Service Dominant Architecture based on S-D logic for Mastering Digital Transformation: The Case of an Insurance Company

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Digitalization and digital transformation requires dramatic change of the enterprise information systems. Today, digitization and related technology trends promise new opportunities but imposes as well certain threat for many businesses. Majority of traditional companies still lacks clear digital strategy because struggling with thorough understanding of the phenomenon digitization. S-D logic provides clarification and explanation concerning the strategic implications of and working mechanisms behind digitally enabled business models and offerings. The paper conceptualizes a service architecture, here defined as Service Dominated Architecture (SDA), because its central purpose is to mobilize resources necessary for service-dominated, customer-centric solutions. The case of insurance companies serves as explorative case and hands-on example as it illustrates how companies can transform their businesses to enable novel value propositions.

1. Motivation

Digitalization and digital transformation requires dramatic change of the enterprise IT. New technology trends promise new opportunities. Employees, business partners and customers have to be engaged through a new generation of enterprise IT systems (Arthur, 2009; Weill and Woerner, 2015; Moore, 2011). Today, customers expect companies to offer digital solutions to excel in customer orientation, through interactive offerings and digital-enabled services, in a way they are used to it from their private and daily lives. However, business appear to lag behind digital developments as they stick to fulfil compliance of internal regulations and their existing IT assets. Service-dominant (S-D) logic serve as a core of digital strategies that emphasize the development of innovative services. In particular, digital strategies focus on the digital transformation, which is a prerequisite for success in the long term. S-D logic and its foundational premises provide hints which capabilities are required to develop and implement digital strategies. S-D logic provides clarification and explain concerning the strategic implications of digitally enabled business models and offerings. By this,

S-D logic provides many useful concepts for developing digital strategies such as co-creation, service ecosystems, service platforms, value creation, etc.

Service ecology links resource integrating entities or actors through shared institutional logics enabling interactions, which result in mutual value creation (Lusch and Nambisan, 2015, 162). Integrating external resources offers competitive advantage (Spring and Araujo, 2013, 61) and motivates innovations. Service architectures relate to modular service development and thus innovation (Lokkegard et al., 2016, Voss and Hsuan, 2009). It is an interesting concept as it provides structures, standard practices (such as structural deepening or internal replacement) (Arthur, 2009, 132-134) and design artefacts such as modules (functional units or building blocks), interfaces, rules and constraints to design and operate service systems (Lokkegard et al., 240). Our research strives for practices to analyse and design service systems on various abstraction levels (Spohrer and Maglio, 2010; Voss and Hsuan, 2009).

Service architectures decompose service systems and their arrangements of components into individual functional elements (modules), their interactions and interfaces. Architecture strongly relates to structure and mechanisms to fulfil a specific purpose or functionality (Arthur, 2009, 33; Böhmann et al., 2014; Voss and Hsuan, 2009; Lokkegaard et al., 2016). Service architectures enable dynamic solutions and customization through contraining modular design synthesis (Lokkegard et al., 2009, 239). Thus from a service system engineering perspective, service architectures are fundamental to understand service innovation and service science (Voss and Hsuan, 2009). Because of its integrated position, the insurance business has to react on innovations occurring in other domains. As example, in the car industry, where intelligent products and services are created, based on networked sensors and devices (Warg and Engel, 2016; Warg et al.; 2015). Insurance companies have to react to offerings of “digital attackers” (Warg and Engel, 2016) by establishing own digital platforms and innovative value propositions. Customers are looking for value more than ever and are easily lost to competitors. User experience and value in use are the new drivers of customer retention. Thus, companies if relying on appropriate digital strategies combined with service strategies can create a strong competitive position in digital markets. Hence, companies have to adapt their existing strategies in order to fit the needs and requirements of the digital age. The remainder of this paper is organized as follows. Section 2 motivates our research objectives and presents the pillars of our research design and methodology. Section 3 then introduces briefly to the challenges of digital strategy and transformation before section 4 creates the link to our case of an insurance company, which creates the practice-oriented research context. Section 5 reviews premises and fundamentals of S-D logic and sheds light on constituent elements of our conceptualization of Service-Dominant Architecture (SDA). SDA provides practices to analyse and build service architecture and solution design. Finally, in section 6 we apply and demonstrate SDA to the case of an insurance company. Section 7 concludes the paper.

2. Objectives and Methodology

This paper explores digitization and digital transformation by presenting the case of an insurance company. In this case, the company is developing digital strategies to react on changes in its environment, such as changing customer behaviour, new technologies, new business models, new “grammars” how to (re)combine and use

technical building blocks to create required solutions for their future business. SDA proposes to operationalize requirements and characteristics for the planning, designing and building of customer centric solutions, which are characterized by value in use. Thereby giving the structure for integrating and arranging operant resources. Following S-D Logic, SDA consists of at least three distinct service systems and a "data lake". The service systems are system of interaction, system of participation, system of operant resources. External resources can be integrated via fix coupling with SDA-external platforms or flexible, lose coupling with resources out of the service ecosystem (Warg and Engel, 2016). Following a business and information system engineering approach (Krcmar, 2015, 228) and software engineering process models (Balzert, 2008; Oestereich, 2009), the SDA proposes high-level requirements and design paradigms without concretizing or deciding for any specific technologies or design principles – but using open standards principles. The output will be a design in the sense of a "*[…] a form, a set of architecture assemblies, to fulfil a set of purposes*" (Arthur, 2009, 91). Service architectures constitute service system entities (Spohrer and Maglio, 2010). They can be instantiated as service systems to offer value propositions in given contexts following the basic principles of resource moblization, interactions and value cocreation activities (Böhmann et al., 2014). The paper takes focus on challenges related to transforming business and design requirements into configuration of resources of value cocreation (Spohrer and Maglio, 2010; Böhmann et al. 2014). We make suggestions for reproducible structures or assemblies of system components in the sense of "engineering service architectures" (Böhmann et al., 2014) by suggesting SDA as constituent element of service ecosystems. Service architectures and related systematic development processes are an interesting emerging research field within Information Systems (IS) (Böhmann et al., 2014). In this context, architectures represent assemblies of connected building blocks (Voss and Hsuan, 2009; Lokkegard et al., 2016) (e.g. modules, subsystems) and configuration of resources (Spohrer and Maglio, 2010) to fulfil a specific purpose or functionality in a given context (Arthur, 2009, 35; Böhmann et al., 2014; Voss and Hsuan, 2009; Lokkegard et al., 2016; Chandler and Vargo, 2011).

