Science, Logic and Architecture Perspectives on Organizational Learning: observations based on the onpier Mobility Platform

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Abstract

This paper demonstrates that the understanding of organizational learning is moving towards a service perspective in which learning unfolds over time and is embedded in broader and dynamic service systems (March 1991, Lusch, Vargo et al. 2010, Spohrer, Fodell et al. 2012). In this process responsible (service system) entities are interacting, understanding, exploring, experiencing in order to change and adapt behaviour to meet the challenges of their specific "survival business". For organizations in their process of transformation to higher capabilities and more competetively value propositions "survival - or adaptive learning" is important but must be joined by "generative learning," learning that enhances the capacities and structures to create (March 1991, Senge 1997, Hagel, Brown et al. 2010, McGowan and Shipley 2020). To contribute to this theory building, the paper draws on three perspectives on service: Service-Dominant Logic, Service Science and Service Dominant Architecture. The purpose of this conceptual paper is to derive implications for better cultural and structural models of organizations to improve interactions and change (Jaakkola 2020, Spohrer, Maglio et al. 2022).

Keywords: Learning, Adaptive Learning, Generative Learning, Organizational Learning, Service-Dominant Logic, Service Science, Service Dominant Architecture

1 Purpose

The definitions of the phenomenon of learning vary widely both within and across disciplines. Learning has proved so tricky to define that Liebermann (1993) names learning "a term devised to embarrass learning psychologists, who tie themselves in knots trying to define it" (Lieberman 1993, Goodenough, McGuire et al. 2009). However, as the following examples from different disciplines indicate, it is also noticeable that some characteristics of learning are mentioned again and again across many disciplines.

In biology Liebermann (1993) and Goodenough et al. (2009) define learning as "a change in our capacity for behavior due to particular kinds of experience" (Lieberman 1993, Goodenough, McGuire et al. 2009). The value of social learning is seen in the time and energy it saves compared to "the business of survival by trial and error" (Goodenough, McGuire et al. 2009).

In psychological usage Thorndike (1931) noted that "in learning resides humanity´s power to change, possibly the most important of all human gifts" (Thorndike 1931, Howe 1980). Howe (Howe 1980, Gross 2010) takes this up and emphasizes the relationship between change and learning. An organism that can change its characteristics and alter its activities has a huge advantage over forms of matter that cannot, the latter being tightly bound to the physical environment surrounding them: "The power to change frees an organism from being fixed in place and function"(Howe 1980).

Hall (2003) refers learning "to the process by which an animal (human or non-human) interacts with its environment and becomes changed by this experience so that its subsequent behavior is modified" (Hall 2003). De Houwer et al. (2013) understand "learning as ontogenetic adaption – that is as changes in the behavior of an organism that result from regularities in the environment of the organism" (De Houwer, Barnes-Holmes et al. 2013). Similar Anderson and Coon emphasize the nature of learning as continuous process; learning is seen as "the process by which relatively permanent changes occur in behavioral potential as result of experience" (Anderson 1995, Gross 2010).

In social sciences Giddens (1984) considers learning as a contribution to the constitution of the society "as social actors, all human beings are highly 'learned' in respect of knowledge which they possess, and apply, in the production and reproduction of day-to-day social encounters" (Giddens 1984). Sawyer (2005) also emphasizes the inseparability of the individual and the society within the context of learning: "rather than internalizing knowledge, the learner should be conceived of as appropriating or mastering patterns of participation in group activities. Learning involves a transformation of the social practices of the entire group and thus cannot be reduced to an analysis of what any one participant in the group does or knows" (Sawyer and Sawyer 2005).

In economics McGowan emphasizes learning in the context of change as "navigating a world of rapid learning, unlearning, and adaptation requires that we become comfortable with ambiguity and vulnerability, allowing us to become champions of human potential in learning tours filled with unknowns" (McGowan and Shipley 2020). Senge emphasizes the competitive relevancy of learning as "the ability to learn faster than your competitors may be the only sustainable competitive advantage" (Senge 1997).

Across all disciplines the recurring aspect of learning is the acquisition of knowledge, skills, capabilities, values, preferences and behaviors or their adaption as a result of experience. Within the context of learning all responsible entities (humans and non humans) have to be seen as inseperable from their environment; as interacting, understanding, exploring (trial and error), experiencing for changing and adapting new behavior to overcome the challenges of their specific "business of survival".

In this paper we focus on organizations as responsible entities that have to overcome their challenges and how they can approach their individual learning strategies. In the context of organizations March (March 1991) explains organizational learning and up-skilling as fundamental investment decision between exploitation of existing resources and exploration of new possibilities.

Exploration includes things like search, copying others, variation, risk taking, experimentation, play, flexibility, discovery, innovation; exploitation such things as choice, production, efficiency, implementation, execution, habits and routines. Organizations that engage in exploration are likely to find that they suffer the costs of experimentation without gaining many of its benefits. Conversely, organizations that engage in exploitation are likely to find themselves trapped in suboptimal stable equilibria. As a result, maintaining an appropriate balance between exploration and exploitation is a primary factor (March 1991, Warg, Frosch et al. 2023).

Spohrer and Maglio extended Marchs two options approach and introduced the three options framework Run-Transform-Innovate (RTI) for analyzing and explaining learning strategies in the context of responsible entities such as organizations (Spohrer and Maglio 2010, Spohrer and Maglio 2010). Run-Transform-Innovate is a terminology from IBM's CIO office (Sanford and Taylor 2006, Spohrer 2017), and represents best practice decision making when investing for organizational change (Keen, Sanford et al. 2004). RTI is about: (1) Run - what to invest in doing routine activities, (2) Transform - what to invest in copying best practices (social

learning), and (3) Innovate - what to invest in exploring and creating new knowledge (Spohrer and Maglio 2010, Spohrer 2017, Spohrer 2021).

McGowan (2020) formulated the following challenge for organizations "as we enter the Fourth Industrial Revolution, the hyperfocus on productivity and value extraction shifts to embrace creativity, innovation, and value created by adapting faster and learning more than your competition. This shift from scalable efficiency that ruled the Second and Third Industrial Revolutions to scalable learning that is at the heart of the Fourth Industrial Revolution requires a new leadership style, one that inspires human potential" (McGowan and Shipley 2020, Frosch 2021).

