



A Value Co-creation Perspective on Information Systems Analysis and Design

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Abstract Information systems analysis and design (ISAD) ensures the design of information systems (IS) in line with the requirements of a business environment. Since ISAD approaches follow the currently dominant logic of business, the rise of a new and thriving business logic may require revisiting and advancing extant ISAD approaches and techniques. One of the prevailing debates in marketing research is the paradigmatic shift from a goods-dominant (G-D) to a service-dominant (S-D) logic of business. The cornerstone of this reorientation is the concept of value co-creation emphasizing joint value creation among a variety of actors within a business network. With the aim of introducing value co-creation as a new discourse to ISAD research, this research note argues that (1) the lens of S-D logic with its core concept of value co-creation provides a novel perspective to ISAD. The authors also assert that (2) value co-creation-informed IS design realizes the paradigmatic shift from G-D to S-D logic. Building on this mutual relationship between value co-creation and ISAD, they propose a research agenda and discuss the ISAD artifacts that prospective research may target.

Keywords Information systems analysis and design · Service-dominant logic · Value co-creation · Research agenda

1 Introduction

Information systems analysis and design (ISAD) is one of the most classical fields of research that arguably lies in the core of information systems (IS) research (Necco et al. 1987; Wand and Weber 1993; Iivari et al. 2006; Sidorova et al. 2008; Siau and Rossi 2011). While IS analysis aims to systematically capture the logic and identify requirements of the respective *business environment*, IS design intends to provide IS solutions that fit the business environment and that address the identified requirements. Thus, ISAD comprises sequential, iterative, or agile processes and activities of linking analysis and design phases in IS development endeavors (Recker et al. 2011; Wang and Wang 2012).

Business environments are conceptualized, analyzed, designed, and managed following a dominant logic of how a business ought to perform (Vargo and Lusch 2004). ISAD approaches should thereby account for requirements of the business environment's dominant logic. If the dominant logic of business undergoes a fundamental shift due to, for example, changes in market or business practices, ISAD approaches need to be revisited accordingly. This is due to the fact that a novel business logic requires to rethink the way a business environment is conceptualized, and the way IS for supporting such a business environment should be consequently analyzed and designed.

Recently, marketing studies (Vargo and Lusch 2004, 2008, 2016) have given rise to a ground-breaking paradigm shift from a goods-dominant (G-D) to a service-

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Table 1 S-D Logic's Fundamental Concepts

Concept	Definition/explanation
Resource	"Resources are a function of how something (tangible or intangible) is or can be used, and not a function of things per se" (Lusch and Nambisan 2015, p. 159)
Operand resources	Tangible and static (e.g., natural) resources that an actor acts on to obtain support (i.e., resources enable or facilitate) (Vargo and Lusch 2004)
Operant resources	Intangible and dynamic (e.g., human skill) resources that act on other resources to produce effects rather than being operated on (i.e., resources initiate or trigger) (Vargo and Lusch 2004)
Resource integrator	All social and economic actors are resource integrators in a network of other actors, and thus all actors are potential innovators or co-creators of value (Lusch and Nambisan 2015)
Offeror	Actors that make offers of resources or service to other actors.
Beneficiary	Actors that benefit from other actors that supply them with service or resources.
Service Ecosystem	"A relatively self-contained, self-adjusting system of mostly loosely coupled social and economic (resource integrating) actors connected by shared institutional logics and mutual value creation through service exchange" (Lusch and Nambisan 2015, p. 162)
Service system	Dynamic configurations of resources that interact with other service systems to (co-)create mutual value (Maglio et al. 2009)
Service exchange	Service is exchanged between service systems to access, adapt, and integrate resources among various service systems (Edvardsson et al. 2011)
Service platform	"A modular structure that consists of tangible and intangible components (resources) and facilitates the interaction of actors and resources (or resource bundles)" (Lusch and Nambisan 2015, p. 166)
Tangible component	Tangible and static components of goods "are seen as vehicles for service provision, rather than primary to exchange and value creation" (Pels and Vargo 2009, p. 374)
Intangible component	"Bundled set of specialized knowledge and skills appearing in the form of intangible and dynamic components in extension to goods" (Lusch and Nambisan 2015, p. 166)
Value co-creation	"The processes and activities that underlie resource integration and incorporate different actor roles in the service ecosystem" (Lusch and Nambisan 2015, p. 162)
Value-in-use	"The customer's experiential evaluation of the product or service proposition beyond its functional attributes and in accordance with his/her individual motivation, specialized competences, actions, processes, and performances" (Ranjan and Read 2016, p. 293)

dominant (S-D) business logic. As opposed to the *value-in-exchange* determination of G-D logic (i.e., value is created when goods are exchanged from a provider to a customer), S-D logic emphasizes that value is determined by a customer on the basis of *value-in-use* (i.e., value is created *jointly* with customers when customers use goods and perceive them as useful) (Vargo and Lusch 2004, 2008). This paradigm shift moves the locus of value creation from exchange to use (Vargo and Lusch 2008). Therefore, the cornerstone of S-D logic is the concept of *value co-creation* (e.g., Galvagno and Dalli 2014; Vargo and Lusch 2016; Ranjan and Read 2016) in that value is determined by the quality of a value-in-use experience and not just by the quality of the provider's goods (Prahalad and Ramaswamy 2004). An example frequently referred to is Rolls-Royce, a global market leader for professional power systems. Rolls-Royce has initiated a value co-creation orientation through selling *jet turbine utilization* (value-in-use, S-D logic) instead of selling *jet turbine possession* (value-in-exchange, G-D logic) (Neely 2008; Fichman et al. 2014; Barrett et al. 2015). Although this shift may seem marginal,

it has in fact fundamental consequences on internal (e.g., product design, contracts) and external (e.g., transactions with customers and suppliers) business functions and requirements. Owing to this paradigmatic shift in conceptualizing economic exchange in the business environment, ISAD scholars may need to examine whether extant ISAD approaches, methods, and techniques can adequately capture novel business requirements and eventually reflect them in the design of IS. In the jet turbine case, the main question is how and whether existing prevalent IS – as results of extant ISAD approaches – can adequately support, for example, the underpinning processes, activities, and continuous business interactions to co-create value among various business actors in the respective ecosystem.