Align IT strategy with business strategy (Applegate et al., 2007, 39) is a pivotal activity of IS management. Followed research design and methodology is eclectic and grounds on various disciplines and related practices. Our research design integrates various disciplines, e.g. information system engineering (Krcmar, 2015), service systems design and engineering (Spohrer and Maglio, 2010), service system piloting and action design approach (Böhmann et al., 2014), IT strategic alignment model (Henderson and Venkatraman, 1990; Applegate et al., 39; Krcmar, 2015, 398) and S-D logic principles (Vargo and Lusch, 2004; Nambisan and Lusch, 2015; Akaka and Vargo, 2012; Grönroos and Voima, 2013; Grönroos and Ravald, 2011; Grönroos, 2008). In addition, our research suggests that service architectures are a way to support rhetoric, action and identity to master and drive organizational and digital transformation (Eccles and Nohria, 1992,8-10).

3. Digital Strategy and Transformation

The effect of digital transformation is discussed to be a revolution that unleashes and develops disruptive powers to change existing structures. In this process, especially business models tend to get servitized (Zolnowski, 2015, Böhmann et al., 2013).

However, those disruptive elements and effects through the adoption and use of digital technologies can be explained as (re)organization of businesses and commercial procedures – around digital technologies, until *"[…] these technologies adapt themselves […]*" (Arthur, 2009, 157) to a specific industry. This process is called "restructuring" or re-architecture of the economy *"[…] to make use of the new domain*" (Arthur, 2009, 157). "*It is not sufficient that businesses and people adapt to a new body of technology. The real gains arrive when the new technology adapts itself to them*" (Arthur, 2009, 158). Figure 1 illustrates that digitization is one element in the identified set of drivers of change (Warg et al., 2015). Digitization captures various phenomenon and restructuring of industries around digital technologies. As shown, digital transformation requires to elicit and document service system requirements, in our case mainly societal changes, change of customer behaviour and digitization, to arrive at implementable solutions. A key essence of strategic planning and digital transformation is to translate abstract requirements into service system entities (Spohrer and Maglio, 2010) and mobilize required resources (Voss and Hsuan, 2009; Böhmann et al., 2014) to derive and implement new capabilities, structures and mechanisms of the organization (Applegate et al., 2007, 39; Henderson and Venkatraman, 1992, 6-7).

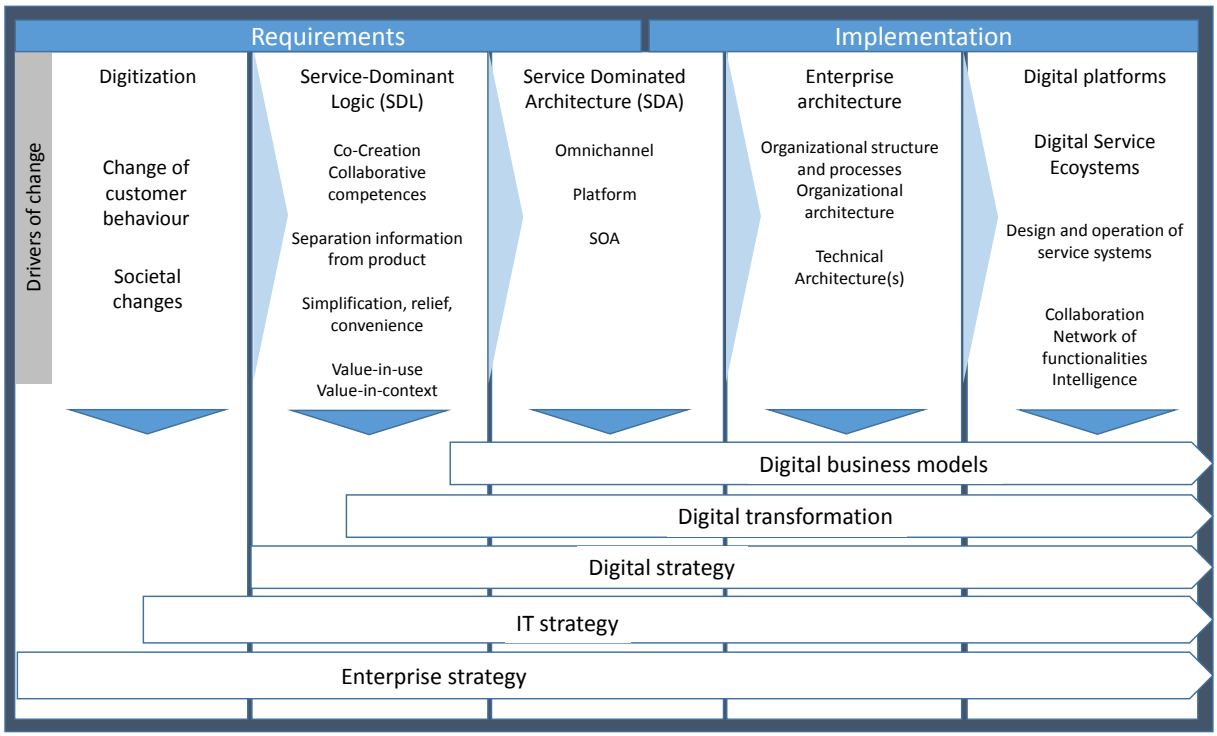


Figure 1: Digitization and Digital Transformation: Service Dominated Architecture operationalizes Digital Strategy and S-D logic principles

