Chapter

Mastering Digital Transformation with Service Dominant Architecture

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Abstract

The paper presents insights from a longitudinal case study of an insurance company. Digital transformation requires companies to review their strategy. Today, information technologies fundamentally transform whole business models, products, and services. Innovations are an opportune strategy for companies to compete in the digital age and to transform their business models, taking a service perspective on their value creation. Service Dominant Architecture (SDA) offers practitioners a framework and environment to design and operate service systems and systems of engagement. Furthermore, it stimulates collaborative theorizing processes by involving decision-makers, managers, and practitioners in general as active participants in the research process (midrange-theory). Our focus is on evolving and applying our framework and IT artifact SDA. SDA provides guidance to practitioners and researchers, respectively, on how to build implementable and operable solution designs in real practice. Our research on SDA is primarily informed and guided by a Design Science Research (DSR) approach.

Keywords: digital transformation, engagement systems, service platform, service dominant architecture, service-dominant logic

1. Introduction

Digitization and digital transformation affect business in many companies. Companies are confronted with fast-changing markets and customer behavior because digital technologies affect the life events of consumers and producers [1]. Most practitioners perceive a gap and disconnect between the design of digital strategies and their execution. We will argue that building systems of engagement is central to key industries and evolve into a crucial role in service innovation. Service Dominant Architecture (SDA) aims to close this gap by translating the requirements of business initiatives into composable technical and business capabilities. SDA is implemented as a platform on top of existing IT infrastructures (systems of record) and offers new capabilities (systems of engagement) summarized as the foundation for strategy execution. SDA constitutes a conceptual framework and solution design, respectively. Management of actor engagement is seen as a key dynamic capability for

companies to cope with the challenges of digital transformation. This research aims to expand the knowledge base and theoretical foundations of SDA.

The chapter provides an update on the current state of play of our ongoing research. We present new insights in relation to achievements and developments of previously conducted SDA research; both from a theoretical and practical point of view. We will provide an update of gained insights and will offer an outlook on future research challenges and the road ahead. We motivate the next steps and activities to evolve the SDA. The originality and value of SDA lie on the one hand in its concreteness and applicability and on the other hand in its link to the foundations of Service-Dominant Logic (S-D Logic) and Service Science.

The paper is structured as follows. The first two sections motivate our research and describe the research contribution, approach, and objectives. Then, we review and describe the digital transformation and its challenges highlighting in particular three decision areas. Next step, looks at required investments in new IT infrastructure capabilities building foundations for execution to realize envisioned digital strategies. Next, SDA is presented as a solution design and framework to guide strategy development and implementation of solutions in real practice. Finally, we summarize our research results and draw conclusions.

2. Research contribution, method and objectives

Our research on SDA is primarily informed and guided by a Design Science Research (DSR) approach [2–4]. Therefore, this chapter is organized according to the requirements and properties of a DSR project [4, 5]. Researchers have to understand the problems emerging in real-life projects and practice. Hevner et al. [2] have emphasized a design science approach that underscores a construction-oriented view of information systems (IS) research.

In particular, DSR puts emphasis on the relevance of research results to applications in business [3]. Accordingly, IS research is concerned with the development and use of IT artifacts in organizations [6]. Hence, the design, development, and evaluation of IT artifacts are at the core of the IS discipline [3, 5]. IS research deals with the development and use of information technology-related artifacts in human-machine systems [3]. DSR projects solve real-world problems involving the design of complex information systems. Hence, the IT artifact should be a focal point in most IS research [4]. Intervention activities are vital for building and evaluating effective systems designs in context as well as reflecting and generating design principles [4]. Suitably, presented research contributes to expand the knowledge of information systems design by technical action and making (**Figure 1**).

Conducted DSR projects covered both technical actions but as well generating a broader knowledge base about the phenomenon of digital transformation. In this way, we act in response to the requirements of DSR projects to advance existing knowledge in either a problem or solution domain [4]. Technical action is primarily focused on and determined by conceptualizing our IT artifact based on the purposed subsystems of SDA. Further, we concretize respective solution designs to meet the requirements of the given organizational context and the observable phenomenon of digital transformation [8]. SDA as a framework conceptualizes five distinguished subsystems. SDA solution design was developed and evolved incrementally and iteratively following an engineering (technical action) approach [7]. In addition, we have considered the requirements of Action Design Research (ADR) [6], service systems engineering [9],

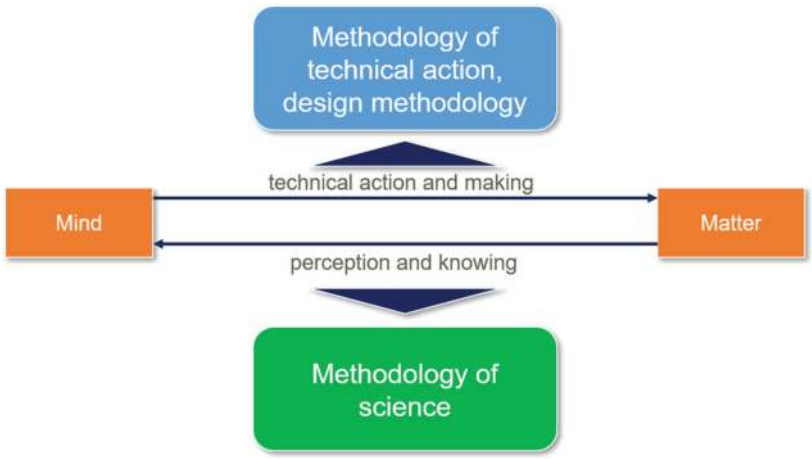

Figure 1.
Research approach and contribution: technical action [7].

and systems development [10, 11]. In order to develop the required understanding and generate knowledge about the state of the problem, we assessed current solutions and their efficacy in a selected organizational context [4].