Senge concretizes in this context the basic meaning of a "learning organization" as "an organization that is continually expanding its capacity to create its future. For such an organization, it is not enough merely to survive. "Survival learning" or what is more often termed "adaptive learning" is important - indeed it is necessary. But for a learning organization, "adaptive learning" must be joined by "generative learning," learning that enhances our capacity to create" (Senge 1997). Hagel et al. (Hagel, Brown et al. 2010) examine how the most pressing challenges can be addressed and recognize a turn from "push" to "pull". "Push" describes a method of organizing activities and actions operating on a key assumption that it is possible to forecast or anticipate demand. Whereas "pull" as open, connected and participative approach is described as follows: "As the number of people we can connect with expands, our ability to pull from that network the resources and people we require to address unexpected needs expands along with it" (Hagel, Brown et al. 2010).

Despite the recurring aspects of adaptive and generative learning there is a lack of coherent and holistic models that explain the interplay between the phenomena of adaptive and generative learning.

The purpose of this conceptual paper is to derive implications for better cultural and structural models of organizations to improve win-win interaction and change processes. Thus empowering organizations as responsible entities to develop and approach strategies for adaptive and generative learning to overcome their challenges. That is, become "better future versions of themselves" in the way they sense and respond to social and economic challenges (Spohrer, Maglio et al. 2022).

2 Research Methodology

This research focuses on the key question of how organizations can approach their strategies for adaptive and generative learning. Answering this question requires to invest wisely in better models: "Better models of the world both complex natural and social systems (science), better mental-models in people to improve interactions (logic), better cultural and structural models of organizations to improve change (architecture). The service innovation community studies and builds better models to improve interactions and change in business and society (Spohrer, Maglio et al. 2022).

As means of model and theory building a "conceptual paper" is chosen as methodology to bridge existing theories and concepts, provide new perspectives and broaden the scope of thinking. Within this methodology a "conceptual model" is applied as research design to address the topic of organizational learning (Gilson and Goldberg 2015, Jaakkola 2020) by building a theoretical framework. The theoretical framework is intended to show, describe,

analyze and predict relationships between the key elements of organizational learning (Meredith 1993, MacInnis 2011, Jaakkola 2020).

Learning definitions are used as starting point to introduce the phenomenon of learning from the perspectives of several disciplines. It is shown that there is still no coherent and holistic approach to model and explain the interplay between the phenomena of adaptive and generative learning. Service-Dominant Logic and Service Science have been selected as domain theories to derive, address and explain the key elements of organizational learning and their interplay.

In the next step, hypotheses about the suitability of the concepts of domain theories for explaining the mechanisms of adaptive and generative learning are presented.

The observation/confirmation/rejection of these hypotheses is done in two steps. First, Service Dominant Architecture (SDA) as method theory and meta-level conceptual framework (design pattern of five (service) systems) is introduced; SDA enables to study, explain and observe the substantive elements, mechanism and relationships of the domain theories (Lukka and Vinnari 2005, Jaakkola 2020). Second on the basis of the mobility platform onpier, which operationalizes and technically instantiates the conceptual framework of SDA.
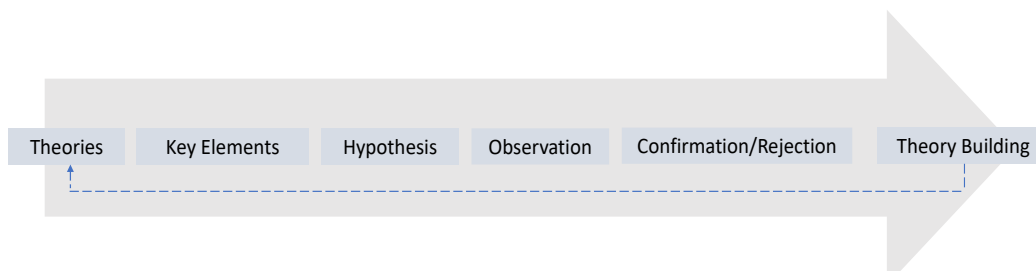
Theories	Key Elements	Hypothesis	Observation	Confirmation/Rejection	Theory Building

Figure 1 Process of deductive theory building

3   Domain Theories: Service Science and Service-Dominant Logic

Why are Service Science and Service-Dominant Logic selected as domain theories for adressing the key elements of organizational learning as the phenomenon to be explained? As Spohrer et al. describe it is because service is so central in this context of organizational learning and so connected to every other important concept. Service is the basis of exchange (e.g., human cooperation, economic exchange). Service is at the core of value cocreation which makes every situation more beneficial and win-win for everyone involved. Service underlies social and economic development, and the wealth of people, businesses, and nations. Simply put, service is the application of resources (e.g., knowledge) for the benefit of another and connects each of us to the world around us (Spohrer, Maglio et al. 2022).

Considering contemporary literature on economic exchange Service Science and Service-Dominant Logic represent a comprehensive aggregation of knowledge on value and value creation based on service exchange and learning via exchange (Vargo and Lusch 2004, Lusch, Vargo et al. 2010, Lusch and Vargo 2014, Vargo and Lusch 2016). Within this, service acts as the unifying element. According to Service Science (Spohrer and Kwan 2009, Kieliszewski, Spohrer et al. 2018) and Service-Dominant Logic (Vargo and Lusch 2004, Lusch and Vargo 2011, Vargo and Lusch 2018), service is always provided in interaction between different actors and results in a unique value.

In the following, the domain theories are introduced in order to elaborate new perspectives on the phenomenon of organizational learning. For this purpose, Service Science is first briefly introduced as a science and the fundamentals of Service Science are outlined. Building on that the core mechanisms of learning from the perspective of the domain theory of Service Science are elaborated. Service-Dominant Logic is then briefly presented as a logic and theoretical foundation. After that the core mechanisms of learning from the perspective of this domain theory are carved out.