Building on the theoretical foundations of S-D logic and its core concept of value co-creation, the research note at hand aims to introduce a new perspective to ISAD research. We promote a discourse within the IS community and outline a research agenda on how this novel business logic can be reflected in ISAD research. To this end, we spotlight a mutual relationship between *value co-creation*

Table 2 ISAD research streams (Iivari et al. 2000, 2004)

Stream	ISAD paradigms	ISAD approaches	ISAD methods	ISAD techniques
Definition	Underlying philosophical assumptions (ontology, epistemology, methodology, and ethics) that guide the interpretation of reality during ISAD	A set of related common features (goals, guiding principles, and fundamental concepts), shared by a class of specific ISAD <i>methods</i> , that drive interpretations and actions in ISAD	A set of goal-oriented procedures that guide the work of the various stakeholders involved in ISAD. Each ISAD method represents a set of concepts, beliefs, values, and normative principles, which are organized in a detailed process.	Well-defined procedures that guarantee the achievement of certain outcomes if executed adequately. Techniques may be reusable across different ISAD methods, i.e., they create outcome components rather than complex outcomes.
Exemplars	Functionalism, social relativism (interpretivism), radical structuralism, and neo-humanism (radical humanism)	Structured, object-oriented, agile, information modeling, interactionist, socio-technical, open source	Structured analysis and design, object-oriented analysis and design, object-oriented software engineering, rational unified process, information systems work and analysis of changes, modern structured analysis	Data flow diagram, entity relationship diagram, state transition diagram, use case, future workshop, pair programming, conceptual model, requirements backlog, UML, mockup
Selected literature	Burrell and Morgan (1979), Hirschheim and Klein (1989, 1992), Iivari (1991), Hirschheim et al. (1995, 1996), Iivari et al. (1998, 2000), and Waller et al. (2008)	Olerup (1989), Iivari (1991), Bansler and Bødker (1993), Iivari et al. (1998, 2000), Warren and Adman (1999), Ba et al. (2001), Wand and Weber (2002), Lamb and Kling (2003), Neus and Scherf (2005), Avital and Te'eni (2009), and Germonprez et al. (2011)	Yourdon (1988), Sircar et al. (2001), Vidgen (2002), Alter (2004), Janssen (2006), Siponen et al. (2006), and Dietz and Juhrisch (2012)	Wand and Weber (1993), Rugg et al. (2002), Grünbacher et al. (2004), Hickey and Davis (2004), Albert et al. (2004), Hadar and Soffer (2006), Fonseca and Martin (2007), Recker et al. (2011), Siau and Rossi (2011), Allen and March (2012), and Frank 2013
Exemplary discourses	Comparative analysis of ISAD paradigms (e.g., Hirschheim and Klein 1989) Epistemology in ISAD (e.g., Waller et al. 2008)	Specific ISAD approaches (e.g., Bansler and Bødker 1993) Future directions of ISAD approaches (e.g., Avital and Te'eni 2009) Comparative analysis of ISAD approaches (e.g., Iivari et al. 1998)	Specific methods (e.g., Dietz and Juhrisch 2012) Comparative analysis of ISAD methods (e.g., Sircar et al. 2001)	Specific techniques (e.g., Siau and Rossi 2011) Conceptual modeling (e.g., Frank 2013) Cognitive views on ISAD techniques (e.g., Browne and Parsons 2012)
S-D logic and value co-creation implications	S-D logic/value co-creation holds <i>specific paradigmatic assumptions</i> about economic exchange and business environments, which IS are intended to support. S-D logic/value co-creation offers <i>a new lens to inform complementary and new ISAD approaches</i> entailing business environments' new goals, guiding principles, and fundamental concepts		S-D logic-/value co-creation-informed ISAD approaches require <i>extended or new ISAD methods and techniques</i> to account for new goals (e.g., service-for-service exchange), new guiding principles and believes (e.g., S-D logic's foundational premises), as well as new fundamental concepts (e.g., service ecosystem, service platform, resource integrator, value co-creation)	

and ISAD, based on which we call for future research. We posit that (1) value co-creation – from an S-D logic perspective – offers a novel lens to rethink the way a business and its corresponding IS are analyzed and designed, and that, in turn, (2) building IS development on S-D logic and value co-creation-informed ISAD facilitates the practical implementation of value co-creation. The latter thereby lays emphasis on the role of IS in materializing the paradigmatic shift from G-D to S-D logic.

In the following we first synthesize existing knowledge on S-D logic and value co-creation, which primarily originates from marketing research. This is followed by a discussion on ISAD's main research streams as well as on the role of S-D logic and value co-creation in ISAD. Eventually, through a value co-creation perspective, we propose a research agenda for advancing extant discourses in ISAD. The paper concludes with a discussion of the immediate contributions that prospective ISAD research may target.

Table 3 Agenda for immediately required ISAD artifacts

Target artifact	Description	Purpose	State of the art
<i>How does the lens of S-D logic and value co-creation inform ISAD?</i>			
Value co-creation glossary	A <i>value co-creation glossary</i> enumerates, defines, and illustrates constructs that are specific to the S-D logic and value co-creation domain (Kishore et al. 2004, p. 172).	Unambiguous understanding of value co-creation's semantics, use, and foundations	Galvagno and Dalli (2014), Vargo and Lusch (2016, 2017), Ranjan and Read (2016), Wilden et al. (2017)
Value co-creation ontology	A <i>value co-creation ontology</i> structures and codifies knowledge about the concepts, relationships, and axioms/constraints pertaining to the value co-creation domain (Kishore et al. 2004).	Facilitating ontology-driven ISAD grounded in value co-creation	Annamalai et al. 2011, Frigidis and Tarabanis (2011), Lemey and Poels (2011), Mora et al. (2011), Gailly et al. (2016)
Value co-creation modeling language	A <i>value co-creation modeling language</i> facilitates building a conceptual model of the domain that IS are intended to support (Clarke et al. 2016, p. 365).	Analyzing, communicating, and documenting requirements of the value co-creation domain	Yu and Mylopoulos (1994), Gordijn and Akkermans (2003), Matulevičius et al. (2007), Frank (2013)
Value co-creation case database	A <i>value co-creation case database</i> facilitates public collection of and access to empirical instances of service exchange and value co-creation processes in the form of case surveys (Larsson 1993)	Detailed empirical evidence and analysis of value co-creation in different contexts	Baron and Warnaby (2011), McColl-Kennedy et al. (2012), Aarikka-Stenroos and Jaakkola (2012), Jaakkola and Alexander (2014), Sharma and Conduit (2016), Beirão et al. (2017)
<i>How does ISAD realize the shift to S-D logic and value co-creation?</i>			
IS-enabled value co-creation case database	An <i>IS-enabled value co-creation case database</i> facilitates public collection of and access to empirical instances of IS-enabled value co-creation in the form of case surveys (Larsson 1993)	Detailed empirical evidence and analysis of digital service platforms as well as IS-enabled service ecosystems, service integration, and value co-creation; providing a basis to inform new ISAD artifacts	Ceccagnoli et al. (2012), Han et al. (2012), Sarker et al. (2012), Breidbach and Maglio (2016)
Design principles for value co-creation-enabling IS instances	<i>Design principles for value co-creation-enabling IS instances</i> enumerate requirements for the design and sustainable growth of such systems with regard to their specificities	Understanding specificities of IS instances (e.g., digital platforms) that are a central point of gravity within networked service ecosystems and enable value co-creation among actors in service ecosystems; providing a set of design principles with regard to specificities of such IS instances	Tilson et al. (2010), Henfridsson and Bygstad (2013), Eaton et al. (2015), Tan et al. (2015), and Reuver et al. (2017)

2 Service-Dominant Logic and Value Co-creation

The S-D logic discussion has gained momentum since its inception by the landmark study of Vargo and Lusch (2004) in marketing research. This study promotes S-D logic in distinction to G-D logic. The latter is well reflected in neoclassical industrial perspectives as well as in our current understanding and analysis of business environments (Akaka and Vargo 2014, p. 371).