Applying a longitudinal case study approach [12] allowed us to investigate the problem at hand, as well as to strive for a deeper and more comprehensive understanding of the given organizational context and its properties. This supports our ambition to generalize generated knowledge beyond the targeted application domain, namely the insurance business. We have been able to achieve the long-term commitment of participating organizations. Our case company is an insurance company with round about 12 thousand employees located in Germany.

In subsequent sections, we further concretize and determine the IT artifact's purpose, desired functionality, and its architecture as a base for technical action. Besides producing the novel artifact and instantiating respective processes and tasks, our DSR project aims to make in addition more general contributions to expand the knowledge base. This is achieved through elaborating on a midrange design theory about the phenomena of digital transformation [4].

As shown in **Figure 1** this relates to our evaluation activities which require a framework allowing to derive conclusions about created evidence. Our objective is to make a research contribution through the demonstration of the novel IT artifact. The IT artifact embodies design ideas and principles and theories which we aim to articulate on basis of our SDA framework. Our ambition is to reflect and generate design principles on basis of decisions made realizing the design proposal [4, 7]. Implemented use cases support evaluation activities comparing hypothetical predictions and facts with requirements [7].

We complement the DSR with an embedded single case study [12]. By analyzing different use cases within the longitudinal single case study of SDA and using more than one perspective, we broaden our scope aiming at a better understanding of the relevance of the solution design and long-term evaluation of the IT artifact created. Our research approach thus addresses the following pivotal research questions [13]:

1. How can digital strategies draw from a S-D Logic perspective and related principles to derive and build new capabilities to build unique value propositions based on service innovations?

2. What are respective capabilities to be derived to support business initiatives and strategic agility to design and operate co-creative business models incorporating digital technologies?

3. Digital transformation and insurance business

This section oversees digital transformation and describes the state of the problem. We start with a general description of the phenomenon of digital transformation. In a further step, we look then specifically into digital transformation in the context of the insurance business. We elucidate observable challenges and related problems. On this basis, we explain how we elaborated our solution design and derived relevant objectives for technical action (construction) and evaluation activities. An important step of the DSR process is to communicate the problem and its importance. This will be in the focus of subsequent sections before we describe our practical solution as a result of our DSR project [5].

3.1 Digital transformation: strategy, technology, value creation

Digital transformation can be defined as "[...] a process that aims to improve an entity by triggering significant changes to its properties through combinations of information, computing, communication, and connectivity technologies" [8, 14]. Hence, digital transformation needs to be understood rather as a process than as a state (**Figure 2**) [8].

Digitalization and digital transformation are the "[...] main driver of innovation and change in all sectors of our economy" and are taking place at a rapid pace [14–18]. The effect of digital transformation is discussed to be a revolution that unleashes and develops disruptive powers to change existing structures and systems [8, 15, 19]. Today, we face dramatic change in the business world through rapid digitization and new innovative business models breaking down industry barriers [19, 20]. Digital

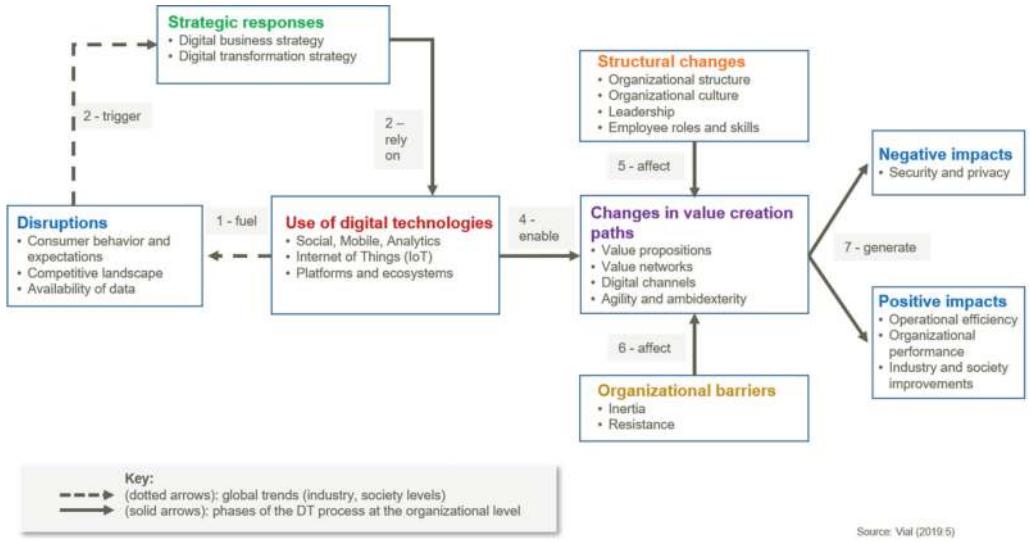

Figure 2.
Building blocks of the digital transformation process (own illustration based on [8]).

technologies are creating new opportunities but require a clear digital strategy [15, 21–23]. Based on a clear digital strategy, decisions concerning required IT investments and new infrastructure capabilities are achievable [1, 18].