3.1   Service Science (Structure)

Science

Referring to Spohrer et al. (Spohrer, Maglio et al. 2022) Science can be viewed as a knowledge creation service and exists within communities of practice working to improve useful models of the world. Service Science builds and organizes new knowledge, capabilities and experience on the subject of service as win-win interactions and outcomes for all actors. It grounds the nature, scientific understanding and management principles needed to understand and improve service and service innovation. The key of Service Science is the application of conceptual, qualitative and quantitative methods to build better models of responsible actors' processes for interaction. As an emerging transdiscipline, Service Science models service and its essential interrelationships and abstracts responsible actors as service systems (service system entities) interconnected by value propositions (Maglio and Spohrer 2008, Spohrer, Vargo et al. 2008, Spohrer, Maglio et al. 2022, p.79,106).

Service Systems

Referring to the interactive character of service that involves at least two entities - one applying competence and another integrating the applied competences - these interacting entities are called service systems. More precisely, service systems are defined as dynamic value co-creation configurations of resources, including people, organizations, shared information (language, laws, methods), and technology, all connected internally and externally to other service systems by value propositions (Spohrer, Vargo et al. 2008). Therefore from Service Science perspective service (eco) systems can be described as a structure of interconnected service system entities.

Spohrer et al. summarize the foundations of service systems as follows (Spohrer, Vargo et al. 2008):

- A system is a configuration of resources, including at least one operant resource, in which the properties and behavior of the configuration is more than the properties and behavior of the individual resources.

- Operant resources can act on other resources (including other operant resources) to create change.

- Service is the application of resources (including competences, skills, and knowledge) to make changes that have value for another (system).

- Value is improvement in a system, as judged by the system or by the system's ability to fit an environment.

- Economic exchange is the voluntary, reciprocal use of resources for mutual value creation by two or more interacting systems.

A service system is defined as an "open system (1) capable of improving the state of another system through sharing or applying its resources (i.e., the other system sees the interaction as having value), and (2) capable of improving its own state by acquiring external resources (i.e., the system itself sees value in its interaction with other systems). In this context, economic exchange depends on voluntary, reciprocal value creation between service systems (each system must willingly interact, and both systems must be improved (Maglio, Srinivasan et al. 2006, Spohrer, Maglio et al. 2007, Spohrer and Maglio 2008, Spohrer, Vargo et al. 2008, Maglio, Vargo et al. 2009, Spohrer and Kwan 2009, Böhmann, Leimeister et al. 2014).

Service Science has emphasized the relational nature of service systems. The definition of service systems recursively includes other service systems; Spohrer, Maglio, Bailey, and Gruhl (Spohrer, Maglio et al. 2007) wrote: More precisely, we define a service system as a value-coproduction configuration of people, technology, other internal and external service systems. This recursive service system definition highlights the fact that service systems have internal structure (intra-entity services) and external structure (inter-entity services) in which actors coproduce value directly or indirectly with other service systems. Individuals, families, firms, nations, and economies all represent instances of service systems (Spohrer, Maglio et al. 2007, Kieliszewski, Spohrer et al. 2018).

Service systems are inherently open and charcterized by their relations with other internal and external service systems. Each connection of a service system with other service systems alters what the service system is. To define itself, a service system makes use of various distinctions with other systems and therefore definition is always relational. Nonetheless, it is important to keep in mind that these self-definitions are not subjective acts; definitions are joint achievements in connection with other service systems (Kieliszewski, Spohrer et al. 2018).

Within a world of diverse interacting service systems organizations as entities adapt to the changing knowledge of value (and value of knowledge) in the ecology. Service systems have run, transform, and innovate mechanisms to adapt and to improve value cocreation interactions (Spohrer and Maglio 2010).

The systemic functioning of networked service systems requires an structuring of interconnections. A structural configuration, in fact, does not imply the emergence of a synergistic interaction capable of cocreating value." (Vargo and Lusch 2018, p.246). Any service system can be observed as a structure of interconnected elements, to understand how it behaves it is necessary to see its systemic functioning. "Each instance of resource integration, service provision, and value creation, changes the nature of the system to some degree and thus the context for the next iteration and determination of value creation" (Vargo and Lusch, 2011: 5). Service systems are dynamic phenomena and their boundaries are defined by the resources that operant resources can bring to bear. (Spohrer, Vargo et al. 2008, Vargo and Lusch 2018, p.249)

The study of service systems inherently incorporates the exploration of networks and the relationships and resources that establish links within and among them (Vargo, Lusch et al. 2010).

Learning

From the perspective of Service Science, the phenomena of adaptive and generative learning

and its interplay is related to both to the individual service system and to the structure of the interconnected service systems as a whole. Out of a service systems perspective adaptive and generative learning can be understood as (1) improving the state of another system (or other systems) through sharing or applying its resources, and (2) as improving its own state by acquiring external resources (Spohrer, Vargo et al. 2008). This is both adaptive learning through the process of adjustment and generative learning through the building up of capacity to create.

From the perspective of Service Science, learning can be viewed as the improvement of a service system or network of service systems, as assessed by the abilities and capacities of the system or systems to adapt to an environment.

3.2 Service-Dominant Logic (Process)

Logic

According to Vargo et al. (Spohrer, Maglio et al. 2022) logics exist within the minds of people and become dominant when they improve people's capabilities for interactions and outcomes. Service-Dominant Logic takes a broad view of the context and role of economic exchange in society to try to understand how value is cocreated through systems of exchange. This alternative logic has been called Service-Dominant Logic, because it maintains that this exchange is better understood in terms of service-for-service than in terms of goods-for-money. That is, it is about the process and outcome of actors (e.g., people and organizations) applying their resources, such as knowledge, for the benefit of others — that is, service provision — in exchange for others providing service for them" (Spohrer, Maglio et al. 2022, p.80).