In this way, we respond to research challenges as motivated by Böhmann et al. (2014) such as exploration of new and unknown service systems as well "participatory design" and "prototyping approaches". SDA enables "*complex service systems innovations and their real world effects*" (Böhmann et al., 2014). Thus, this research is work in progress and constitutes an initial starting point for follow up activities and future research endeavours to contribute to service systems engineering. SDA intends to set up a research community to share practical insights and experiences of pilot designs to tackle real world problems (Böhmann et al., 2014). SDA contributes to action design research. SDA supports piloting of novel, complex service systems

and value propositions for the digital age (Böhmann et al., 2014). Architectures decompose assembled systems into their building blocks or components organized around specific principles, functions or a purpose (Arthur, 2009, 31; Böhmann et al.; 2014; Voss and Hsuan, 2009; Spohrer and Maglio, 2010, Lokkegard et al., 2016).

One key essence of digital transformation (Kane et al., 2015a; Kane et al., 2015b) lies in linking various service systems to create value (Grönroos, 2011), enable value cocreation (Vargo et al., 2008) and novel value propositions (Böhmann et al., 2014) in and among service systems (Vargo et al., 2008). This requires the ability to enable interactions and mobilizing resources (e.g. resource density and resource integration) across connected service systems (Vargo et al., 2008) to support value cocreation activities (Lusch and Nambisan, 2015; Akaka and Vargo, 2012; Böhmann et al.; 2014; Spohrer and Maglio, 2010; Voss and Hsuan, 2009). Digital transformation is primarily about digital technologies and the conceptualization of their potential impact on a companies' current or future business. It is crucial for business leaders to understand the disruptive forces that digital technologies can unleash changing current business logics and value constellations (Kane et al., 2016), (Deloitte, 2016). Digital disruption is a process, which creates dramatic change for industries or business branches based on the following attributes (Weill; Woerner, 2015): (1) rapidly digitizing, (2) breaking down industry barriers, (3) creating new opportunities, and (4) while destroying long-successful business models. Subsequently, focus lies on digitalization and digital transformation in the insurance business before the paper overviews the role of service innovation in the context of S-D logic and digitization.

4. Digital Transformation in Insurance Business

"*A combination of disruptive forces – some economic, some societal, some technological – is shaking up the insurance industry comfort zone*" (IBM, 2014).

No doubt, insurance business is currently undergoing dramatic change and is subject of digital disruptions (originating from new innovative service offerings and new market players ("digital attackers"). Despite the fact that discussion about digital transformation of traditional business is not new (Andal-Ancion et al., 2003; Erickson et al., 1990, McKinsey, 2012). Various research reports are available evaluating threats and opportunities of digital transformation. The reports explore influencing factors driving respective change in the insurance business. Furthermore, the reports come up with recommendations how insurers successfully transform their business and are able to create new business options to thrive their business in the digital age (EY, 2013; IBM, 2014; Naujoks et al., 2013). From a service systems perspective, digital technologies influence processes of valuing and algorithms, mechanisms how value is determined (Spohrer and Maglio, 2010). Presented use cases present the first wave of digital transformation. It is expected that next generation of digital value propositions adapts to changing processes of valuing (Vargo and Lusch, 2004; Spohrer and Maglio, 2010) as service systems change as their structures and mechanisms coevolve (Spohrer and Maglio, 2010). Nevertheless presented cases are the starting point of SDA and presented research. Table 1 overviews the use cases and derives properties and characteristics concerning service and information system design.

No.	Use case	Value proposition (service system entities)	Service-Dominated Architecture (SDA)	
			S-D logic principles / service components	IT capabilities/ solution components
1	Life insurance	Life insurance with flexible fees dependent on actual customer behaviour and pro-vision of access to personal customer data (vital functions trackers, analytics apps)	- Resource liquefaction - Resource density - Resource integration - Value cocreation - Interaction systems - Service ecosystem - Process of valuing - Mobilization of resources - Modularity - Reciprocity	- Service platform - Big data analytics - Social networks - Mobile apps - Wearables; sensor networks and data - Cyper-Physical-Systems - Cloud computing - Microservices / containers / docker technologies - Resilience
2	Car insurance	Car insurances are offered on flexible basis or as “as-a-service” offerings. Flexible fees are offered on basis of technical car and behavioural driver data combined with external third party services.		
3	Household insurance	Make use of sensor data and monitoring apps of the insured facility. Insurers and technical service providers may collaborate to create new value propositions for customers.		
4	Emerging digital markets	Insurance offerings making use of digital technologies to create new value propositions and offerings. New unprecedented market offerings create new markets.		

Table 1: Use cases to be analysed and used for service system design and piloting

5. Service related foundations

In this section, we look for explanations and theories, which explicate why whole markets are subject of disruptive powers and digital transformation. By adding a service systems view as argued by Spohrer and Maglio (2010), Maglio and Spohrer (2008) and the concept of "service ecosystems" as motivated by (Akaka and Vargo, 2014; Lusch and Nambisan, 2015; Vargo and Akaka, 2012; Edvardsson and Tonvoll, 2013), our perspective results in a broader view of service innovation in the context of digital transformation and service systems. SDA translates and proposes high-level requirements concerning derived new capabilities to realize digital solutions and digital-enabled services for customers. For this, firstly, we review the aspect of service innovation in context of S-D logic as well as S-D logic key messages and principles, before we derive a list of requirements and concepts that need to be included in our solution design. Subsequently, we overview and summarize major results yielding from our analysis.