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 logic and value constellations [16, 17]. Digital disruption is a process, which creates dramatic change for industries or business branches based on the following attributes [19]: (1) rapidly digitizing, (2) breaking down industry barriers, (3) creating new opportunities, and (4) while destroying long-successful business models [1, 8].

In the remainder, we follow the proposed structure and elucidate related challenges in three particular areas shown in **Figure 2**, namely (1) strategy responses through digital strategy, (2) investment and use of digital technologies aligned with business strategy, and (3) changes in value creation activities and paths due to new business logics and changing markets.

3.2 Digital strategies and strategic responses

Digital responses to digital disruption encompass developing a digital business strategy and designing a digital transformation strategy [8]. Digital strategy is a business strategy inspired by the newly created IT infrastructure capabilities enabled by digital technologies (such as SMACIT: Social, Mobile, Analytics, Cloud, Internet of Things). The aim is to deliver unique, integrated business capabilities supporting strategic agility [23]. Hence, they have to be responsive to constantly change market conditions [23]. Thereby, companies seek ways to combine and augment existing capabilities with capabilities enabled by new digital technologies to create new value propositions [23].

Digital technologies remove long-established constraints of value creation activities, namely allowing new unprecedented reconfigurations of resources by applying new business logic such as platform-led strategies [24, 25]. Companies have to find appropriate strategic responses to resulting impacts and have to anticipate proactively future developments to be able to build required new digital capabilities.

Ross et al. [23] see in general two major directions to develop digital strategies, namely (1) customer engagement and (2) digitized solutions. Both directions allow to respond to described challenges [22, 23]. Digital business design relates to decisions oriented toward the support and realization of relevant business initiatives [15, 21]. Based on a vision of how the company will operate, business and IT have to agree and decide on key architectural requirements of the foundation for execution. Foundation for execution can be seen as a synonym for the Enterprise Architecture (EA). Each business initiative needs to highlight how it benefits from or contributes to the foundation for execution. Business initiatives can be either supplier-, customer- or internally oriented [26].

3.3 Digital technologies and new capabilities

Digital technologies constitute a central change driver fueling changes in value creation paths such as value propositions, value constellations or networks, digital channels, agility, and ambidexterity [8]. Digital technologies are linked in general to three types of disruptions: (1) change in customer behavior, preferences, and

expectations, (2) new competitive landscape (new value constellations and removed barriers for competitors), and (3) availability of data [8].

Mastering the challenges of digital transformation, companies need to reflect and rethink their strategic positioning and by this their information systems and information technology strategy [23]. Enterprise architecture reflects the awareness that the design of information systems needs to be seen in a broader business and enterprise context. Business and IT need to be co-designed, and well-aligned to create foundations for execution [18, 27]. However, building foundations for execution requires companies to look at organizational design dimensions, which are often overlooked and not adequately considered in architectures that are aligned to the business strategy and the solution design [28]. Thus, digital technologies from our perspective open up new opportunity spaces for companies to interact in new ways with their customers and reach for new customer segments. However, this requires unprecedented levels of customer intimacy and a higher frequency of customer interactions. Digital technologies offer new strategic perspectives for companies to compete through service innovations substantiated in a shift from products to solutions to value-in-use. This translates into new practices of learning [4, p. 86] to arrive at more personalized, customized solutions and offerings, offering new strategic opportunities to operate as platform owner or "smart service provider".

Senior management has to make important decisions concerning infrastructure investments to introduce new strategic and operative capabilities for the company required to sustain in the digital age. Companies need to incorporate digital technologies to build new IT and business capabilities [18, 26] to achieve the required strategic agility and to create unique value propositions [15, 22].

Mastering digital transformation requires a clear understanding of the relationship as well as interdependencies between IT (infrastructure) capabilities of the enterprise and its "ability to implement its business initiatives" [26]. This relationship is addressed by an emerging discipline named EA Management (EAM) [21, 27, 29]. EA as discipline deals with "[...] controlling the complexity of the enterprise and its processes and systems" [29]. Hence, enterprise architecture defines principles, methods, and models resulting from the design of what constitutes the foundation for execution [21]. Weill et al. define strategic agility as "[...] set of business initiatives an enterprise can readily implement" [26]. Enterprise capability encompasses coordinating a respective set of elements such as customer base, brand, core competence, infrastructure, and employees, into an "integrated group of resources" [26].

Companies have to strive for strategic agility through building required IT infrastructure capabilities [18, 26]. However, what are the required IT infrastructure capabilities? Moore [30] motivates a new generation of enterprise IT systems based on interactive IT infrastructure capabilities which he summarizes as "systems of engagement" [13, 30, 31]. In essence, digital transformation requires a dramatic change in enterprise information systems (EIS).

3.4 Changes in value creation logics

Digital transformation is increasingly associated with a service imperative. However, this necessitates to establish respective mindsets and perspectives (**Figure 1**). Related developments are discussed increasingly as "digital servitization" [32–34] by augmenting existing offerings and value propositions with (digital) service elements. In the remainder, we argue a service perspective to overcome the challenges of digital transformation.