To develop a comprehensive conceptual foundation, Vargo and Lusch (2004) proposed, and further advanced (Vargo and Lusch 2008, 2016), a set of foundational premises for S-D logic. Building on these foundational premises, S-D logic re-conceptualizes the notions of *service* (applying specialized competencies for the benefit of

another actor), *economic exchange* (not the exchange of outputs but the exchange of the performance of specialized activities), and *value* (occurs when the offering is useful to the customer) (Lusch and Nambisan 2015; Vargo and Lusch 2004). These re-conceptualizations imply three shifts in analyzing a business environment. First, S-D logic moves the spotlight from a single organization to a broader actor-to-actor network – comprising competitors, suppliers, partners, and customers – in which an organization operates (*network-centric focus*). Second, in economic exchange, goods (as outputs of production and service delivery processes) are no longer the sole object of exchange, but also their associated or stand-alone intangible offerings in which the extent of information content is high (*information-centric focus*). Third, there is also a shift

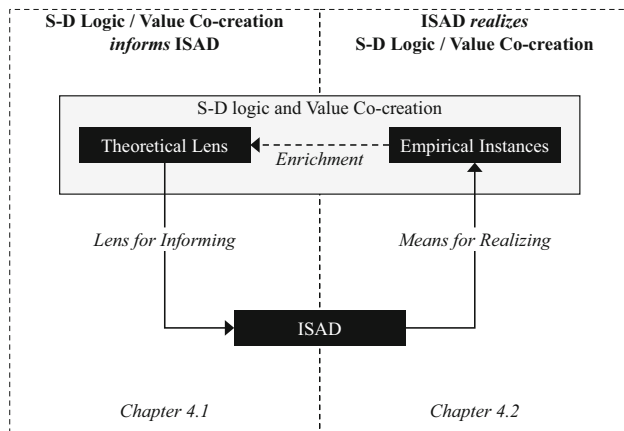


Fig. 1 Mutual relationship between value co-creation (as a lens for informing ISAD) and ISAD (as a means for realizing value co-creation)

in the perception of economic exchange outcomes, from features and attributes of a product/service to the value that is co-created in the given business network (*experience-centric focus*) (Lusch and Nambisan 2015). Thus, S-D logic advocates a novel, yet unified, understanding of the nature of the business environment, which entails the need for commencing new discourses in various disciplines (Vargo and Lusch 2016, 2017).

The cumulative effort of bringing S-D logic to the forefront of marketing research has resulted in its core concept of *value co-creation* as well as value co-creation's related concepts of *resource*, *resource integrator*, *service ecosystem*, and *service platform*. Table 1 explains and defines these fundamental concepts.

Value co-creation is a process through which actors integrate various types of resources to jointly create value. In response to the equivocal understanding of value co-creation in academic literature, we draw on recent literature reviews, which posit *value-in-use* as the underlying constituent of value co-creation (Galvagno and Dalli 2014; Ranjan and Read 2016). Value arises through a process of consumption, which is mostly independent of the provider's intervention or exchange. The user's use context and processes including time, location, uncertainties, unique experience, stories, and perceptions determine value-in-use (Macdonald et al. 2016).

To further conceptualize value co-creation, S-D logic elaborates on additional concepts, namely resource, resource integrator, service ecosystem, and service platform (Table 1). Through value co-creation processes, *resources* are integrated. S-D logic re-conceptualizes resources, which "have historically been viewed as those tangible things that humans use for support, often natural resources that are fixed or limited in supply" (Lusch and Nambisan 2015, p. 159). In S-D logic, resource refers to anything that an actor can draw on for support. It comprises

both tangible and static (i.e., operand) as well as intangible and dynamic (i.e., operant) resources (Vargo and Lusch 2004). In S-D logic, all actors (e.g., individuals, groups, or organizations) are *resource integrators* (Lusch and Nambisan 2015). Resource integrators offer resources to other actors (*offeror*) or benefit from resources that other actors supply (*beneficiary*). Through the concept of *service ecosystem*, S-D logic re-conceptualizes the notion of supply chains in terms of actor-to-actor networks in which actors co-evolve their capabilities and roles and that actors depend on one another for their overall effectiveness and survival (Moore 1993). A service ecosystem comprises several *service systems* and their mutual interactions (Vargo and Akaka 2012). Thus, various service systems engage in *service exchange* to access, adapt, and integrate resources among themselves. Finally, actors employ *service platforms* to facilitate their day-to-day resource exchanges and to mutually co-create value. To enhance the efficiency and effectiveness of value co-creation processes, *service platforms* are configured through modular architectures, comprising both *tangible components* (e.g., wood, metal, IT hardware, humans) as well as *intangible components* (e.g., knowledge, skills, experiences, processes, digital artifacts).

3 Information Systems Analysis and Design

In promoting S-D logic and its core concept of value co-creation as a new discourse to ISAD research, this section summarizes the main research streams in ISAD and elaborates on how ISAD research can embrace the underpinning premises of S-D logic and value co-creation.