5.1. Service and service innovation

In contrast with old service definitions that define service with negative, enumerative, and constitutive definitions (Corsten, 1997; Buhl et al., 2008), Vargo and Lusch (2004) present a new perspective on the exchange in economics, called the service-dominant logic (S-D logic). The main focus of S-D logic is value and value creation, particularly value for the stakeholder as well as the way the value is created. Service is the main basis for value exchange and is created with the cooperation of different actors (Vargo and Lusch, 2004; Vargo and Lusch, 2011). Within the S-D logic, service is defined as "the application of specialized competences (knowledge and skills) through deeds, processes, and performances for the benefit of another entity or the entity itself" (Vargo and Lusch, 2004, p. 2). Other service definitions take a similar direction. For example, Grönroos (2008) defines service as "a process that consists of a set of activities which take place in interactions between a customer and people, goods and other physical resources, systems and/or infrastructures representing the service provider and possibly involving other customers, which aims at assisting the customer's everyday practices." (Grönroos 2008, p. 300).

S-D logic defines eleven foundational premises that describe the nature of service. As core of these premises, five axioms are emphasized from which the other premises can be derived. The first axiom specifies that "*Service is the fundamental basis of exchange*" (Vargo and Lusch, 2016). With this axiom, all economic transactions are defined as service. Another axiom claims that *"All social and economic actors are resource integrators*" (Vargo and Lusch, 2016). Hence, in order to create value, all relevant actors have to integrate their specific resources and thus have to cooperate. A third axiom says that "*value is cocreated by multiple actors, always including the beneficiary*" (Vargo and Lusch, 2016). Within this axiom, the integration of resources from many different sources is accentuated. The fourth axiom claims that "*Value is always uniquely and phenomenologically determined by the beneficiary*" (Vargo and Lusch, 2016). By this, the context of the beneficiary is emphasized when discussing the actual value of a customer. The last axiom highlights that "*value cocreation is co-*

ordinated through actor-generated institutions and institutional arrangements" (Vargo and Lusch, 2016) and thus, the importance of service ecosystems.

The actor system perspective and the respective value for each of the actors, is an important concept in S-D logic. In S-D logic, service encompasses all economic activities (Lusch and Nambisan, 2015). This includes goods that serve as alternatives to a direct service provision (Lusch and Nambisan, 2015). In particular, the exchange of a good has no direct value (value-in-exchange); rather, value is created by the application of a good (value-in-use) in a specific context (value-in-context) (Lusch and Nambisan, 2015). From the S-D logic perspective, service is viewed as a "*[…] transcending mental model for all types of forms of innovations (intangible and tangible)"* (Lusch and Nambisan, 2015).

An additional concept in S-D logic describes the resource liquefaction. It *"[…] refers to the decoupling of information from its related physical form or device*" (Lusch and Nambisan, 2015) and emphasizes the importance of knowledge and skills. Knowledge and skills are operant resources and the basis of strategic benefit (Vargo and Lusch, 2016). As far as a network of actors institutionalize resources, they become a service ecosystem. A service ecosystem is defined as a "[…] spontaneously sensing and responding spatial and temporal structure of largely loosely coupled value proposing social and economic actors" (Chandler and Vargo, 2011). In this loosely coupled system, actors establish a relationship network to conduct complex processes of resource integration, service provision, and value creation (Vargo and Lusch, 2010). Once, these networks are established service systems can emerge. Service systems are defined as "[…] a socio-technical system that enables value co-creation guided by a value proposition" (Böhmann et al., 2014). Hence, service systems are socio-technical systems comprising a composition of resources that exist to fulfil a specific purpose and to achieve desired outcomes (Spohrer and Maglio, 2010; Vargo and Lusch, 2004; Böhmann et al., 2014).

Service innovation (Gallouj and Weinstein, 1997) is a prerequisite to achieve competitive advantage for companies. S-D logic views innovation as a collaborative process (Lusch and Nambisan, 2015). From their perspective, all product innovations are service innovations (products being only mechanism, medium or vehicle for delivering service (Lusch and Nambisan, 2015). Current discussion concerning S-D logic create a link between service systems (Spohrer and Maglio, 2010; Edvardsson and Tronvoll, 2013), value co-creation (Vargo et al., 2008), service ecosystems (Vargo et al., 2015) and technology (Lusch and Nambisan, 2015; Akaka and Vargo, 2014) as pivotal elements to service innovation. Companies need to develop their "*[…] ability to create service innovations systematically and reliably*" (Spohrer and Maglio, 2010). Service science aims to improve this ability through provision of theory and practice around service innovation. From this viewpoint, service innovation is about the "*[…] evolving repertoire of value-cocreation mechanisms used by service systems entities*" (Spohrer and Maglio, 2010). One important field of innovation is enabled by digitization, such as the development of new data-driven business models (Zolnowski et al. 2016). To take advantage of digitization, companies require new capabilities and have to develop a thorough understanding of service theory, mainly S-D logic, to be able to develop effective digital strategies and innovations.

5.2. Technology

In the context of S-D logic, technology, as computer software and hardware, determine their benefit by the application in value propositioning and value cocreation. This is also reflected by reviewed literature that considers technology, beside practices and institutions, as one central component of innovation (Akaka and Vargo 2014). However, even if service innovation is technology based, technology act mostly as operand resources (Lusch and Nambisan, 2015). IT as operand resource provides required digital infrastructures which supports actors to maintain their business relationships (either latent or evident) and in this way enabling collaboration in the ecosystem (Lusch and Nambisan, 2015). Beside its role as operand resource, IT can also be seen as operant resource and thus, as basis of strategic benefit.

Akaka and Vargo (2014) argue that institutions develop strong influence concerning acceptance or rejection of particular technologies in a given social context. Based on the review of Akaka and Vargo (2014) and Lusch and Nambisan (2015) it can be concluded, that interaction with technology influences both institutional setting itself and humans in their actions. This means technology transforms the structures of organizations, whereas institutional properties influence humans in their action with technology. In consequence, "*technology can be considered as either an operand or operant resource, because it can be both a medium (operant resources) and an outcome (operand resource) of human action*" (Akaka and Vargo, 2014). As conclusion, "*[…] technology can be conceptualized as the recombination of a set of practices, processes and symbols to serve a human purpose, but this recombination occurs through both value proposition and value determination phase*" (Akaka and Vargo, 2014). Digital strategies have to reflect the important role of S-D logic to achieve competitive advantage and to take an active role in transforming their business by means of digital technologies. Hence, if technologies are integrated isolated of the associated or connected institutional settings the potential risk of failure of technology-based innovations gets evident.

