similarly, design features that provide actors with better social cues offer richer social experiences and permit richer discussions in online communities, thereby generating greater opportunities for value co-creation. For example, new semantic visualization tools allow users to identify patterns in online conversations and navigate toward the content-rich part of those conversations (Donath 1999; Erickson et al. 2002; Smith 2002).

Recent studies in IS and organization science have illustrated that online communities devoid of traditional structural mechanisms for collaboration and coupled with specific technological and contextual characteristics can facilitate “unconstrained knowledge recombination” (Hughes and Lang 2006). Thus, a broader area for inquiry would be to understand how online communities can promote such generativity in service ecosystems. Faraj,

Jarvenpaa, and Majchrzak (2011) offer some promising starting points in this regard—specifically, enactment of temporary roles by actors (e.g., mediator, shaper, idea champion), narratives as a way to channel participation among diverse actors, and different types of technology affordances (e.g., reviewability, recombability, and experimentation).

Adapting Internal Processes

Along with establishing mechanisms to support actor interactivity in ecosystems, companies may need to adapt their existing (or adopt new) business processes to embrace diverse actors as part of the service ecosystem. Instituting appropriate internal processes to accommodate (actors') value co-creation activities can go a long way toward enhancing the value experienced by the beneficiary. This might also involve establishing new organizational roles to connect the customer with the internal actors. For example, Microsoft has specially designated employees called “buddies” to serve as bridges between users in the online community and the organization. Such mechanisms should also be deployed to bring coherence to value co-creation activities across a firm's different service platforms (offerings)—by identifying service exchange opportunities that involve resources from multiple service platforms and by providing common resource access tools and processes. Another issue for future research pertains to the potential interaction effects between these process adaptations and the underlying digital infrastructure through value co-creation.

Transparency of Activities

Clarity about the different roles in value co-creation can reduce the potential for beneficiaries' misplaced expectations about the nature of value that can be derived from those activities. Prior studies have suggested the relationship between role and process transparency and customer expectations (e.g., Bowen 1986). IT can be important in enhancing transparency in

value co-creation activities, indicating issues for further study. For example, IT can help enhance clarity by making actor roles in value co-creation and the underlying processes explicit through embedded policies and guidelines in online communities. Similarly, explicit recognition of the issues related to intellectual property rights in value co-creation is critical for enhancing outcome transparency. Practices that bring clarity to “who owns what intellectual asset” and communicate that effectively to actors involved in value co-creation will be of utmost importance.

The discussion so far indicates several promising directions for future research in IT. First, it raises the broader question of how IT can support diverse roles (particularly those of beneficiaries) in value co-creation. For example, what design aspects of the digital infrastructure enhance interactivity among actors and resources in a service ecosystem? Similarly, how can companies achieve coherence in devising and deploying digital infrastructures that host or support diverse value co-creation roles and activities. In addressing these issues, there is much potential to draw on theoretical concepts and insights from multiple research areas, including computer-mediated communication, user innovation, and social media. A desired outcome of such studies would be a theoretically grounded framework that could guide the selection and integration of varied elements of the digital infrastructure to support the different roles in service innovation.

Second, the discussion shows the need to understand how organizational mechanisms and processes may complement the digital infrastructure in supporting resource integration and service innovation. Studies that focus on the potential interaction effects of such organizational mechanisms with distinct elements of the digital infrastructure could offer invaluable insights to companies in ensuring the broader success of their service innovation ecosystems.

DISCUSSION

We offer a broadened view of service innovation based on S-D logic and develop an integrated framework that describes the nature and structure of such a new perspective of service innovation. The framework offered holds important implications for research and practice in the areas of both service innovation and IT.

At a broad level, future studies should consider the dual roles of IT in digital service innovation—as an operant resource and as an operand resource. As discussed previously, in the former role, IT becomes part of the service innovation; as such, decisions about IT affect the design and development of the offering, in turn expanding or restricting service innovation opportunities. In the latter role, IT ensures that the collaborative value creation process that underlies service innovation is efficient and effective. The research implications of these two roles are likely to diverge and call for drawing on different management areas. Specifically, the issues related to the first role potentially emphasize concepts and insights from technology development, design science, marketing, platforms and standards, and so on. The issues related to the second role sharpen the focus on concepts and insights from prior research on strategic alliances and collaboration, knowledge management, network governance, orchestration processes, and so on. Studies that draw on these and other such areas could offer valuable insights into how IT can enhance service innovation.