3.1 Research Streams in Information Systems Analysis and Design

ISAD comprises two major areas that represent the foundations of this research field (Necco et al. 1987; Iivari et al. 2000, 2004). First, *IS analysis* aims to gather, analyze, specify, and document IS requirements based on a common understanding that stakeholders have about a real-world domain (Recker et al. 2011). Thus, IS analysis refers to "a number of activities in the early stages of information systems development [...] to identify and document the requirements for an information system to support organizational activities" (Iivari et al. 2006, p. 510). Second, *IS design* employs techniques to translate requirements into logical IS designs to eventually fulfill the requirements imposed by the real-world domain (Gregor and Hevner 2013). Thus, IS design refers to "the process of defining the system architecture, components, modules, interfaces, and data for a software system to satisfy the requirements

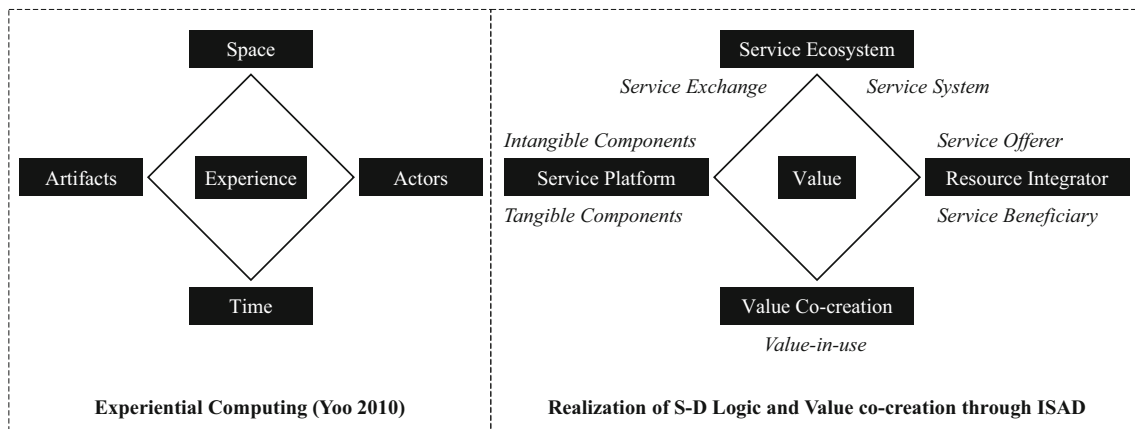


Fig. 2 Conceptual framework for the realization of S-D logic and value co-creation

specified during systems analysis” (Iivari et al. 2006, p. 510).

We distinguish four ISAD research streams (Table 2) by considering studies of influential ISAD scholars (e.g., Necco et al. 1987; Frank 1999; Iivari et al. 2000; Wand and Weber 2002) as well as studies published in the three special issues on ISAD in the leading IS journals (Briggs et al. 2004; Parsons et al. 2005; Iivari et al. 2006). The first stream, *ISAD paradigms*, is concerned with a set of philosophical (paradigmatic) assumptions and believes that guide our interpretation of reality. For instance, Recker et al. (2011) use an ontological theory to describe and evaluate ontological completeness and ontological clarity of conceptual modeling grammars. The second stream, *ISAD approaches*, embodies a set of related features (e.g., goals, guiding principles, and fundamental concepts) that drive interpretations and actions in ISAD. Therefore, different ISAD approaches can be distinguished by their, for instance, distinct fundamental concepts such as processes (e.g., Structured Analysis and Design approach), data (e.g., Information Modeling approach), and objects (e.g., Object-Oriented approach). The third stream, *ISAD methods*, is concerned with a set of activities that are intended to guide the work and cooperation of various stakeholders involved in ISAD endeavors. For instance, Jacobson (1992) offers Object-Oriented Software Engineering (OOSE) as a comprehensive object-oriented ISAD method for developing large-scale industrial IS. It has since evolved into the Rational Unified Process (RUP) method. The fourth stream, *ISAD techniques*, is concerned with the development of well-defined, reusable procedures to achieve certain outcomes. For instance, the Unified Modeling Language (UML) (Booch et al. 1999) comprises a set of standardized, domain-independent ISAD techniques (e.g., class diagram, object diagram, or activity diagram). Each technique’s application results in a partial graphic representation of a system’s model. UML’s techniques are

intended to standardize and unify disparate ISAD techniques underlying the object-oriented ISAD approach.

These four streams are hierarchically interrelated so that ISAD approaches can be grouped into a number of paradigmatic positions. Further, an ISAD approach can be interpreted as a class of specific ISAD methods and, in turn, an ISAD method can be interpreted as a class of specific ISAD techniques (Iivari et al. 2000, 2004). For instance, Object Oriented Software Engineering (OOSE) and Object Oriented Analysis and Design (OOAD) *methods* associate to the Object-Oriented *approach* and, in turn, the OOSE method holds several ISAD *techniques* such as use case diagrams and class models (Iivari et al. 2000, 2004).

Considering the two major phases of ISAD (i.e., IS analysis and design), a substantial part of IS development failures are attributed to problems that arise during the IS analysis phase (Shemer 1987; Castro et al. 2002; Pitts and Browne 2004; Iivari et al. 2006; Lukyanenko and Parsons 2013). In this phase, IS analysts and designers try to make sense of the business environment in which IS are supposed to support organizational practices. Therefore, emergent logics of business should be systematically captured in the IS analysis phase and then need to be translated to IS designs. Nevertheless, due to a lack of attention to theoretical foundations that conceptualize the business logic of IS, many of the ISAD methods and techniques are developed based on common sense and intuition about the nature of the business environment (Siau and Rossi 2011). This results in proposing yet another set of ISAD methods and techniques – called “methodology jungle” by Iivari et al. (2000, p. 182) and “fetish of technique” by Wastell (1996) – most of which lack theoretical foundations to demonstrate their considerable relevance (Siau and Rossi 2011).

By following the latter rationale and with the aim of capturing some of the emerging aspects of contemporary business environments, extant ISAD research calls existing

ISAD methods and techniques into question and develops new ones. For instance, Lukyanenko and Parsons (2013) argue for the necessity of personalizing customer experiences to better match product and service offerings to individual customer needs (analogous to experience-centric focus of S-D logic). They also argue for the necessity of managing heterogeneous information in a network of interacting organizations (analogous to network-centric focus of S-D logic). Through discussing the abovementioned requirements – imposed by the contemporary business environment – they challenge long-held propositions about conceptual modeling and ask whether traditional conceptual modeling techniques are becoming obsolete. Similarly, other scholars argue that organizations have evolved towards business and service ecosystems (analogous to network-centric focus of S-D logic) and develop, for instance, a new modeling technique (Limonad et al. 2012), an agile business process management life cycle (Bruno et al. 2011), or an ontological model (Lavassani and Movahedi 2017) to account for the contemporary business logic.