Narrative and Process of Service-Dominant Logic

Service-Dominant Logic is focused on the interaction of network actors as they co-create value through collaborative processes (Lusch and Vargo 2008). The interactive relationship during value co-creation results in added value that improves one's own state or condition. As shown in Figure 2 for the process and narrative of value co-creation the integration of resources is a central concept (Vargo and Lusch 2004, Peters 2016, Vargo and Lusch 2016). In this process actors are natural or legal entities capable of acting on potential resources and carrier of operant and/or operand resources (Löbler 2013). Operant resources, such as competences, are those that act upon other resources to create benefit; while operand resources are those resources which must be acted on to be beneficial, such as natural resources, goods and money (Constantin and Lusch 1994, Vargo, Lusch et al. 2010). Service-Dominant Logic serves as a meta-theoretical framework for explaining the process of value creation through service exchange among multiple resource-integrating actors forming institutionally coordinated service ecosystems (Vargo and Lusch 2016, Vargo and Lusch 2018).
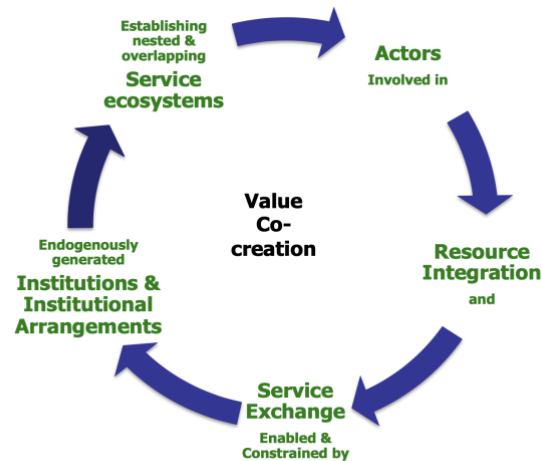
Figure 2 The narrative and process of Service-Dominant Logic (Vargo and Lusch 2016)

As shown in Figure 2 Vargo and Lusch (Vargo and Lusch 2008, Vargo and Lusch 2011) established the roles of generic actors fundamentally doing the same things by integrating resources and engaging in service exchange, all in the process of co-creating value (Vargo and Lusch 2016). This process of actor-to-actor orientation and interacting by resource integration and service exchange implies that value creation takes part in networks since resources at least in parts come from other actors. It also implies a dynamic component to these networks. Because the nature of the network is changed by each interaction or application of resources. This reveals that a network understanding alone is inadequate and a more dynamic (service) systems orientation is necessary (Spohrer, Vargo et al. 2008). Along with this dynamic (service) systems mechanisms have to be existent facilitating resource integration, service exchange and the coordination of actors. Thus the role of institutions as routinized coordinating mechanisms becomes essential; "as actors within a service ecosystem are cognitively distant from each other, shared institutional arrangements are necessary in order to coordinate their otherwise unrelated behaviour " (Vargo and Lusch 2016, Vargo and Lusch 2018). Institutions are the human-made rules, which coordinate resource integration and service exchange among actors (Edvardsson, Kleinaltenkamp et al. 2014, Vargo and Lusch 2016).

Learning

From this perspective Figure 3 explains how actor, e.g. organizations, are able to serve by adapting and learning to constantly offer competitively compelling value propositions. In brief, learning in the context of an organization enhances its chances (capacities) of serving and thus remaining a viable and functioning part of a value network by: (1) developing an S–D orientation or logic, and (2) liquefying (i.e. separating information from a physical form) information resources, building (3) resource and capability density (in the sense of generative learning) and (4) new resource combinations as innovative and competitive value propositions (Normann 2001, Arthur 2009, Lusch, Vargo et al. 2010, Lusch and Nambisan 2015).
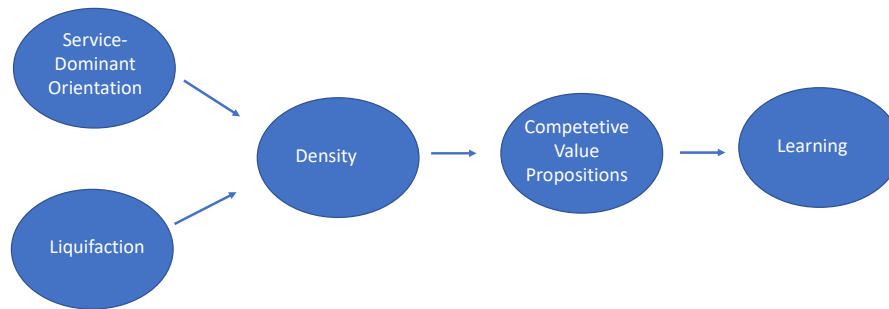
Figure 3 Learning to serve in a value network (Lusch, Vargo et al. 2010)

4 Hypothesis

Hypothesis: the core concepts of Service Science and Service-Dominant Logic are suitable to explain the phenomena of adaptive and generative learning and their interplay; this in principle and in particular in the context of organizations.

To observe, confirm or reject these hypotheses, a two-stage observation is conducted. In the first stage Service Dominant Architecture (SDA) as method theory is introduced to explain the key elements of the domain theories and their suitability for explaining the phenomena of adaptive and generative learning and their interplay. In the second stage, observations regarding learning are made in the organizational context using the SDA based B2B2C mobility platform onpier as an example.

5 Method Theory: Service Dominant Architecture

Service Dominant Architecture (SDA) as method theory and meta-level conceptual framework enables to study and explain the substantive elements, mechanism and relationships of the domain theories (Lukka and Vinnari 2005, Jaakkola 2020).

For this purpose, it is after a short introduction of architecture shown how SDA as design pattern of five (service) systems is derived from the concepts of Service Science and Service-Dominant Logic. Then the five (service) systems are also presented from the perspective of adaptive and generative learning.

Architecture

Architecture is understood as both the process and the output (product) of planning, designing, and constructing buildings or other structures (Alexander 1977, Gamma, Helm et al. 1995, Warg and Deetjen 2021). Within organizations enterprise architectures are the organizing logic for business processes and technologies (Ross, Weill et al. 2006, Warg and Deetjen 2021, Behara 2023).

Referring to Warg et al. (Spohrer, Maglio et al. 2022) architectures exist within the culture of organizations and become dominant when they improve organizations' capabilities for adapting to change. The focus of this research is organizational architecture. Put simply, the architecture of a building includes interconnected room structures (floor plan) that provide service, and the

architecture of an enterprise includes interconnected organization functions (organization plan) that provide service.

What is a dominant architecture? Dominant refers to how many actors adopt and embrace a particular mindset and worldview. Architectures exist within the culture of organizations and become dominant when they improve organizations' capabilities for adapting to change. Architecture can, therefore, be called dominant when its design patterns for change become part of social and cultural practices and are reused over and over again in different social, organizational, and technological contexts (Spohrer, Maglio et al. 2022, p.61). Economic actors are in a race to find the best organizational architecture. The race is on to become the dominant architecture that can best support the required changes, constantly adapting to multiple environmental factors (e.g., competitors, regulations, technologies, customer preferences, employees, partners, shareholders, etc.) while competing for collaborators (Spohrer, Maglio et al. 2022, p.61).