5.3. Conceptualization of Service Innovation

From S-D logic perspective, service innovation is embedded in an actor-to-actor network, which "*[…] underscores the importance of common organizational structures and sets of principles to facilitate resource integration and service exchange among those actors*" (Lusch and Nambisan, 2015). Figure 2 illustrates the conceptualization of service innovation through a tripartite framework proposed by Lusch and Nambisan (2015) consisting of three major concepts, namely service ecosystem, service platform and value cocreation. We propose service architecture as additional concept because it enables piloting of complex service systems and action design approaches (Böhmann et al., 2014).

The aim of this conceptualization is to understand the role of technology (foremost IT or digital technologies). Service ecosystems provide an organizing structure for actors, whereby service platforms provide an organizing structure for the resources (Lusch and Nambisan, 2015). Platforms and ecosystems are pivotal concepts, which have to be part of an adequate digital architectural design. These concepts include important capabilities for organizations to develop, such as collaboration or networking (building, maintaining and participating in actor-to-actor networks) as well as the ability named "resource integration" as prerequisite of value co-creation. Ecosystems

can be platform-based and either open or closed (Lusch and Nambisan, 2015). Table 2 shows the conceptualization of service innovation through the tripartite framework based on (Lusch and Nambisan, 2015). S-D logic principles and capabilities are described.

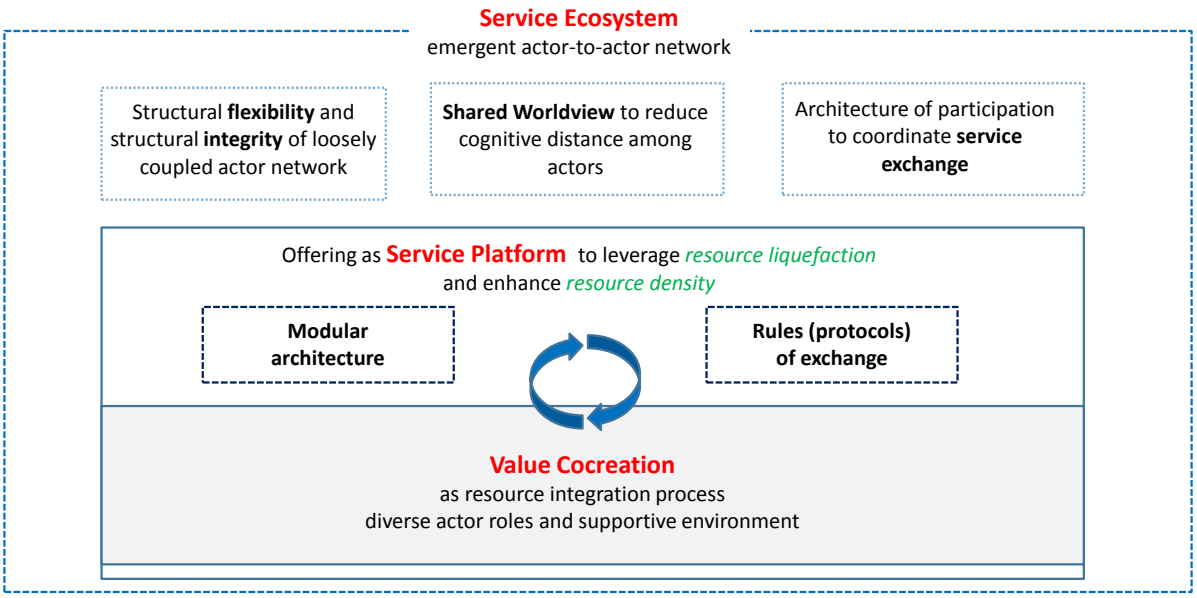


Figure 2: Conceptualization of S-D logic and service innovation (based on (Lusch and Nambisan, 2015)

In Table 3 S-D logic principles are mapped to capabilities and competences with regard to an architecture design using three layers, which vary concerning type of system and focus / purpose. The two columns on the rights show two antipoles spanning a continuum from systems supporting interactions and value cocreation and systems offering stability and access to organizational memory (e.g., here seen primarily as operand resources). On the platform level this data and information is transformed into knowledge through the given context and processes. This layer provides mechanisms and structures to access operant resources (competence and knowledge or service potential (Bettencourt et al., 2014)). Important elements on the platform level are support of capabilities such as resource density (Lusch and Nambisan, 2015), resource integration and aggregation (combining and configuring resources to become available service system entities deployable to the service ecosystem (Spohrer and Maglio, 2010). Ability of docking various platforms as resource configurations defines the boundary for accessibility of resources (resource density).

Conceptualization	Definition	Principles / Key issues
Service ecosystem *(S-D logic: actor-to-actor network.*	- 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**.	- **structural flexibility and structural integrity** of the service ecosystem (and manage the potential conflicts between the two) - develop and **maintain a shared worldview** among a set of cognitively distant actors - devise and implement **architecture of participation** to coordinate actors and their service exchanges.
Service architecture *(service systems: structure and mechanism)*	- a structure for planning, designing and building solutions / piloting of complex service systems - enables **customer centric solutions** by configuring, mobilizing and integrating operant resources	- 3 service systems oriented at S-D Logic: * system of interaction * system of operant resources (mobilization of resources) * system of participation - data lake - loosely coupled systems and modular architecture
Service platform *(S-D logic: resource liquefaction; resource density)*	- **modular structure** that consists of tangible and intangible components (resources) - **facilitates the interaction** of actors and resources (or resource bundles)	- devise an appropriate **modular architecture** that enhances **resource density** - define and implement the **rules** of exchange of **protocols for exchange** of services through the service platform (i.e. prescribe how actors/resources can **interface** with the platform)
Value co-creation *(S-D logic: resource integration, interaction)*	- **processes and activities** that underlie resource integration - incorporate different **actor roles** in the service ecosystem.	- **define the key roles** (including those of the beneficiaries) and - describe the **nature of value created or cocreated** by each actor role. - create 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), (3) enhancing the **transparency** of resource integration activities in the service ecosystem.