In this context, service innovations can be seen as an opportune strategy for companies to compete in the digital age [35]. Companies need to change their prevailing product-dominant mindset to a service-dominant one to develop digital strategies [15, 18, 22, 23]. New technologies introduce new capabilities, such as resource integration, that catalyze service innovations [18, 31]. Executing digital strategies is a major challenge for many companies as they rely on outdated, monolithic EIS. As a result, siloes prevent companies to mobilize and integrate valuable internal and external resources [36].

No doubt, the 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")) [1]. Consequently, insurers have to develop new visions of how to develop new value-adding offerings. This requires deeper customer insights and redesigning operations from the customer perspective. Incumbent insurers lack the required capabilities along with facing significant inertia and as a consequence are thus slow and not agile as their emerging competitors. Thereupon, incumbent insurers have launched new organizational entities freed from slowing and impeding restrictions such as compliance, regulations, and cultural barriers. Those new digital entities move faster, more agile, and adapt easier also more flexible to emerging changes such as customer preferences, behaviors, or new market segments (for example, car sharing, electric bikes, etc.) [37]. In consequence, incumbents have to find the right strategic responses to compete against digital attackers with more appealing, customer-centric, cheaper, more innovative products and services. To adapt and survive such digital Darwinism, insurers have to rediscover and renew their capabilities such as digitizing operations, imagining new customer journey, delighting their customers with excellent service, and reimagine their core systems and structures.

3.4.1 Service-dominant logic

As previously argued, digital technologies offer new opportunities for companies to innovate and to leverage their productivity. Taking a service lens on innovation and related processes is preferable, as it spurs new creative thinking through new mental models and creative business thinking by drawing from new perspectives on value creation activities.

Service-Dominant (S-D) logic [38–40] grounds on a resource-based perspective. It differs from broadly established goods-dominant (G-D) logic thinking through prioritizing "operant resources" (competence, skills, and knowledge) against "operand" resources (physical assets, goods) to achieve competitive advantage. Accordingly, S-D logic puts emphasis on cocreation, actor-to-actor networks, and interactive processes of learning. Service is defined as the application of resources (in particular knowledge, skills, and competencies) to make changes that have value for another [38–42].

Table 1 shows the S-D logic axioms and foundational premises (FP) which formalize related value creation logics and principles [38–41, 43, 44]. The value co-creation takes place in service systems. Service systems are defined as dynamic value-cocreation configuration of resources, including people, organizations, shared information (language, laws, measures, methods), and technology, all connected internally and externally to other service systems by value propositions [9, 45, 46]. Accordingly, a service system is an open system (1) capable of improving the state of another system through sharing or applying its resources, and (2) capable of improving its own state by acquiring external resources [47]. Overall, service systems [45–47] foster a systems

Axiom	Description	Capability
A1/FP1	Service is the fundamental basis of exchange	Service-for-service exchange
FP2	Indirect exchange masks the fundamental basis of exchange	
FP3	Goods are a distribution mechanism for service provision	Operand resources
FP4	Operant resources are the fundamental source of competitive advantage	Operant resources
FP5	All economies are service economies	Service provision Service economies
A2/FP6	Value is co-created by multiple actors, always including the beneficiary	Value cocreation
FP7	The enterprise can only make value propositions	Interaction
FP8	A service-centered view is customer-oriented and relational	Relationship Learning Customer orientation Value propositions
A3/FP9	All social and economic actors are resource integrators	Resource integration Resource orchestration
A4/FP10	Value is always uniquely and phenomenologically determined by the beneficiary	Value-in-use Value-in-context Service experience
A5/FP11	Value co-creation is coordinated through actor-generated institutions and institutional arrangements	Coordination Value cocreation Service Ecosystem Collaboration Actor-to-actor network Institution, institutional arrangements

Table 1.
Service-dominant logic: axioms and foundational premises (FP) [38–41].

perspective for studying and understanding service ecosystems and their influence on service-for-service exchange and emerging digital markets. S-D logic provides guidance through its systemic perspective on value creation activities, through service-exchanging entities and underlying logic. 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 [35].

As proposed by Lusch and Nambisan [35], service innovation can be conceptualized through a tripartite framework consisting of three major concepts, namely service ecosystem, service platform, and value co-creation. S-D logic showed high relevance for the later development of our framework and respective design patterns. S-D logic serves as the theoretical foundation of Service Science.

Of particular relevance is the concept service platform. Platform concepts create systems or environments to engage with other actors and resources in mutual value creation activities (systems of engagement) [18, 31]. In this context, to identify and know about resources external to the firm and the services they are able to render are of vital importance and constitutes a major incentive to search for new external knowledge.

3.4.2 Building systems of engagement

As previously motivated digital strategies are based on customer engagement and digitalized solutions. Understanding customer engagement or more general

actor engagement is a pivotal capability to master successfully digital transformation. Systems of Engagement (SoE) relate to service platforms and digital platforms, respectively. Hereinafter, we summarize briefly relevant contents and refer to previous publications for further details and studies [1, 18, 31, 48–51]. SoE is seen as the next stage of enterprise IT which bring companies new communication and collaboration capabilities to engage with their customers and suppliers, and vice versa, with a focus on communication to enable collaborative business in real-time with all the benefits of mobility and speed [18, 30, 48, 50]. In summary, SoE brings companies new communication and collaboration capabilities. SoE brings S-D logic to the fore as this type of systems will foster interactions and relationships with communities and in more general resources that are outside the enterprise. Actor engagement [31, 48, 50–52] can be conceptualized as microfoundation for value cocreation within service ecosystems [9, 53]. Engagement platforms are an interesting field of research as the concept is not yet clearly defined. Engagement platforms are defined as multisided intermediaries that actors leverage to engage with other actors to integrate resources. Engagement platforms can be both intermediary or mediator. Hence, resource integration [54] turns into a core business capability to run what Moore [30] phrases as social business systems [48]. **Table 1** shows a list of elicited capabilities that need to be addressed by systems of engagement.