Our framework also holds implications for research on service innovation in general. The first implication highlights the need to further explicate the key characteristics of the three elements of service innovation described here (i.e., service platforms, service ecosystems, and value co-creation processes). Given the limited scope and length restrictions, here, we considered only the four meta-theoretical foundations of S-D logic for identifying the three components. Examination of additional concepts and insights from S-D logic might enable the development of

a more exhaustive characterization of these three components. Such a line of inquiry might also lead to further avenues for research in IT. Specifically, studies that consider additional characteristics of service platforms, service ecosystems, and value co-creation processes might help identify other salient implications with regard to research and practice in IT. For example, previously we differentiated between operand and operant resources and discussed the importance of operant resources for service exchange and innovation. A hierarchy of operant resources exists (Madhavaram and Hunt 2008) and helps inform how service platforms and service ecosystems can facilitate the effective deployment of operant resources for service innovation. The lowest level of operant resources, basic operant resources (BORs), refers to “tangible and intangible entities available to the firm that enable it to produce efficiently and/or effectively market offerings”; at the next level, composite operant resources (CORs) refer to the combination of “two or more distinct basic/higher-order operant resources and collectively enable the firm to produce efficiently and/or effectively valued market offerings”; and at the highest level, interconnected operant resources (IORs) consist of a “combination of two or more distinct basic/higher-order operant resources where the lower order resources interact and reinforce each other in enabling the firm to produce efficiently and/or effectively valued market offerings” (Madhavaram and Hunt 2008, p. 71). When moving from BORs to CORs to IORs, it becomes more difficult for firms to acquire or develop these resources, and thus these resources are more likely to provide the basis of service innovations with relatively higher levels of sustainable competitive advantage. As such, a key question would be which design characteristics of the service platforms would help promote and facilitate the integration of IORs for service innovation. Studies that draw on these and other such concepts from S-D logic would contribute to a fuller characterization of the three basic components discussed here.

Another implication involves the need for companies to adopt a holistic focus and consider all three components and their interconnections. A limited focus on the service platform may lead to the design of an offering that facilitates innovative resource integration but without the complementary support for establishing and maintaining a network of partners or for collaborating value co-creation processes. Similarly, a focus on the service ecosystem may help bring together a network of value co-creating actors, but without the simultaneous consideration of a service platform, it may deemphasize the significance of enhancing resource density and thus hinder these actors' ability to seek out relevant resources for integration. Companies focusing on all three elements have found success in enhancing service innovation—for example, Apple with its iPhone as a service platform, iTunes as the service ecosystem, and the iPhone discussion forums as a way to connect with actors involved in value co-creation.

Our discussion also indicates some of the potential interconnections among the three elements (e.g., the architecture of participation implemented by the service ecosystem guides the diverse actors in exploiting the innovative flexibility offered by the layered modular architecture of the service platform); however, more detailed investigation is required to develop a deeper understanding of the dependencies among the three elements and how their interactions enhance service innovation.

CONCLUSION

Service innovation in a digital world will accelerate. Whereas most innovation throughout human civilization has captured natural phenomena to invent tangible product offerings, with the separation of information from matter and the rapid growth of global communications networks, more and more innovation will be intangible, digitally enabled, and created or co-created around social phenomena.

In this article, we offer a broadened view of service innovation, founded on S-D logic, which emphasizes the need for companies to focus on actor-to-actor networks, resource liquification, density creation, and resource integration. The concepts of service ecosystems, service platforms, and value co-creation serve as vehicles to enhance or enrich the opportunities for service innovation. In discussing these, we identified the implications for both research and practice in IT. We hope the broadened view of service innovation (and the associated concepts) offered here will motivate further research on the nature of service innovation in the digital world and the role of IT in it.