Service Dominant Architecture

Service Dominant Architecture (SDA) is an emerging architecture putting the findings, logics and processes of Service Science and Service-Dominant Logic into practice. SDA is grounded in Service Science and Service-Dominant Logic and provides an organizing logic for shaping organizations, service platforms, and service ecosystems through design patterns aimed at making it possible to build and orchestrate capabilities in a systematic way.

SDA empowers responsible actors to act in the era of X+AI and in the context of openness, interoperability and connectivity in a meaningful way and to organize service as a transdisciplinary process of value cocreation. That is rearchitecting the operating architectures of organizations from goods based, reactive, and siloed to platform based, proactive, open, and AI-centric (Spohrer, Maglio et al. 2022).

5.1 SDA Design Pattern generated from Service Science and Service-Dominant Logic

SDA operationalizes core elements of Service-Dominant Logic and Service Science using design pattern as a configuration of five (service) systems:

Foundations and Concepts of Service Science and Service-Dominant Logic	Service Dominant Architecture as Design Pattern of 5 (Service) Systems
A **service system** as an "open system (1) capable of improving the state of another system and (2) capable of improving its own state (Spohrer, Vargo et al. 2008). Each instance of resource integration changes the nature of the service system to some degree and thus the context for the next iteration and determination of value creation. Networks are not just networks (aggregations of relationships); they are **dynamic systems** (Vargo and Lusch 2011).	**Design Pattern** of 5 (service) systems. Applied by an responsible actor the SDA systems become dynamic value cocreation configurations and by this service systems (Warg and Engel 2016, Spohrer, Maglio et al. 2022). Transferred to organizations the design pattern correspond to the "Normann's map": "This realm is about the process of perceiving patterns in the `landscape', thus creating `maps' which, when enacted, can change the territory" (Normann 2001).
Service - the application of resources for the benefit of another actor or oneself - is the fundamental basis of exchange (Vargo and Lusch 2004, Spohrer, Maglio et al. 2007, Vargo and Lusch 2018)	**System of Interaction** - interaction, application of resources - resource integration - service exchange - value (in use and context)

|	
Value-in-use: the change in well-being from an actor's perspective that results from the direct or indirect application of resources (Vargo and Lusch 2018) **Dynamic interaction** and open communication provides a mechanism for learning via the exchange process (Vargo, Lusch et al. 2010)	- **adaptive** learning via the exchange process; also in combination with the other systems esp. the System of Data
Co-produce service offerings. Actors invite other actors to assist in the production of service offerings (Vargo and Lusch 2011) Actors in a system of other actors cocreating value through r**esource integration** and **service provision** (Vargo and Lusch 2011)	**System of Participation** - actor-to-actor orientation - connecting/integration partner and co-producer - resource integration - **generative learning:** increasing resource density and the capacity to create
Complementary resources (such as time, competence, information, etc.), increasing the capacity and density of a value-creating system and process (Normann 2001). **Data architectures** offer the opportunity to bridge the gap between powerful AI-based analytics and the highest standards of personal data protection (Spohrer, Maglio et al. 2022)	**System of Data** - data as (complementary) resource - customer data (context, preferences) - customer record / history - contextual data - databased understanding and adaptation of behavior (adaptive) learning - event driven service exchange and resource integration for competitive value propositions
Operant resources can act on other resources (including other operant resources) to create change. (Spohrer, Vargo et al. 2008) **Unfreezing** and **liquification** (**liquifaction**) of assets and activity (Normann 2001, Lusch, Vargo et al. 2010, Lusch and Nambisan 2015). **Service innovation** can then be considered the rebundling of diverse resources that create novel resources that are beneficial (i.e. value experiencing) to some actors (Lusch and Nambisan 2015). **Combinatorial evolution** (Arthur 2009)	**System of Operant Resources** - resource integration - resource-bundling, -unbundling, -density - operant resources - (re-) configuration of resources for value propositions - service innovation by new combinations of r sources as competitive value propositions
The role of **institutions** as routinized coordinating mechanisms becomes essential (Vargo and Lusch 2016)	**System of Institutions** - rules for actor coordination - rules for resource integration - enable and constrain service exchange

Table 1 SDA Design Pattern derived from Service Science and Service-Dominant Logic

The five (service) systems of SDA are (Warg, Weiß et al. 2015, Warg and Engel 2016, Warg, Zolnowski et al. 2019, Spohrer, Maglio et al. 2022):

1. System of Interaction: The system facilitates value in use and value in context by enabling the application of resources and capabilities bundled in value propositions. In the course of interaction resource integration and service exchange occur. With each interaction actors signal their preferences; thus the System of Interaction facilitates adaptive learning, e.g. value propositions (as behavior) are adapted as a result of interacting. Experience is build up as data based knowledge also in combination with the other SDA systems esp. the System of Data. In this way, the System of Interaction enables the organization to react to changes in its network with adapted behavior - for example new value propositions.

2. System of Participation: The concept of cocreation connects other (external) actors as co-producers of the value proposition. In this process the System of Participation enables actor-to-actor orientation and the participation of other actors by coordinating ac

actors and facilitating the process of resource integration. In this way, resource density is increased and generative learning is made possible as an extension of the capabilities and capacities to create new value propositions.

3. System of Operant Resources: The System of Operant Resources is the heart of SDA. It represents the workbench, where the various resources and capabilities are brought together and processed e.g. unbundled and combined for value propositions. For this, this system applies certain logics or processes. In line with S-D Logic, the focus is on intangible capabilities, previously defined as operant resources (like competence, knowledge, skills, software code), which are used and brought together to (co-) create value propositions. The emergence of value propositions is dependent on the achievable level of resource density. A high resource density positively impacts generative organizational learning by enhancing the capacity to create new resource combinations and thus innovative value propositions.