Table 2: Conceptualization of service innovation through tripartite framework (modified from (Lusch and Nambisan, 2015)

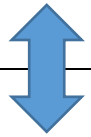
Architecture layer (assembly/ part)	Capability / competence	S-D logic principles	Focus	Type
Value Cocreation (Omnichannel) 	• Context-oriented solutions for customers and customer processes • Interactive, consistent customer experience over all communication channels • Seamless, channel independent, dynamic interactions	• Interaction • Exchange of services (competences) • Customer relationship • Value in-context	Dynamic interaction Elementary transaction	Systems of Engagement Systems of Record
(Service) Platform 	• Orchestration and assembly of value creating building blocks (modules/ micro-services) and prompt interplay (co-creation, collaboration) between services, data and other resources (knowledge, processes, rules, technologies and systems) • Aggregation and combination of resources	• Value co-Creation • Collaboration • Value-in-use (solution) • Resource aggregation • Resource density • Co-Production		
Service Oriented Architecture (SOA)	• Integration of core services of the organization and made accessible to i.e. platform layer and interactive processes (omnichannel)	• Modularization • Access to resources • Exchange of services • Resource integration		

Table 3: Service Dominated Architectures: Operationalization of S-D logic Principles and Capabilities (Warg et al., 2015; Warg and Engel, 2016)

6. Solution Design

The most consequent operationalization of this service-dominant logic yielded in an architectural blueprint, which we call Service Dominant Architecture (SDA). The architecture constitutes a conceptual design and articulated respective IT-related functional and non-functional requirements, namely derived from S-D logic and service systems perspective. It comprises mainly the following three functional layers, which implement the required capabilities to act as exchange services across distinct service ecosystems, act as resource integrator and to facilitate cocreation of value supported by service platforms. SDA provides guidance and serves as appropriate approach to respond to current challenges in service systems engineering (Böhmann et al., 2014) by embracing S-D logic principles and related practices to foster service innovations (Lusch and Nambisan, 2015).

6.1. Service Dominant Architecture

In the remainder, the Service Dominant Architecture (SDA) is overviewed presenting major building blocks and elements. SDA conceptualizes a solution design based on yielded results from our research.

The central aim of SDA is to offer value propositions and flexible solutions for the given customer context and its processes. It makes use of dynamic configurations of resources. The SDA is configurable to the needs of the service business model and underlying business logic. Figure 3 shows the conceptualization of S-D logic principles and related capabilities as high-level architecture for the design of digital-enabled services and solutions. As shown previously elicited S-D logic concepts are mapped as conceptual design to respective subsystems of SDA, that require further concretization concerning underlying technological concepts and paradigms to be used to become implementable in real life scenario. Important to note, that there will be not one solution design, SDA serves as vehicle to communicate strategic targets and related capabilities required by the organization to utilize digital business models. The second layer shows the **systems of engagement** (Moore, 2011) characterised as fast, open, interaction-oriented and agile. This layer includes all required subsystems and elements to interact with customer and to collaborate with other actors in the network (e.g. partners but as well other customers). It responds primarily to the need to react fast and flexible to customer preferences and changing conditions on the market to tailor **solutions** (1) exactly to the needs and the context of the customer process. Thus, it is important to understand how customers determine and calculate value in their given context (Spohrer and Maglio, 2010). The customer's process needs to be in focus. The **interaction system** (2) supports customer interactions and value cocreation activities through respective structures and mechanisms "[*…] to access resources in a coordinated and purposeful manner*" (Spohrer and Maglio, 2010). The **system of participation** (3) integrates external resources and provides access to resources of other platforms or systems. Thus, it provides access to the actor-to-actor-network and the stakeholders forming the service ecosystem. The **system of operant resources** (4) implements the capabilities to integrate and orchestrate resources. Last system element is the **data layer** (5), which exchanges data with other

systems (primarily the systems of record). The **systems of record** (Moore, 2011) includes all legacy and back-end systems.