These fragmented considerations of contemporary business environments entail a need for a conceptually sound basis to systematically inform new *ISAD methods and techniques*. This is where the underpinning theoretical foundations of S-D logic can contribute in introducing new *ISAD approaches*. Through a set of well-defined and unified concepts and premises, S-D logic and its core concept of value co-creation delineate distinct paradigmatic assumptions about business environments and offer a lens to inform complementary and new ISAD approaches. Consequently, new ISAD methods and techniques can be developed to account for new goals (e.g., service-for-service economic exchange), guiding principles (e.g., S-D logic's foundational premises), and fundamental concepts (e.g., service ecosystem, service platform, resource integrator, value co-creation). We thus highlight the pivotal role of theory-informed ISAD approaches to afford a sound basis for developing advantageous ISAD methods and techniques. This brings us to the primary aim of the research note at hand in promoting S-D logic and its core concept of value co-creation as a relevant conceptual basis to advance ISAD research.

3.2 S-D Logic and Value Co-creation in Information Systems Analysis and Design

Since S-D logic aims to provide a shared vocabulary across different disciplines (Maglio and Spohrer 2008), it has already been applied in various disciplines such as consumer research (Xie et al. 2008), technology and innovation management (West and Bogers 2014), or institutional economics (Pels and Vargo 2009). By the same token, S-D

logic and its core concept of value co-creation have been influential in theorizing IS phenomena.

Most dominantly, extant IS research promotes *S-D logic and value co-creation as a theoretical lens* to study various IS phenomena, such as co-creation of IT/service value (Ceccagnoli et al. 2012; Grover and Kohli 2012; Sarker et al. 2012), strategic alignment (Tallon 2010), business model patterns (Peters et al. 2015), or service-oriented systems (Bardhan et al. 2010). In addition, IS research illustrates and discusses the *realization of S-D logic and value co-creation* through IT (e.g., Ordanini and Pasini 2008; Yan et al. 2010; Giesbrecht et al. 2016). For the latter, the focus of IS research is often reflected in service-oriented architecture (SOA) and its related discussions, which are notably guided by the notion of service science. We follow Galvagno and Dalli (2014) in differentiating service science and S-D logic, both of which started and developed in parallel but independent from each other (Vargo et al. 2010; Galvagno and Dalli 2014). Service science literature is neither strictly related to nor grounded in the co-creation debate (e.g., Vargo et al. 2008; Barrett et al. 2015). Our focus lies on S-D logic since it sophisticates the value co-creation concept and complements extant debates of service science (Lusch and Nambisan 2015; Vargo and Lusch 2016).

In offering our view on ISAD through the lens of S-D logic and its core concept of value co-creation, we draw a mutual relationship between value co-creation and ISAD (Fig. 1). We argue that while (1) value co-creation opens up new pathways to analyze and design IS, in turn, (2) ISAD leverages the realization of value co-creation. The latter inevitably provides empirical and practical insights in enriching the theoretical body of value co-creation. Our view thus motivates two main research questions, which call for future research in ISAD.

- First, we motivate prospective research to address the question of *how the lens of S-D logic and value co-creation informs ISAD*. This research question is in line with existing IS research that promotes S-D logic and value co-creation as a theoretical lens (as outlined earlier in this section) as well with the outlined implications of S-D logic and value co-creation on ISAD (as discussed in Sect. 3.1).
- Second, we motivate prospective research to address the question of *how ISAD realizes the shift to S-D logic and value co-creation*. This research question is in line with extant research in IS concerning the realization of S-D logic and value co-creation through IT (as outlined earlier in this section). It is also in line with recent calls to better understand the nuances of IS as a dynamic and influential resource in value co-creation (Akaka and Vargo 2014).

4 Towards Advancing Information Systems Analysis and Design

Both directions of the abovementioned mutual relationship between value co-creation and ISAD (Fig. 1) are explicated in this section resulting in a research agenda towards advancing ISAD from a value co-creation perspective.

4.1 Informing IS Analysis and Design by S-D Logic and Value Co-creation

As discussed in Sect. 3.1, due to its specific paradigmatic assumptions, S-D logic and its core concept of value co-creation offer a new lens to inform complementary and new ISAD approaches and consequently new ISAD methods and techniques. To elaborate on these implications, we build our discussion on Lusch and Nambisan's (2015) perspective on how S-D logic and value co-creation can advance IS research. In effect, focal to value co-creation is the integration of resources (Ranjan and Read 2016). Lusch and Nambisan (2015) hence shed light on the *dual roles* of IT as both *operand* and *operant* resources in value co-creation processes. Therefore, ISAD methods and techniques should account for the dual roles of IT in not only identifying and documenting IS requirements (IS analysis) but also in their implementation (IS design).

IT as Operand Resource: IT as *operand* resource ensures that the underlying processes of value co-creation are efficiently and effectively *facilitated* (Lusch and Nambisan 2015). In that sense, IT plays a passive role in enabling actors in their mixing and matching of resources during value co-creation. For instance, IT helps actors establish and maintain a service ecosystem, search for appropriate resources, or bundle and integrate resources and knowledge. Extant instances of IS in organizational practice at best implicitly and fragmentarily offer capabilities to facilitate value co-creation. Therefore, new or augmented ISAD methods and techniques should adequately identify and leverage the implementation of IS requirements that, for instance, capture how IT (1) generates or constrains the diverse forms of value co-creation in service ecosystems; (2) facilitates the dynamic construction, dissemination, search, and identification of resources among diverse sets of actors; (3) supports the different roles of service beneficiaries – as ideator, designer, or intermediary – in experiencing co-created value; and (iv) enhances the transparency of value co-creation activities (i.e., roles, processes, and outcomes) in service exchange. The latter supports actors in sharing their experience, in personalizing a service offer during usage time, and in mediating mutual relationships.

For instance, jet turbine producers employ software as *operand* IT resource to analyze long-term turbine usage data along different turbine parameters (e.g., pressure, temperature, or vibration). Moreover, jet turbine producers employ on-board sensors and live data feeds during jet turbine usage time to track and monitor the health of their customers' installed base of engines operating worldwide. In close collaboration with the producers, airlines conduct data analysis to reduce fuel consumption and to calculate minimal maintenance downtime (Neely 2008; Fichman et al. 2014; Barrett et al. 2015). Therefore, such a role of IT as *operand* resource in value co-creation demands ISAD methods and techniques that effectively and efficiently analyze and design real-world instances of value co-creation as illustrated above.

IT as Operant Resource: IT as *operant* resource plays an active role in *triggering* or *initiating* value co-creation and in *affecting* other actors and their choices (Vargo and Lusch 2004; Akaka and Vargo 2014). In that sense, IT “seek[s] out and pursue[s] unique resource integration opportunities on its own, and in the process, engage[s] with (or act[s] upon) other actors” (Lusch and Nambisan 2015, p. 167). Initial exemplary indications of how IT as an *operant* resource may manifest are the ways they *proactively* act in value co-creation. Extant instances of IS in organizational practice, however, may not account for IT as *operant* resource, since such a role for IT is dynamic in nature and its specificities are yet to be explicated (Lusch and Nambisan 2015) and new IS instances to support such a role are yet to be uncovered (Yoo et al. 2010). Therefore, new ISAD methods and techniques should adequately identify and leverage the implementation of IS requirements that, for instance, capture how IT *itself* – as an active agent or trigger – will (1) generate and share knowledge, ideas, and creativity; (2) grant and receive control to/from other actors in the service ecosystem; (3) autonomously design and readjust the interfaces of interaction with the given organization and its customers; (iv) personalize service by immersing itself in the context and developing specialized competences; and (v) jointly, reciprocally, and iteratively collaborate with other human and non-human actors during value co-creation processes.