4. Digital transformation and insurance business

Trends such as connected cars, automated driving, smart home, connected healthcare are just a few examples representing change and new requirements for the insurance business. Incumbent companies possess customer insights and can rely on strong relational ties to their customers and business partners. However, this advantage is lost increasingly to new players entering their markets and targeting for their profitable customer segments. Those companies are named "digital attackers" [55]. Digital technologies are lowering the barriers for digital attackers to enter those markets to exploit new opportunities by using their digital capabilities and related key competencies as an advantage. Digital attackers are faster, more focused on customers, and responsive to their particular needs. Insurers risk to lose prosperous customer segments—foremost the younger generation—to new emerging competitors such as insurtechs [49, 50].

4.1 Building foundations for execution

Digital strategy outlines and details besides the business aspects the respective steps forward and targeted investments in IT infrastructure capabilities [18, 21, 26]. Ross et al. identify five building blocks for a digital transformation: (1) operational backbone, (2) digital platform, (3) external developer platform, (4) shared customer insights, (5) accountability framework [15]. "The advantage of approaching digital business design as a set of building blocks is that it allows leaders to focus on specific manageable organizational changes while implementing holistic design" [15]. Bonnet and Westerman propose and describe new elements as the foundation of new digital capabilities [14]. The new elements are grouped into five areas: (1) business model-related capabilities, (2) customer experience, (3) operations, (4) employee experience, and (5) digital platform.

Building a digital platform is fundamental for mastering the challenges of digital transformation [14, 56]. Digital platform contains three components: (1) core

platform (operational and transactional systems), (2) externally facing platform, and (3) data platform [14]. The core platform is the company's technology backbone [14]. Detailed requirements of platform-related capabilities are discussed and analyzed in Weiß et al. [18] and are here not further detailed [18, 56, 57]. Secondly, the externally facing platform realizes customer-facing experiments and enables personalized experiences [14]. Finally, the third component, data platform, offers enhanced data analytics capabilities, build and test algorithms, and enables processing of huge amounts of unstructured data [14].

4.2 Service dominant architecture

In this section, we summarize and refer to previous research results and updates documenting the evolution of the IT artifact [13, 18, 31, 36, 58].

SDA was derived from the knowledge base of the domain theories Service Science, S-D Logic, and Institutional Economics with the aim of putting the findings, logic, and processes into practice by enabling actors in the process of value co-creation. Used in practice SDA enables entities to purposeful build up capabilities and to engage in the process of service exchange and value co-creation [55, 58, 59]. SDA can be viewed from a conceptual and an applied perspective:

(1) firstly, SDA a design pattern or virtual order in the understanding of a structure of five systems [58]. (2) secondly, SDA a tangible structure instantiated by at least one entity [60].

The instantiated structure consists of five systems including the recently added SDA service catalog as the fifth system focusing on shared institutional arrangements. SDA applied within an actor-to-actor network facilitates the process and coordination of service exchange and mutual value creation [38, 58]. SDA as architecture operationalizes the core elements of S-D logic by focusing on co-creation and resource integration. The aim of this development is to facilitate the before-motivated SoE [30] by introducing an additional architectural layer. SDA proposes to operationalize requirements and characteristics for the planning, designing, and building of customer-centric solutions, which are characterized by value in use.

4.2.1 SDA conceptual framework

In order to meet these requirements, the SDA conceptual framework defines the design patterns of four purposed subsystems and a Data Lake (**Figure 3**). In the following, respective design patterns are introduced.

1. *System of operant resources:* The system of operant resources is the heart of the SDA framework. It represents the workbench, where the various ingredients (resources) are brought together and processed. For this, this system applies certain logic or processes. An important target of this system is to achieve the required resource density. Solutions are dependent on the achievable level of resource density as a high level of resource density impacts positively the emergence and creation of innovative and valuable solutions [58].

2. *System of interaction:* The system of interaction, enables a bidirectional data flow between the provider and the customer. The aim is to achieve consistent customer-centricity across all customer channels in parallel, also known as omnichannel