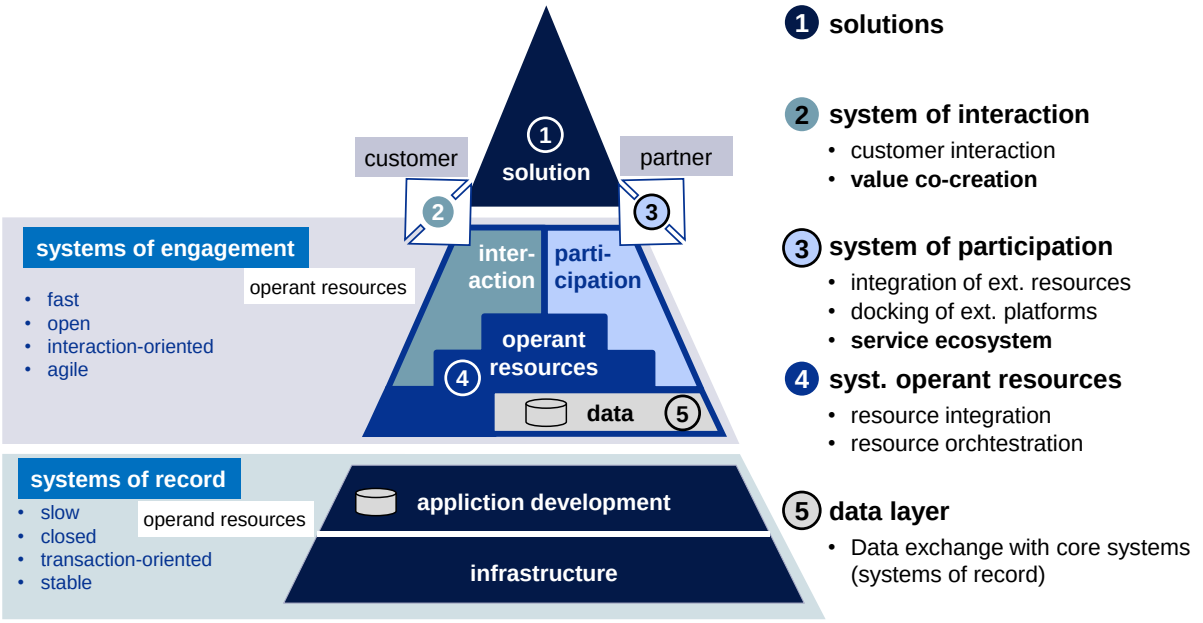


Figure 3: Service Dominated Architecture (SDA) as SDA as core component of digital transformation (Warg et al., 2015; Warg and Engel, 2016)

In this way, SDA provides access to the organizational memory and resources (mainly operand). Data brought in the context of respective processes and service system entities transforms to operant resources (knowledge and competence), which is fed into respective value cocreation activities.

6.2. Use Case: Household Insurance

Figure 4 depicts the use case household insurance and related business process and transactions. SDA offers a structure for resources and provides mechanisms how resources can be accessed and made available (access rights, roles, etc.). In our example, the service process is illustrated by five major subprocesses and related activities. SDA supports and enables interactions required to support cocreation processes between involved actors. First activities refer to the arrival of the customer. The system interacts with the customer using a web portal or app. The customer fills in required data (e.g. login data) and the system grants access to his individual profile. The actor now continues his journey personalized. The interaction system supports the customer through search mechanism and analysing customer behaviour to understand his intention in order to present context-sensitive and purposeful information (activity 1 and 2). In this case, the customer is interested in household insurances and the system configures dynamically resources for the given purpose. The platform layer starts mobilizing resources by extending the user profile as soon the systems reasons that the customer is interested in household insurances (based on real time analytics). The system then sends queries and processes retrieved data to present it process-aware as information in the user interface. The interaction system triggers the operant resources system. Data is queried from various IT systems (core systems), which store relevant contractual and product-related data. This includes checking contracts and customer's portfolio.

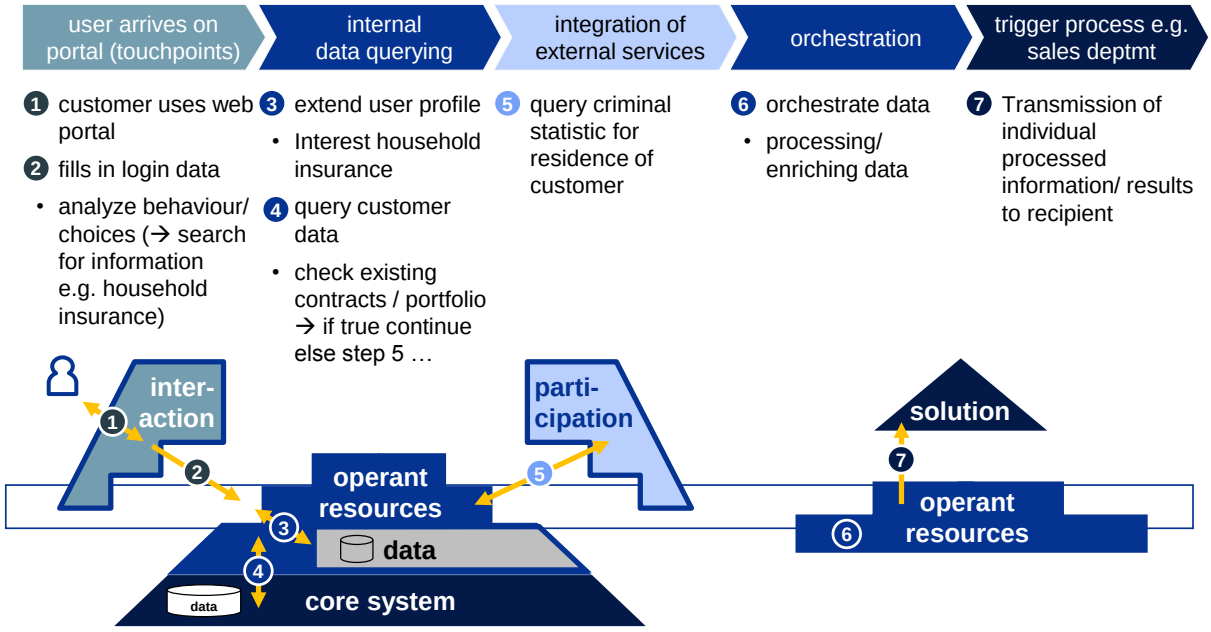


Figure 4: Example Use Case: Customer journeys as starting point (example household insurance) (Warg and Engel, 2016)

Now the process “issue household insurance” triggers the workflow system, which guides the customer through the single process steps. The system configures available “operant resources” to cocreate value with the customer processing context variables to involve potentially additional actors (e.g. partners or personal service personal from an agency located close to the customer’s residence). Based on knowledge and competence the system assists and guides the customer through his information and decision-making process to achieve best outcome for both insurance company and the customer. The system follows thereby the logic “one-stop-to-the-customer”, “everything” and “anything” (Kagermann et al., 2011, 39-44). Interactions with customers aim at creation of user experiences (activities 3 and 4). Before the household insurance can be issued, various steps are required to clarify the contractual details and to process the fee for the customer based on available data. The system queries external sources, such as criminal statistics for the residence of the customer (using big data sources and techniques). All data is orchestrated and enriched with further data, which is further processed analysed in context to achieve knowledge. In the last step, the case is processed to internal departments (e.g. sales department) and respective follow-up processes are triggered to issue the household insurance (e.g. prepare, check and send offer to customer). SDA enables customers, insurance company and partners to cocreate value and to develop value propositions based on interacting service systems, which suggest novel service experiences and offer solutions tailored to the needs of the customer’s process.