For instance, sensor-based airplane pilot assistance service systems themselves, as *operant* resource, actively trigger and control jet turbine operations during flight time as a function of weather parameters, aircraft behavior, and pilot behavior to increase flight efficiency (Neely 2008; Fichman et al. 2014; Barrett et al. 2015). Therefore, analyzing and designing use cases of such a role for IT as *operant* resource demands ISAD methods and techniques that can capture both extant real-world instances of *operant* IT in their service system contexts (such as

illustrated above) as well as innovative use cases in value co-creation that yet need to be discovered.

Regarding the decisive role of IT as both operand and operant resources in value co-creation processes, S-D logic's distinct, yet unified, paradigmatic assumptions on economic exchange provide a fruitful basis to inform new ISAD approaches with their respective new goals, guiding principles, and fundamental concepts. For instance, current ISAD methods and techniques are dominated by process-, data-, and object-oriented ISAD approaches (see Sect. 3.1). These approaches mainly concern efficiency, accuracy, or productivity through IT applications (IT as operand resource). Therefore, ISAD research can be informed by S-D logic's, for instance, value-, resource-, and ecosystem-orientations to offer new ISAD approaches and their associated methods and techniques. The latter is in line with Avital and Te'eni's (2009) outlined IS design considerations (i.e., generative capacity and generative fit) to enhance creativity, generate innovation, and reveal new opportunities through IT applications (IT as operant resource).

4.2 Realizing S-D Logic and Value Co-creation through IS Analysis and Design

In the preceding discussion, we elaborated on the contribution of S-D logic and value co-creation in complementing extant views on ISAD. The focus was on S-D logic's perspective on IT, as both operand and operant resources, in value co-creation. In this section, we embed value co-creation in S-D logic's other relevant concepts (i.e., *resource integrator*, *service ecosystem*, and *service platform*, see Table 1) to eventually elaborate on how ISAD can realize the shift to S-D logic and value co-creation.

Relying on the underpinning premises of S-D logic, *customer experience* is central in co-creating value because, along this co-creation experience, customers can integrate their own resources in the service and determine the ultimate value of the proposed service (Lusch and Nambisan 2015; Vargo and Lusch 2016; Ranjan and Read 2016). Therefore, an experiential approach provides purposeful guidance for conceptualizing how IS should be analyzed in and designed for such business contexts. To this end, we employ the framework of experiential computing developed by Yoo (2010, p. 219) as it (1) focuses on individuals' experience mediated by IT, (2) concerns the experience-based design of IT, and (3) exhaustively provides the conceptual dimensions that need to be considered in realizing experience-based design of IT. This framework posits that IS in general, and digital technology in particular, mediate the four dimensions of *human experience* – namely, *time*, *space*, *actors*, and *artifacts* (Yoo 2010,

p. 213). For the purpose of our paper, we translate this conceptual framework's four dimensions and its core element of experience to our topic of interest (Fig. 2). We translate *experience* to *value* – that is, *value* resides in the core of a conceptual model of value co-creation in IS research. The four dimensions' translation to our topic of interest is explained in the following.

Service Platform: According to Yoo (2010), *artifacts* are physical, digital, or digitally enabled means through which humans make experience. In S-D logic, *service platforms* are any kind of *artifacts* that act as the mediator, enabler, facilitator, or distribution mechanism for service provisioning. For instance, jet turbines are service platforms facilitating the service of *airtime*. A software for computer-aided design is a service platform facilitating the service of *turbine design*. Notably, recent IS research emphasizes the notion of “digitally enabled service platform” (Lusch and Nambisan 2015, p. 167). *Digital* and/or *digitally enabled* service platforms involve new combinations of digital and physical components to create novel market offerings (Yoo et al. 2010). Thus, both IS components (e.g., software for computer-aided jet turbine design) and IS components embedded in non-IS components (e.g., sensors installed in jet turbines) are conceptualized as service platforms (Neely 2008; Fichman et al. 2014; Barrett et al. 2015). We posit that, to experience co-creation of value, IS need to be analyzed and designed to digitally mediate embodied experience of value as a function of *service platform* (artifact), *service ecosystem* (space), *value co-creation* (time), and *resource integrators* (actors) (Yoo 2010; Lusch and Nambisan 2015). Specifically, digital service platforms can be the focus of prospective IS research due to their relevance and ever-increasing importance. To this end, prospective research is motivated to address how digital service platforms can be analyzed and designed to realize, for instance, appropriate modular architectures with the aim of enhancing dynamic (re-)combination of resources (Lusch and Nambisan 2015, p. 162).

Service Ecosystem: According to Yoo (2010), *space* is a structure that is created by human experience and actions. In S-D logic, a complex service ecosystem consists of emergent actor-to-actor networks (Akaka et al. 2012; Lusch and Nambisan 2015; Friend and Malshe 2016) as the *space* in which value is experienced. Under such premise, resources are dynamically integrated by all actors – comprising individuals, groups, organizations, and markets (Sidorova et al. 2008) – in a network of other actors, all being potential co-creators of value. Thus, service ecosystems should be incorporated in ISAD in that digital and digitally enabled service platforms contribute to the realization of service exchange within and between service

systems. To this end, prospective research is motivated to address how IS can be analyzed and designed to, for instance, realize the diverse forms of collaboration and service exchange in the ecosystem by taking into account the multiplicity, variety, and interdependency of service systems (i.e., structural complexity), and by taking into account the rates and patterns of changes in the ecosystem (i.e., dynamic complexity). For instance, the aviation ecosystem extensively draws on data exchange facilitated by inter-organizational systems to align flight plans and coordinate airplane maintenance prior to take-off.