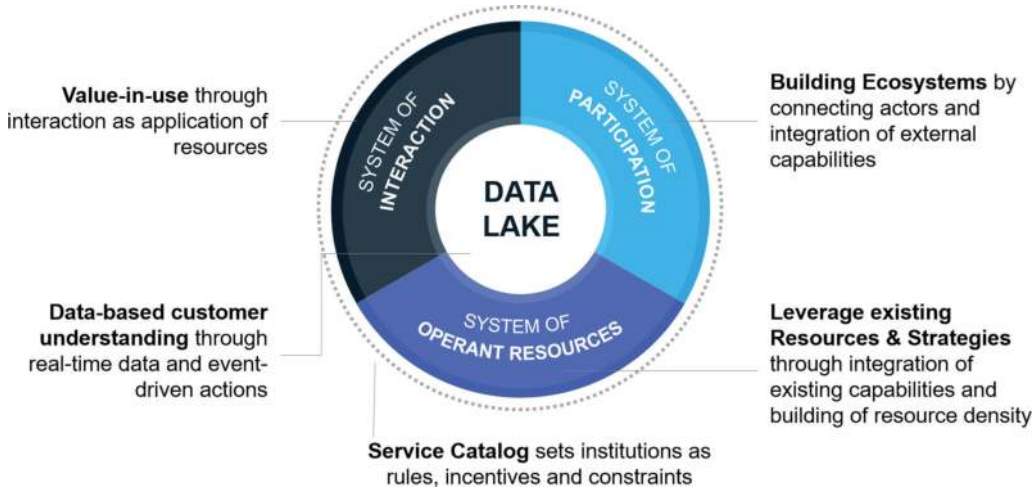

Figure 3.
Design pattern as architectural framework of service dominant architecture (SDA) (source: IfSD.Hamburg).

integration. In such an omnichannel integration layer is created, prerequisite for an interactive, uniform customer experience across all communication channels relevant to the customer.

3. *System of participation:* Ideally, the already presented concept of co-creation includes other co-producers in addition to the respective customer or more general actor. The system of participation enables actor-to-actor orientation and resource integration of third parties, i.e. other external resources.

4. *Data lake:* From a company's point of view, data received and generated by interacting with customers or in the value creation process should be systematically recorded and evaluated in real-time [58].

5. *System of institutional arrangements (service catalog):* As rules in use, institutions enable the coordination of actors as well as access to and use of resources. In conjunction with SDA design pattern, institutions enable the coordinated creation of solution designs by connecting actors and enabling the integration and application of resources [58].

4.2.2 SDA objectives and capabilities

In essence, SDA is the technical implementation of S-D logic (**Table 1**) and one of the most important elements for strategy execution to create valuable service experiences, called value in use. By combining a set of purposed subsystems, SDA provides a technical environment that combines external resources from customers and partners, for example, user data or market data, with internal resources, for example, customer relationship management data, or services.

Therefore, SDA links business architecture and IT architecture and achieves a shared understanding of EA and strategic priorities. Objectives of SDA design are reflecting business needs on technical side, including customer and service focus, collaboration, complexity containment, and agility [58].

5. Use case design, implementation and evaluation

The use cases of the first generation have been rather simple, but are essential to initiate learning processes and building required capabilities. **Table 2** displays the next generation of more demanding and advanced use cases. Each use case implements a set of respective capabilities operationalized by SDA. Selected use cases stem from the insurance business, namely an insurance company, which will be our application domain for experimenting and evaluating our developed IT artifact and solution design.

No.	Use case/service	Description	SDA capabilities/ S-D logic principles
1	Edith care	• Personal care assistant • Support for administrative activities • Application process: five minutes instead of six days	• Value cocreation • Resource integration • Resource density • Resource orchestration • Institutional arrangement/ rules in use
2	Claim notification	• Support services for managing claim requests and processes (focus on scalability requirements in case of natural catastrophe) • Integration of external services (e.g., Service/call centers, and AI-based services and partner (fraud management)	• Service ecosystem • Resource integration • Co-creation • Resource density
3	Stroke prevention (ai4medicine)	• Customer receives individual risk scoring and personalized recommendations and an action list • Personal health advisor app	• Value cocreation • Institutional arrangement/ rules in use • Resource integration • Resource density • Resource orchestration
4	Medicproof	• Assistance and information services for customers to manage medicamental treatments and drugs	• Co-creation • Resource integration • Service ecosystem
5	Cross carrier pension information	• Collected and aggregated data about customer status and forecast of pension request • Consolidation of data from various pension fonds based on historical data (career steps/status)	• Resource integration • Service ecosystem • Institutional arrangement/ rules in use • Value cocreation
6	Universally submission service	• Uploading and handing electronically documents and material by means of customer app • Supported by AI and chatbots.	• Value cocreation • Resource integration • Institutional arrangement/ rules in use

Table 2.
Evaluation: overview use cases (partly based on [13, 18, 58, 61].

5.1 Development and implementation

Before technical action is taken and concrete solutions are developed, DSR process foresees to determine desired functionality and architecture of actual solutions. S-D logic forms our core theory and allows us to derive objectives to design and develop the IT artifact [5]. Presented IT artifact aims to solve identified problems in the given organizational context. S-D Logic is used to identify new capabilities that are later operationalized through the IT artifact [4]. As previously stated, digital transformation necessitates to build new IT infrastructure capabilities to seize opportunities by launching business initiatives and to implement the company's digital business strategy [21, 26]. In this context, as already argued before business-IT alignment [62] plays a pivotal role to implement the foundation for execution. Nunamaker et al. [10] argue that systems development is one of the valid research methodologies and provides "proof-by-demonstration" [10]. Against this background, three stages of "last mile research" are eminent: (1) proof-of-concept, (2) proof-of-value, and (3) proof-of-use [11]. Researchers have to decide on the right balance of scientific rigor (formulation of design theories) and practical relevance (useful artifacts) [4, 11]. Nunamaker et al. [10] propose a multimethodological approach to IS research. Furthermore, we respond to corresponding research challenges as motivated by Böhmann et al. [9], foremost exploration of new and unknown service systems as well as call for "participatory design" and innovative "prototyping approaches".