6.3. Systematic Development of Service Innovations

Böhmann et al. (2014) motivate three challenges for service systems engineering, namely service architecture, service systems interaction and resource mobilization. Architectural innovations are seen as key to achieve innovations on value propositions (Böhmann et al., 2014). Figure 5 shows a proposal for a systematic design and development of service innovations based on four steps. First step identifies and packages use cases making use of service design thinking methods. Second step

then analyses and designs the service business model. Service Business Model Canvas (SBMC) (Zolnowski, 2015) as methodology provides guidance concerning decision on the required dimensions. This exercise results in a business configuration and provides clarity concerning required resources and related questions of availability and sourcing. Both activities can be summarized as service design or systematic development of service innovation and service operation.

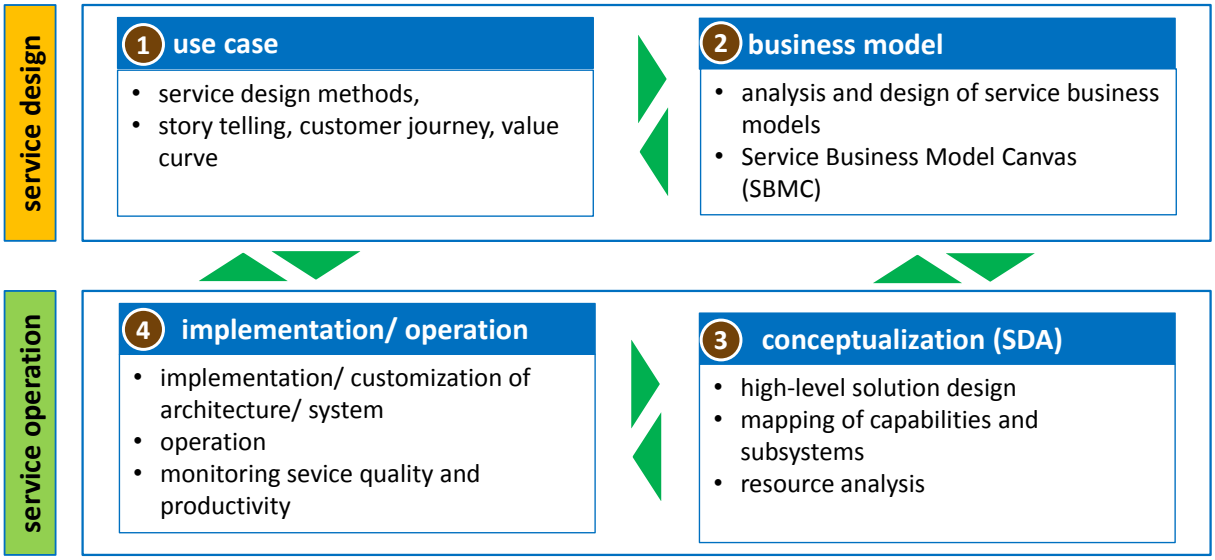


Figure 5: Systematic design and development of service innovations

The configuration of the service business model (modelled by means of SBMC) then translates into implementable concepts. The SDA offers a shared language between business analysts/ designers and IT professionals/ specialists through conceptualizing requirements into a high-level solutions design. This supports IT business alignment processes. Then, SBMC concepts are translated into capabilities and competences, which are assigned to the system elements of the SDA. As shown previously, SDA is primarily a conceptualization and hence does not explicate concrete technologies and implementable systems. This is subject of subsequent fourth step implementation and operation. Last step foresees to customize and configure the IT systems so that the business scenario can be implemented. Important to note, that the shown process does not explicate all required steps. As an information systems engineering approach is followed, all required steps such as agile system development, use case analysis and design, process and data modelling are not explicitly named and described. However, the approach motivates to conduct further research in order to develop a common SDA methodology supported by respective processes and tools. Each use case evaluates and demonstrates the broader applicability of the SDA approach.

7. Summary and Outlook

Previously, we have suggested that digital strategies grounded on S-D logic are adequate to develop digital strategies. We have described what digital strategies and their purpose are and have proposed Service-Dominated Architecture (SDA) to overcome current challenges of service systems engineering. This architectural design conceptualizes major components by organizing them into a structure that describes

system elements encapsulating S-D logic principles and related functionalities. We followed an action oriented research design (Böhmann et al., 2014) based on piloting and evaluating results by means of a real world case of an insurance company. We suggest that digital strategies ground on S-D logic. Thus S-D logic principles provide fundamental components and building blocks (as capabilities) to develop compelling digital strategies and novel value propositions. We described what digital strategies are about and presented a conceptualization of a solution design. SDA constitutes a high-level (IT) architecture that translates purpose and high-level requirements into respective configurations of resources and infrastructures (e.g. strategic alignment model of Henderson and Venkatraman, 1990). Presented research is work in progress and constitutes an initial starting point for follow up activities and future research endeavours to contribute to service systems engineering. We conclude that SDA contains mechanism and structures to build **service ecosystems** on basis of interacting service systems as important catalyser of future service innovations. SDA intends to become standard practice and an integral element of digitization and digital transformation strategies. However, this requires further research and evaluation.

Next steps foresee to invest in further research to sharpen the theoretical base and strengthen the fundamental theory behind the SDA approach and evaluate pilots of complex service systems and value propositions. SDA intends to set up a research community to share practical insights and experiences of pilot designs to tackle real world problems. Thus, this intentions guide our next research steps. Future research on SDA contributes to action design research to establish service systems engineering as discipline within service science. SDA can make a substantial contribution by its ability of piloting and evaluating novel, complex service systems and value propositions in real world scenarios. SDA enables novel value propositions not only for the insurance business, but for all companies challenged by digitization.

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