Resource Integrators: According to Yoo (2010), humans are *actors* that experience artifacts and other actors. In S-D logic, tangible and intangible resources are integrated by *service offerors* and *service beneficiaries* as the *actors* that offer and experience value, respectively. Thus, resource integrators should be considered in ISAD in that digital or digitally enabled service platforms adequately support actors in efficiently and effectively realizing their service offerings and service benefits. To this end, future research is motivated to address how IS can be analyzed and designed to, for instance, realize actors' searching for and bundling (mixing and matching) resources within and across service platforms. Resource integration, however, may not be a predefined and stable process anymore. Instead, resource integration may be dynamically adjusted all the time and thus requires dynamic adaptations of further elements such as business processes. For instance, airlines, as operators of jet turbines, integrate their resources with travel agents, jet fuel suppliers, and ground handling providers to co-create the eventual mobility service. Since such high levels of differentiation of resource integrators are barely thinkable without IS support, we posit that ISAD needs to reflect such distinct roles of resource integrators. Further, runtime re-configuration and integration of resources to fit the respective service to customers' changing requirements should also be a design consideration.

Value Co-creation: According to Yoo (2010), experience is always a function of *time* and temporally emergent. Therefore, the time dimension reflects a process through which experience unfolds. In S-D logic, value is co-created through the processes of resource integration as the *time* along which co-created value emerges. Under such premise, *value-in-use* is always temporary and in the process of becoming – that is, temporally emergent (Payne et al. 2008). *Value-in-use* is always uniquely derived from the user's use context (Ranjan and Read 2016). Thus, value co-creation should be embodied in ISAD in that digitally enabled service platforms properly support the realization of processes underpinning resource integration. To this

end, prospective research is motivated to address how IS can be analyzed and designed to realize, for instance, customers' aspirations of embedding their experience in the realization of value and personalizing exchanged service during usage time. Since value-in-use is temporary, ISAD needs to support designers to purposefully shape the space of interaction, which is spanned by the resources to be integrated and the time along which co-creation takes place. For instance, airlines increasingly draw on IS in establishing joint, reciprocal, and iterative processes with the airline customers during flight time. Therefore, capturing the dynamism of the runtime context in which value-in-use occurs becomes decisive in the design of such IS.

In this subsection, we discussed some of the novel requirements in the analysis and design of IS to account for the fundamental concepts raised by S-D logic. Since value co-creation from an S-D logic perspective still is a rather new topic in IS research, the discussed novel requirements are provided as some exemplars (for more exemplars see Lusch and Nambisan 2015) serving as a basis to demonstrate how IS contribute in realizing S-D logic and value co-creation in organizational practices. In sum, the offered conceptual framework (Fig. 2) asserts that IS are central in realizing the theoretical assumptions of S-D logic and its core concept of value co-creation. To this end and to effectively experience *co-creation of value*, ISAD needs to grasp the dynamic collaboration among actors in actor-to-actor networks (*service ecosystem*) to help them integrate and exchange resources (*resource integrators*) through digital or digitally enabled platforms (*service platform*). In this regard, digital platforms are central so that their roles as both operand and operant resources should be considered in ISAD. To briefly illustrate how the contemporary business environment requires extended or new ISAD methods and techniques, we employ digital platforms as an exemplary ISAD case. Digital platforms are gaining significant momentum in IS research and practice and have become a novel means to extend the notion of value creation in firms beyond their organizational boundaries (Parker et al. 2017; Reuver et al. 2017). Each digital platform is associated to a service ecosystem comprising the owner of the digital platform as well as other actors such as partners, subcontractors, regulators, and customers. Various actors in the service ecosystem exploit the respective digital platform to integrate their unique resources and to eventually offer a unique value proposition (a service) to a specific customer (Ceccagnoli et al. 2012; Han et al. 2012; Sarker et al. 2012). In that sense, the digital platform owner is merely the provider of the platform, while the platform's survival depends on the quality of value co-creation processes among other actors (Ceccagnoli et al. 2012; Parker et al. 2017). Further, each service is triggered by a customer (reflecting the

customer's unique and contextual requirements), for which different actors integrate their resources to serve the very specific need of the customer. Therefore, the pertinent digital service ecosystem can be characterized by the dynamic and case-base integration of resources among various actors to provide specific service to particular customers through the digital platform (Eaton et al. 2015). Such an ISAD case is different compared to conventional ISAD cases in terms of the underpinning *ISAD approaches* and their associated *goals*, *guiding principles*, and *fundamental concepts* (see Sect. 3.1). In this case, the main *goal* is value *co-creation* through service-for-service exchange, so that platform partners exploit the owner's platform to develop and offer their service to customers in the respective service ecosystem. Similarly, *guiding principles* are different in that value is co-created by multiple actors (e.g., owner, partners, and subcontractors), always demanded by and *including* the beneficiary (i.e., end customer) (Vargo and Lusch 2016). Consequently, *fundamental concepts*, to be considered in ISAD, are different so that other central concepts (compared to process, data, and object concepts in conventional ISAD approaches) should come to the fore such as value, value co-creation, service, service ecosystem, resource integrators, among the others. Owing to this new ISAD approach's distinct goals, guiding principles, and fundamental concepts, extended or new ISAD methods and techniques are required. As an example, such ISAD methods and techniques should consider the relative, subjective, and experience-based nature of value (Holbrook 2006; Gallarza et al. 2017). That is, resource integration is not limited to "design-time" alone, but during the delivery of a service, changes may occur with regard to, for instance, customer's interventions, availability of resources, and the run-time configuration of the service (eco-)system. Such changes are likely to have an impact on the a priori expected co-creation of value. Therefore, the design of the service delivery, in particular how the value co-creation will materialize, needs to be dynamically adjusted at "run-time". This is, in fact, due to the inherent dynamics of value co-creation processes (Andreu et al. 2010; Gummesson and Mele 2010; Kowalkowski 2011) as well as the subjective nature of the perceived value by the customer (Holbrook 2006; Gallarza et al. 2017).

5 Conclusion and Research Agenda

This research note is based on the premise that research in ISAD should account for emergent business logics that require to rethink the way a business environment is conceptualized, and, consequently, the way IS as part of such a business environment are analyzed and designed. Due to

the increasing recognition of S-D logic, as a paradigmatic shift away from G-D logic, this research note builds on S-D logic and its core concept of value co-creation to introduce a new discourse and to outline a research agenda for ISAD research. In doing so and by drawing a mutual relationship between value co-creation and ISAD, we motivate prospective research to address the questions of (1) *how the lens of S-D logic and value co-creation informs ISAD*; and (2) *how ISAD realizes the shift to S-D logic and value co-creation in practice*. In the following, we discuss a research agenda for each of the questions mentioned above and suggest contributions that can be particularly relevant and instrumental in examining the mutual relations between value co-creation and ISAD (Table 3).