5.2 Use case development

Table 2 overlooks selected use cases showing relevance as elaborated jointly with the case company. Shown use cases are used to evaluate produced IT artifacts in the given organizational context. Our aim is to strive for proof as motivated in the paragraph before. Continuous practitioner feedback and interaction with related organizational context is vital to adjust and find the right configuration of resources and people for aspired service systems.

Evaluation is considered a crucial task and will be conducted continuously. The evaluation depends on implementing exemplified use cases and derivable requirements by means of IT solutions based on SDA experimental prototypes. In this way, we will be able to launch appropriate experiments to strive for the required "proof of concept". Furthermore, our goal is to receive further feedback and data for next development iterations. Currently, SDA is evaluating various solution designs, various technologies, and SDA prototypes incrementally. At this stage of development, activities focus primarily on implementing SDA stable core. Purposed subsystems as described will be continuously expanded and further concretized through adding additional features and functionality. Various architectural paradigms have been tested and validated. As result, we foresee to launch further real-life experiments evaluating SDA in the context of available use cases, which stem from the digital transformation endeavors of our case company.

5.3 Example: use case stroke prevention

The following example is based on [58, 61]. SDA is reflected as a construction plan for microservices in respective technical stacks (as bundles of microservices). As motivated, SDA serves as medium, structure, and output for actor engagement.

SDA is implementable on various technology platforms. SDA instantiates processes of value co-creation in the given organizational context.

5.3.1 Implementing use cases: experimental designs

SDA provides ground for real-life experiments. SDA and related subsystems were implemented as experimental designs and prototypes (technical action). In this way, we aim to evaluate on basis of data and processes obtained from respective use cases. SDA informs about both required investments and how to build required new IT infrastructure capabilities. From a management perspective, SDA serves as a communication tool clarifying strategic directions. In addition, solution design has to meet required levels of agility enabling response to environmental changes. The central aim is to build a foundation for execution comprising an operational model, enterprise architecture/IS architecture, and related IT artifacts. Furthermore, this encompasses decisions concerning targeted investments to achieve required IT infrastructure capabilities. SDA provides guidance for the construction and planning of microservices in technical stacks (bundles of microservices). Current market competition enforces faster and more convenient development of solutions, strictly oriented toward customer requirements and embracing collaboration of business and IT within organizations [63]. Microservices and related technical concepts are not further detailed, we refer to previous publications and scientific literature [18, 63–65]. Microservices as a technical concept are associated with new development paradigms such as DevOps and agile development practices (such as SCRUM). Those new emerging paradigms allow us to build real-life solutions with a strong relation between business and information systems. This realizes required Business IT alignment and builds applications around business capabilities and use cases [63]. We provided a more detailed overview of the underlying conceptual base in Weiß et al. [18].

5.3.2 Institutional design and implementation: service catalog

Service Catalog is a new added system and element of SDA. Zolnowski and Frey [61] analyze requirements and develop relevant use cases such as ai4medicine comprising personal health advice service for stroke prevention in Germany (**Figure 4**).

The business model of ai4medicine is based on using an app to comprehensively assist customers in reducing potential stroke risk. Based on risk assessment, customers receive appropriate recommendations for behavioral changes contributing to reducing the risk of stroke. Solution develops recommendations based on customers' shared data aiming at adequate changes in customer behavior to prevent stroke. Service ai4medicine combines clinical and epidemiological data on stroke and generates domain knowledge to develop and train artificial intelligence models. Designed AI models and algorithms enable innovative, personalized value propositions and facilitate evidence-based, AI-powered stroke prevention guiding principles and strategies. Once customers have installed the respective mobile app on their devices, they can register and start using ai4 medicine application functionality. In addition, this application supports continuous consolidation of customers' historical health data accessible from partners' platforms (for example liaised insurance companies) and improves in this way continuously data quality and hence individual stroke prevention. Partner companies can seamlessly integrate ai4medicine into the application landscape, for example by offering additional functionality on run mobile apps.