4. System of Data (Data Lake): From an responsible actor's (e.g., organization) point of view, data received and generated by interacting with other actors (e.g., customer) should be systematically recorded and evaluated in real time. In this way, data and knowledge about the preferences, feedbacks and the context of other actors like customers can be build up continuously. Thus data-based understanding as knowledge about actors can be built. Transferred to the description of learning in biology, this knowledge corresponds to the experience and social learning that animals (human or non-human) make during the process of interacting with their environment. The value of this data based knowledge is to save time and energy compared to "the business of survival by trial and error". As a consequence of this data based knowledge the development of value propositions, e.g. in organizations, can be adapted (adaptive learning) and aligned to the needs of other actor like customer. Events are generated by the System of Data for the adaptation and creation of value propositions. These events access the resources of the System of Operant Resources and System of Participation in particular.

5. System of Institutions (SDA Service Catalog): As rules, institutions enable the coordination of actors and the access to and use of resources. In conjunction with design pattern, institutions enable the coordinated creation of solution designs and value propositions by connecting actors and enabling the integration of resources.
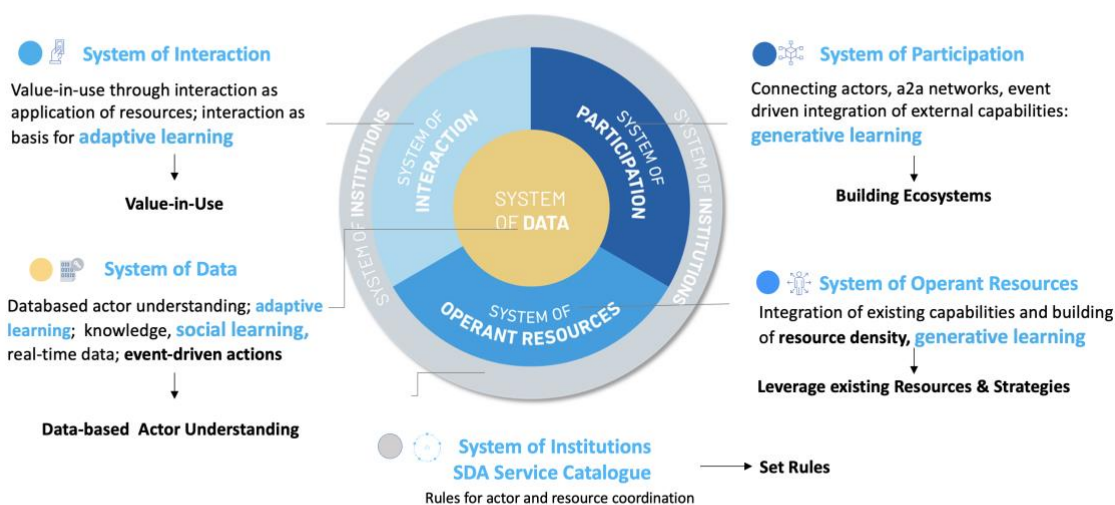
Figure 4 Service Dominant Architecture as Design Pattern of 5 (Service) Systems

SDA enables organizations as responsible entities to approach strategies for adaptive and generative learning and fosters organizational development as improvement of its capabilities to pull, integrate, adjust, combine and apply resources (Warg and Zolnowski 2018, Warg, Zolnowski et al. 2019).

5.2   SDA as Process and Output for e.g. Service Platforms

Based on platform technologies, SDA enables responsible actors (e.g., individuals, companies, and organizations) to act in the context of openness and connectivity in a meaningful way and to organize service as a transdisciplinary process of value cocreation (Spohrer, Maglio et al. 2022, p.64). The technical implementation of SDA can be compared to Lego. Open-source and cloud platform technologies form the base plate. Technical, functional, and business services are implemented as generic or specific bricks. Each brick is preconfigured with the five roles as systems. The base plate and the bricks are coordinated via the SDA service catalog that sets the rules and standards. Once the bricks (technology systems consisting of microservices) are used by actors (service system entities), the process of actor engagement and value cocreation is organized and structured.

After the state of one system is improved (e.g. by data integration), the system drives value for other SDA systems. For example, data are fed into the data lake (System of Data) as a result of interactions (System of Interaction). Thus facilitation data analytics and advanced forms of collaboration. Capabilities become exchangeable and tradeable via the service catalog, and resource density is built. Thus, SDA facilitates the reshaping of organizational operating architectures (Spohrer, Maglio et al. 2022, p.65).

As shown in figure 5 the design pattern of the five SDA service systems facilitate as a construction plan the process of value cocreation and the service platform as output of step by step (use case by use case) implementation:

- the process of value co-creation (connecting actors, resource integration, service exchange, setting rules) for building and application of value propositions, and

- the output (digital service platform) as a result of implementation and systemic building of resources and capabilities according to the SDA design.
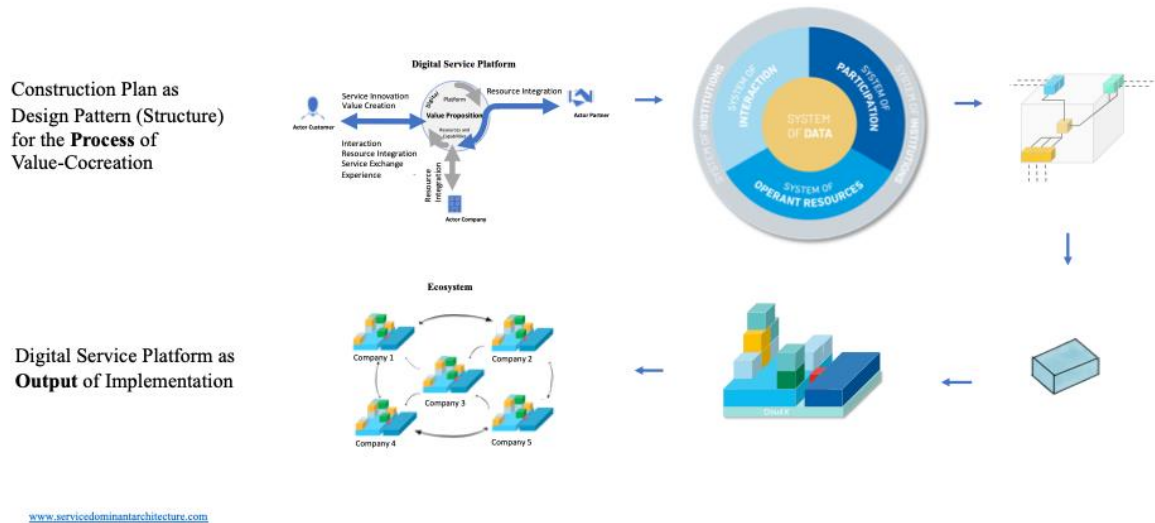