Concerning the first question, S-D logic and its core concept of value co-creation provide a basis to inform new and complementary ISAD approaches and their corresponding ISAD methods and techniques. Nevertheless, these research endeavors require some preliminary steps towards comprehensive ISAD approaches. More precisely, the attempt to thoroughly reflect S-D logic in ISAD approaches suffers from an equivocal understanding of value co-creation's conceptual boundaries. For instance, McColl-Kennedy et al. (2012) developed a catalogue of 27 different definitions of value co-creation, emphasizing the underlying theoretical ambiguity. Therefore, a multidisciplinary reference vocabulary in the form of an unambiguous S-D logic and value co-creation *glossary* is not available for ISAD. This void has been raised not only in IS literature (Alter 2012), but also in the reference discipline of S-D logic (i.e., marketing research) (O'Shaughnessy and O'Shaughnessy 2009; Godsiff 2010). Once academia has agreed upon the abovementioned glossary, an *ontology* would facilitate ontology-driven ISAD (Fonseca and Martin 2007; Chen-Huei Chou et al. 2014). As an ontology is a description of components and their relationships that describe the nature of a domain of discourse (Chandrasekaran et al. 1999), a value co-creation ontology would comprise the meanings of constitutive components of value co-creation and, more importantly, their inherent relationships. There are few studies aiming at one or a few fragmented aspects of value co-creation in ontology development endeavors, for instance, ontological foundation of S-D logic (Fragidis and Tarabanis 2011), core value ontology (Gailly et al. 2016), service system ontologies (Annamalai et al. 2011; Lemey and Poels 2011; Mora et al. 2011), and service science ontology (Lusch et al. 2008). Nevertheless, no such work on a value co-creation ontology from an S-D logic perspective is available. Extant ontologies related to S-D logic or value co-creation either (1) engage in ontology development for value co-creation, but not from an S-D logic perspective; or (2) engage in an S-D logic perspective, but do not focus on value co-

creation. Thus, an ontology should deal with the general assumptions concerning the explanatory invariants of S-D logic. These assumptions would then provide a framework enabling the understanding and explanation of value co-creation across all research domains (Fonseca and Martin 2007).

Relying on a solid glossary and on an ontology for value co-creation, the next step towards advancing ISAD is the development of ISAD techniques such as a *modeling language* for value co-creation. In effect, modeling is a core activity in ISAD, which refers to “building a conceptual model of the domain that an IS is intended to support” (Clarke et al. 2016, p. 365). There are a number of modeling languages and frameworks aiming at one or a few fragmented aspects of a language for S-D logic and value (co-)creation, for instance, e3Value (Gordijn and Akkermans 2003) for value modeling, i* (Yu and Mylopoulos 1994) and KAOS (Matulevičius et al. 2007) for goal modeling, as well as ArchiMate (Lankhorst et al. 2009) for general enterprise architecture modeling including service aspects. However, no work on a reference language for modeling value co-creation from an S-D logic perspective is available. Such a modeling language should not only account for the structural aspect of value co-creation (e.g., constructs that represent the domain of interest) but also its behavioral aspect (e.g., dynamics, runtime re-configuration, and context) (Siau and Rossi 2011).

Moreover, due to the novelty and abstractness of value co-creation from an S-D logic perspective, extant research lacks empirical illustrations to demonstrate service thinking in real-world practices. This lack of empirical illustrations hampers the translation of the value co-creation knowledge base to the domain of ISAD. The concept of value co-creation has been discussed for more than a decade (Galvagno and Dalli 2014; Ranjan and Read 2016), but empirical evidences on how service offerors actually interact and exchange resources to co-create value with service beneficiaries are just emerging (e.g., Sarker et al. 2012). Consequently, we lack empirical analyses of how economic actors engage in value co-creation, and, consequently, we have only few guidelines for ISAD on how this process could ideally be realized (Payne et al. 2008). Therefore, conducting case surveys to collect empirical data on value co-creation and making these cases available in a *database of value co-creation cases* would be a considerable contribution to the respective research community.

In sum, the suggested future research on value co-creation glossary and ontology can be considered as the first steps towards value co-creation-informed ISAD approaches. The value co-creation modeling language, in turn, provides a fruitful ISAD technique in pursuing the respective ISAD approaches. Finally, a further research

step is required to bring these efforts together in ISAD methods not only through the conceptual foundations of S-D logic, but also through their empirical manifestations in real-world organizational practices.

Concerning the second question, we posit that the IS community could considerably contribute to materialize the paradigmatic shift underpinning the philosophical reorientation from G-D logic to S-D logic. Relying on the fundamental concepts of S-D logic, examining the second question requires systematic research on digital service platforms as well as on IS-enabled service ecosystems, resource integration, and value co-creation.

Extant IS research has already started investigating this question through demonstrating how SOA realizes value co-creation (Ordanini and Pasini 2008; Yan et al. 2010) or how value co-creation has been reflected in existing IT applications, for instance, in IT-supported citizen advisory services (Giesbrecht et al. 2016). Nevertheless, IS scholars still call for further investigations (Akaka and Vargo 2014) on, for instance, novel aspects of IS that would generate or constrain diverse forms of resource integration; novel mechanisms of IS that enable identification, dynamic construction, and wide dissemination of resources; as well as novel ways of developing digital resources that trigger value co-creation (Lusch and Nambisan 2015). Owing to the mutual relationship between value co-creation and ISAD, the resulted insights from these studies would (1) enrich S-D logic and value co-creation’s extant body of knowledge and (2) inform the development of complementary or new ISAD approaches, methods, and techniques. Therefore, the immediate contribution to be particularly relevant in this research question is *empirical illustrations on IS-enabled value co-creation*. These empirical studies would serve as a basis for not only demonstrating the actual realization of value co-creation through IT applications, but also informing design considerations and the employed methods and techniques in designing such IS-enabled value co-creation instances. Further, those IS instances that enable value co-creation (e.g., digital platforms) are a pivotal means to shape digital service ecosystems comprising various actor roles. Due to the dynamic nature of value co-creation processes and owing to a multitude of actors’ engagement (that constantly join or leave the respective ecosystem) in value co-creation processes, such IS instances are considerably different in their design and evolution compared to conventional IS instances (e.g., enterprise systems). One of the mainstream discussions on the specificities of such IS instances is the required balance between control (to centrally stabilize the provision of the requested services) and generativity (to attract as many resources and actors as possible to satisfy diverging requirements of end users) in their design and evolution (Ciborra 2000; Tilson et al. 2010; Henfridsson

and Bygstad 2013; Eaton et al. 2015; Tan et al. 2015; Reuver et al. 2017). Therefore, delineating *design principles for value co-creation-enabling IS instances*, with regard to their specificities, would be of considerable value. Such studies would leverage and facilitate the shift to S-D logic and value co-creation through purposefully designed IS instances for value co-creation processes.

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