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Table 1: S-D Logic and Service Innovation

Central Theme	Definition	Key Issues
<p>Service Ecosystem</p> <p><i>(S-D Logic: Actor-to-Actor network)</i></p>	<p>A self-adjusting system of loosely coupled social and economic (resource-integrating) actors connected by shared institutional logics and mutual value creation through service exchange.</p>	<p>Need to enhance both structural flexibility and structural integrity of the service ecosystem (and manage the potential conflicts between the two).</p> <p>Need to develop and maintain a shared worldview among a set of cognitively distant actors.</p> <p>Need to devise and implement an architecture of participation to coordinate actors and their service exchanges.</p>
<p>Service Platform</p> <p><i>(S-D Logic: Resource liquification; Resource density)</i></p>	<p>A modular structure that consists of tangible and intangible components (resources) and facilitates the interaction of actors and resources (or resource bundles).</p>	<p>Need to devise an appropriate modular architecture that enhances resource density.</p> <p>Need to define and implement the rules of exchange or protocols for indirect exchange of services through the service platform (i.e., prescribe how actors/resources can interface with the platform).</p>
<p>Value Co-creation</p> <p><i>(S-D Logic: Resource integration)</i></p>	<p>The processes and activities that underlie resource integration and incorporate different actor roles in the service ecosystem.</p>	<p>Need to define the key roles (including those of the beneficiaries) and describe the nature of value appropriated by each actor role.</p> <p>Need to create a supportive environment for resource integration by focusing on (1) mechanisms that facilitate interactions among diverse actors, (2) adapting internal processes to accommodate different actors (roles), and (3) enhancing the transparency of resource integration activities in the service ecosystem.</p>

Table 2: Key Themes in Service Innovation and the Research Implications for IT

Central Theme	Research Implications for IT
Service Ecosystem	<ul style="list-style-type: none"> • What specific aspects or elements of the digital infrastructure would generate or constrain the <i>diverse forms of collaboration and service exchange</i> possible in the ecosystem (i.e., enhance structural flexibility)? • How can digital infrastructures enable (1) the dynamic construction and wide dissemination of and (2) searching for and identifying <i>value propositions</i> among diverse sets of actors in the service ecosystem (i.e., enhance structural integrity)? • What is the role of digital infrastructures in enabling a service ecosystem to become <i>ambidextrous</i> (i.e., in managing potential conflicts between structural flexibility and structural integrity)? • What characteristics of the digital infrastructure would facilitate the development of a <i>shared worldview</i> among the diverse participants or actors in a service ecosystem? • How should the digital infrastructure be architected so as to facilitate the easy incorporation of a <i>dynamic set of rules of service exchange</i> among actors (e.g., business processes and standards)? • In what ways can the digital infrastructure enable a wide range of <i>value appropriation forums</i> to fit the nature and form of service ecosystems (and the diverse types of service exchanges)?
Service Platform	<ul style="list-style-type: none"> • How should a firm <i>design the structure</i> of its digitally enabled service platform so as to enhance resource density and thereby maximize the opportunities for service innovation? • In what ways can IT support actors in searching for and bundling (<i>mixing and matching</i>) <i>resources</i> within and across service platforms? • How should a firm regulate or control the <i>digital interface specifications</i> of the various components (resources) so as to facilitate faster, economical, and effective resource integration? • What is the role of IT in implementing a diverse and <i>dynamic set of rules and protocols</i> that would help validate and verify both structured and unstructured interactions between actors and resources through the service platform?
Value Co-creation	<ul style="list-style-type: none"> • In what ways can IT support the different <i>roles of beneficiaries</i> in value co-creation—as ideator, as designer, and as intermediary? • How can online communities facilitate <i>unconstrained knowledge recombination</i> by beneficiaries (actors) in the service ecosystem? What technological/contextual characteristics mediate or moderate such a function by online communities? • What adaptations do actors need to make in their <i>internal processes</i> to facilitate value co-creation, and how do these processes/mechanisms <i>interact</i> with the digital infrastructure? • In what ways can IT enhance the <i>transparency</i> (role, process, and outcome) of value co-creation activities in a service ecosystem? How does the digital infrastructure interact with other strategies and practices to enhance such transparency?

Figure 1
A Broadened View of Service Innovation