Fig. 5. Service Dominant Architecture (SDA) as Process and Structure

6   Observations based on the onpier Mobility Platform

onpier is an open B2B2C platform for non-insurance services. By connecting to onpier, insurance companies can offer their customers additional value propositions that go beyond traditional insurance solutions.

onpier B2B2C Mobility Platform Value Proposition: Vehicle Registration

SDA inside: Construction Plan for the collaborative creation, building and application of Value Propositions
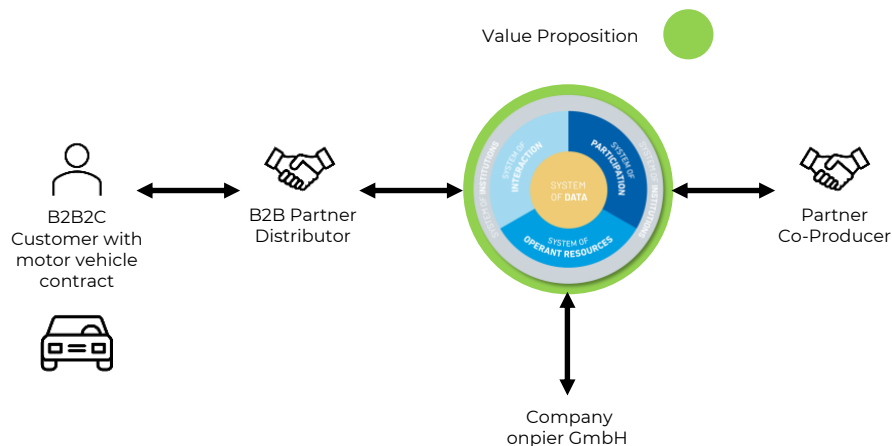
Value Proposition

B2B2C Customer with motor vehicle contract

B2B Partner Distributor

Partner Co-Producer

Company onpier GmbH

Figure 6 onpier B2B2C Mobility Platform - Use Case Vehicle Registration

As demonstrated in figure 6 the two motor insurers HUK-Coburg and LVM founded in cooperation with the insurer HDI the new B2B2C platform to offer their customers value propositions related to driving - outside of their core business insurance. This form of cooperation is also referred to as coopetition. The companies cooperate in the process of creating value propositions in the area of mobility and remain competitors in their core business area of insurance.

Car insurance market leader HUK-Coburg and the insurer LVM launched the platform beginning 2023 and declared explicitly to open it up to other service providers and investors. Together, the three companies insure around 18 million vehicles, which is just under a third of all vehicles registered in this country. With the new platform, they want to bind their customers more closely to them and distinguish themselves as service providers for all sides of mobility (Fromme 2021, Pfauntsch 2021, Prisma 2023).

Figure 7 demonstrates examplary value propositions like vehicle registration, vehicle purchase or sale, GHG (greenhouse gas)-bonus, wallbox, workshop services, financing or vehicle preparation or maintenance. With the help of artificial intelligence, the platform aims to make customers offers that are precisely tailored to their needs. The service provider of onpier is the Hamburg-based platform-builder SDA SE offering platforms and services based on above presented Service Dominant Architecture.
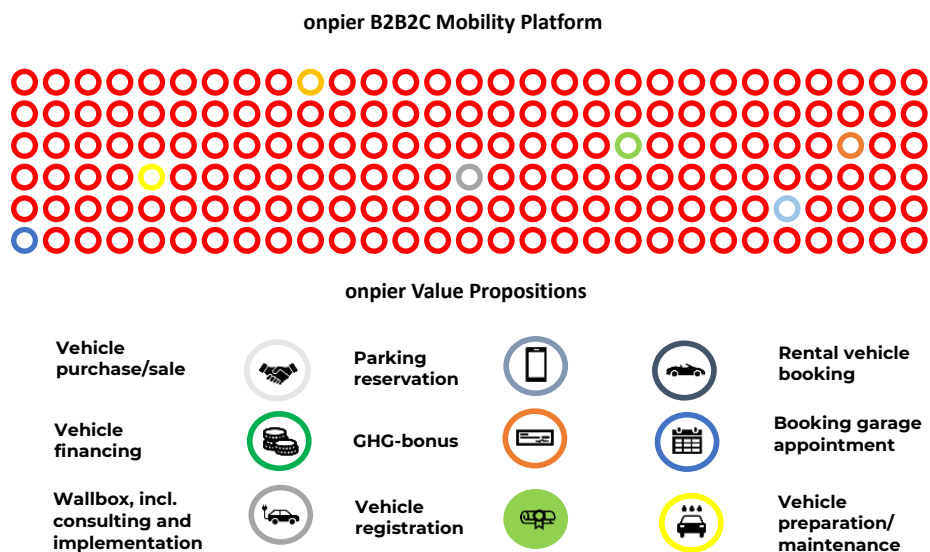
onpier B2B2C Mobility Platform

onpier Value Propositions

Vehicle purchase/sale		Parking reservation		Rental vehicle booking
Vehicle financing		GHG-bonus		Booking garage appointment
Wallbox, incl. consulting and implementation		Vehicle registration		Vehicle preparation/ maintenance

Figure 7 Value Propositions of onpier B2B2C Mobility Platform

The example of vehicle registration is used to illustrate organizational learning on the basis of SDA and onpier. As shown in Fig 8, the customer is informed about the onpier value proposition vehicle registration e.g. after conclusion of his insurance contract. The information is provided in this use case with a link to the onpier value proposition send by the insurance company (e.g. sales agent, service center) to the customer. As soon as the customer interacts by applying the resources configured as value proposition, the customer is asked for his consent in line with data protection requirements. Once this has been given to the System of Data in interplay with the System of Interaction, all necessary data can be entered online by the customer. For example, the customer can choose his desired license plate number and simply pay.

After verification and plausibility checks the data are forwarded by onpier to the co-producer. Via the System of Participation the service exchange with the co-producer is organized. The co-producer than realizes the registration at the admission authority and dispatches the car license plates to the customer. Finally the customer has received his license plates and evaluates the service quality.