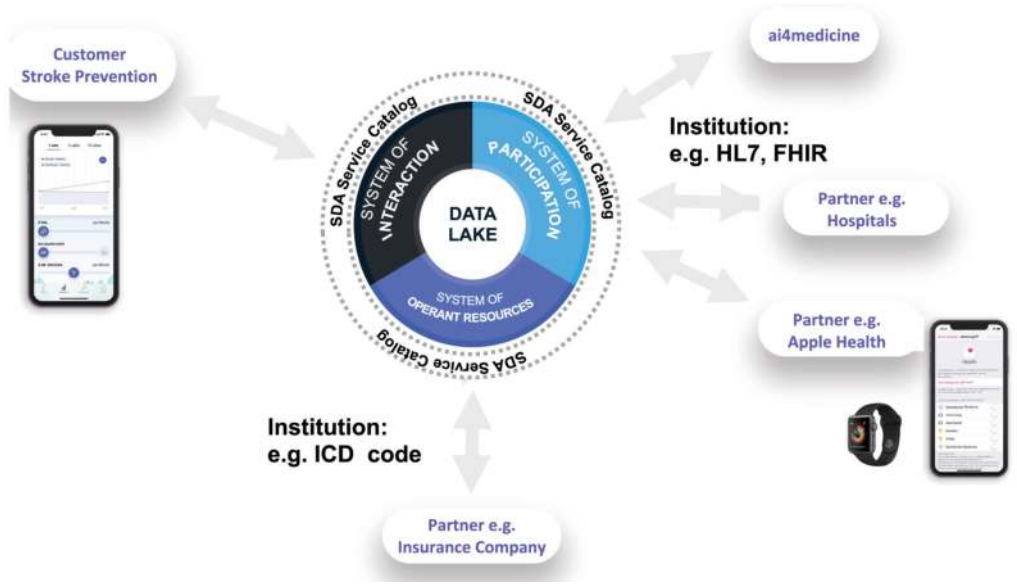

Figure 4.
Evaluation SDA: use case stroke prevention [58].

Furthermore, additional health data is supported to augment respective personal health data set, for example, data accessible from connected smart devices such as wearables, given appropriate interfaces and data interoperability. This reduces significantly additional efforts and pains related to manually entering data and keeping data updated [61].

6. Discussion

Design and execution of digital strategies [15, 21–23] are of utmost importance. New capabilities need to be built around emerging digital technologies and trends such as hybrid cloud, intelligent process automation, and artificial intelligence, in particular machine learning. Hence, building a robust digital platform turns into a core competence to be able to compete against digital attackers [37]. In response, companies alter their existing business models by incorporating digital technologies to arrive at new value propositions and new resource configurations [24, 32]. S-D logic [38–41, 66] offers valuable concepts and guidance on how to overcome the challenges of digital transformation. Executing and implementing digital strategies makes many incumbent companies struggle [23]. In the past, striving for higher efficiency and optimization for the foundation for execution has created a significant strategic advantage for incumbent companies against their competitors. In this way, those companies created an operational backbone based on a "[…] set of standardized, integrated systems, processes and data support a company's core operations" [15]. This constituted the main source of strategic advantage because smaller businesses or startups have not been able to rely on comparable resources and system performance, computing power as well as related IT infrastructure capabilities. However, nowadays, these historically grown and highly optimized systems are causing observable complexity in enterprise systems and are a reason for inertia to transform and react to rapidly changing market requirements and customer demands [15, 21, 67]. Investments in IT infrastructure capabilities should be driven by initiatives

and business value. Strategic agility expresses the ability of a company to readily implement respective business initiatives. The more time and effort required to implement them indicates the existence of inconsistencies and reveals inappropriate alignment between business demand and previous investments in IT infrastructure capabilities. Hence, company's need to decide on the required capabilities to get future-ready [19, 20, 26] by investing in their foundation for execution [21]. Identified initiatives and measures are aggregated into a strategic roadmap. Initiatives are orchestrated through a high-level architectural vision shared and agreed upon by business and IT. In absence of an architectural vision explicated as EA, the company runs at risk to make isolated and siloed investments in its IT infrastructure, systems, and applications leading to "technical debt" [15, 68]. Technical debt is caused by previous pragmatic solutions or uncoordinated investments in IT infrastructure capabilities (often visible as "shadow IT"). Often new business initiatives had created demands which were solved through individual "rewiring" of system connections and creating uncoordinated on-demand interfaces to integrate systems. Consequently, the company's strategy development needs to clarify new capabilities required to compete in future digital markets, to exploit new opportunities and to nurture new customer segments.

7. Summary and conclusion

Digital transformation brings new requirements and challenges for companies to respond to market opportunities and take advantage of new digital technologies. We argued that the majority of companies aiming to address digital transformation, face challenges in developing appropriate digital strategies and struggle to shift from traditional goods-based to service-based focus [31].

Applying a DSR approach, SDA contains prescriptions for design and action in the form of a new design artifact, and in this way intends to formalize and generalize knowledge for the targeted problem and solution domain. Consequently, conducted research started with the developing of a novel artifact (namely SDA) in the given organizational context. We operationalized Service-Dominant Logic (S-D Logic) serving as descriptive or kernel theory that informs artifact construction [3]. Whereas S-D Logic is rather to be seen as a grand theory, SDA can serve as middle-range theory to overcome the perceived gap or disconnect between theory and practice [6]. However, this requires to fulfill respective requirements [3].

Following a DSR approach presented research aims to make clear contributions to real-world application environments [3]. Focus is set on technical action in the sense of an inside-out approach to stimulate and implement change [7]. In addition, we generate knowledge (outside-in) by studying the state of problem and current solutions and their efficacy. Our central aim was to create the artifactual solution in order to use it to solve identified problems not hitherto addressed [5]. Accordingly, we determined the artifacts desired functionality and its architecture. We created the actual artifact by applying S-D Logic and conceptualized offered concepts to move from objectives to solution design. Finally, we demonstrate and use the created IT artifact in a given organizational context [5]. DSR and ADR define concrete requirements and offer methodology for how this can be achieved. One particular effort can be seen in generalizing achieved outcomes and produced results. Our research objective is hence to further strengthen the theoretical foundations of SDA to transport design knowledge and guide digital strategy development as well investment decisions [3]. The IT artifact is a subject of continuous improvement and is being evolved

primarily in its organizational context. In this way, we stimulate learning processes, create new knowledge and gain new insights studying the phenomenon of digital transformation.

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