The rules for the coordination of the actors and the orchestration of the process (e.g. sequence, data formats) are set by onpier also in coordination with the other actors via the System of Institutions.

In the System of Operant Resources, the resources and capabilities are built up and bundled that make the individual value proposition unique, that act on the resources of the other systems and, from onpier's point of view, form the basis for new combinations of capabilities and thus for new innovative value propositions. For example, if during the process of vehicle registration is recognized that the vehicle is an e-vehicle these data will be stored in the System of Data. Through a variety of interactions, knowledge is built up about data in this way; for example, that the number of registered e-vehicles is rising sharply. Events can then be generated on the basis of data analytics in order to adapt the orientation of the next value propositions to these

developments and trends at an early stage. This is how onpier realizes the phenomenon and process of adaptive learning based on the SDA.

Within the System of Operant Resources the capabilities needed will be built up in addition to engaging partners and their resources to adapt and offer new value propositions. In the course of adapting to the experience of increasing number of e-vehicles, the next capabilities built up could be for value propositions like GHG bonus, i.e. the easy process to get the financial support for e-vehicles of the state; or a wall box (incl. installation) to charge the vehicle with electricity.

onpier Value Proposition: Vehicle Registration

1 Insurance contract and reference of insurance company to the onpier value proposition vehicle registration

2 Data collection for vehicle registration (onpier **B**2B2C):
   - consent of customer and insurance company
   - verification of data collected (onpier)
   - selection of desired license plate number (customer)
   - paylink payment (customer)
   - forwarding data to partner (onpier)

3 Dispatch of documents from customer to partner (co-producer) direct from customer to partner

4 Registration and dispatching documents and plate
   - registration (partner)
4 - dispatching documents to customer (partner)

5 Customer rates service

6 Data analysis and offer of next value proposition
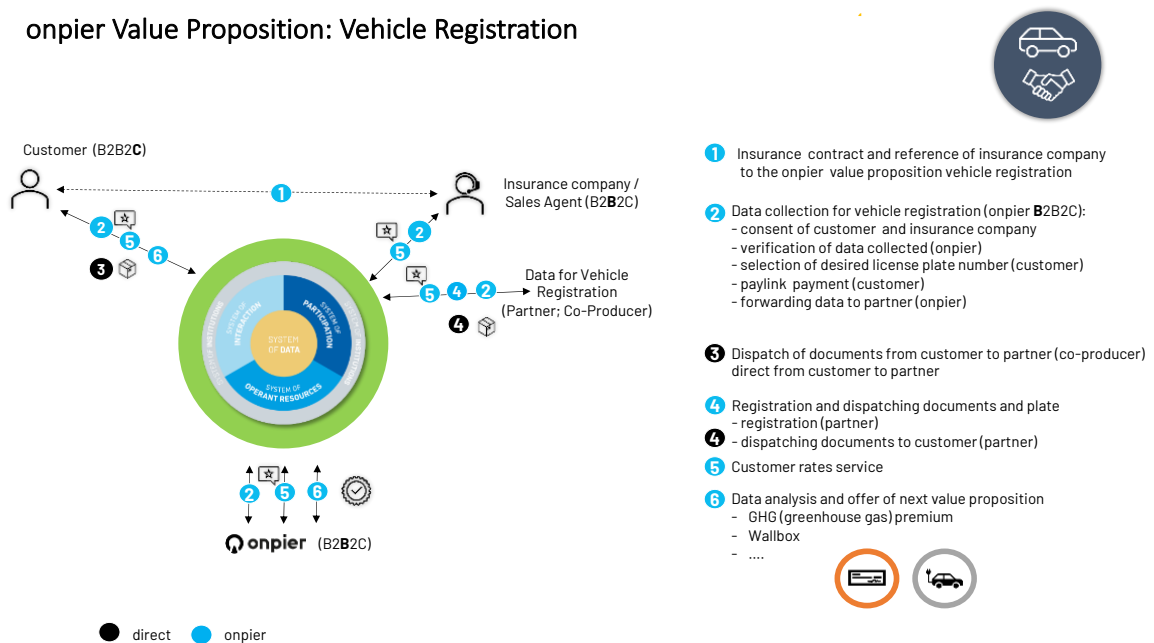   - GHG (greenhouse gas) premium
   - Wallbox
   - ....

Figure 8 Use Cases as Learning Journey

The process illustrates how organizations can implement with the help of the B2B2C platform onpier both adaptive learning and generative learning based on SDA. Every interaction is used to build data-based understanding of the customer's preferences and context, and to adapt behavior based on this knowledge (experience). As illustrated by the registration service example, once the knowledge that the vehicle is an e-vehicle has been built up, the vehicle owner is offered further value propositions in the context of electromobility. Onpier itself is also learning generative by building up capabilities and capacities in this area after data-based recognition that more and more electric vehicles are being registered.

7 Findings

The paper contributes to the theory building that the phenomenon of learning is moving towards a service perspective. The domain theories reveal that service as the basis of exchange is also a suitable foundation for explaining the key elements of learning. The hypothesis that the core concepts of Service Science and Service-Dominant Logic are appropriate to explain the key elements of adaptive and generative learning and their interplay is proven by means of Service Dominant Architecture as method theory and the observations of onpier mobility platform as a practical example.

From the perspective of the core concepts of service it is demonstrated how responsible actor, as service system entities, e.g. organizations, transform theirselves by building capabilities and capacities to improve their adaptability as change processes and win-win interactions within dynamic service system networks. Embedded in actor to actor networks and interconnected by multilateral value propositions actors engage, learn and change their behavior all in the process of mutual value creation and service exchange.

Service Dominant Architecture as design pattern derived from the core concepts of Service Science and Service-Dominant Logic operationalizes and internalizes this mindset and the core mechanisms for giving and getting better service. As observed in the example of the mobility platform onpier, Service Dominant Architecture is applicable for interaction based adaptive and generative learning of organizations.

Whether the design pattern of SDA can be reused again and again and become an institutionalized pattern as part of social and cultural practices is an interesting task for future research. In this way, SDA as architecture can generate further valuable inferences about the mechanisms of the core concepts of service and their interplay. And thus, contribute to better models. Better models of the world both complex natural and social systems (science), better mental-models in people to improve interactions (logic) and better cultural and structural models of organizations to improve change (architecture).

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