Service Perspectives on Lean Management Strategies in Dynamic Networks

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Abstract

"Put the network eye-glasses on your noses" (Gummesson, 2011). With this summing up Evert Gummesson concluded his 2011 presentation at the Naples Forum on Service. Viewing social and economic life as dynamic interactions in complex networks of relationships reveals the need for new marketing, service and management approaches and is all the more important today. This also applies to the phenomenon of value chain-focused lean management approaches. This paper puts the network and value-creation constellation eye-glasses on for exploring on how organizations can improve their lean management strategies in dynamic networks.
For this purpose, the core mechanisms of lean management are elaborated on basis of the Value Stream Mapping (VSM) approach and supplemented by a service lens for introducing the mechanisms of value co-creation in complex networks of relationships. By adaptation of service perspectives the paper seeks to change the scope of lean management practices from value chains to value creation constellations (Normann & Ramirez, 1993). Drawing on this knowledge base design principles and design patterns are elaborated. Finally, strategies for applying Value Stream Mapping in dynamic networks are demonstrated and approaches for their implementation are presented.

Purpose

Lean management approaches have undergone a rapid development in recent years. From the beginning of this century process mining evolved from academic concepts to a game changer based on a software tool driven industry focused on analyzing, monitoring and improving process performance. Driven by a wide range of technologies data-driven lean management approaches, like process mining, are quickly replacing the traditional, observational and subjective practices (Gartner, 2019; Reinkemeyer & Davenport, 2023; W. M. Van der Aalst, 2022; Weijters & van der Aalst, 2001).

As part of digital transformation lean management technologies facilitate business process changes and trigger strategic responses and operative transformation of organizational social and business systems. By adopting and using the new technologies organizations adapt from within by incessantly leaving old patterns and creating new one to stay competetive. The scope of organizational adaptation in the course of digital transformation is broad and ranges from small process changes to a complete change in value creation paths. The latter was labelt by Schumpeter as "creative destruction" (Hanelt, Bohnsack, Marz, & Antunes Marante, 2021; Nadkarni & Prügl, 2021; Rigby, 2025; Schumpeter, 2017, 2021; Vial, 2019).

For exploring how organizations are affected and how they can improve their lean management practices in dynamic networks, it is helpful to first locate and categorise the status of the organization with regard to its adaptation. To enable this positioning, we categorize our findings according to "Porter´s three waves" (Coase, 1937; Drucker, 1995; Normann & Ramirez, 1993; Michael E Porter & Heppelmann, 2014). Porter's example of the three waves of IT-transformation illustrates the impact of transformations on the value creation paths of organizations. From changing the intra-company value chains to transforming the value chains by linking single activities across actors up to the reinventing of products and the re-examination of the core mission within an increasingly coupled and networked world of IT devices based on internet technologies (Michael E Porter & Heppelmann, 2014).

During the first wave (1960s-1970s) information technology permeated and transformed the value chains at every point by automating individual activities. This increased productivity and resulted in cross-company process standardization (M. E. Porter & Millar, 1985). In the second wave (1980s-1990s) the rise of internet fostered the ability to link and coordinate activities and actors. This wave transformed the value chain as set of activities through which a product is created. But the products themselves remained largely unaffected (M. E. Porter, 2001). This changed in the third wave (started about 2000). In this wave IT transforms the products themselves by becoming an integral part of products. Embedded sensors, processors and software coupled products increased data generation, connectivity, functionality and performance of products. Smart connected products affect the industry scope and the boundaries of competition. Porter summarizes (Michael E Porter & Heppelmann, 2014, p. 23) that "the focus is shifting to the broader need companies meet, rather than their traditional product definition." As consequence Porter predicts that companies will have to reexamine also their core mission and value propositions during to stay competetive within continuously increasing networks.

The three waves illustrate how technologies and technological coupling, and networks foster the change of organizational value creation paths and strategies. Either as internal process optimization or as co-operation and co-productive constellations up to "creative destruction" of the existing value constellations. In this paper we put the network eye-glasses on to explore how to develop lean management strategies in dynamic networks. In our understanding of strategy and and the derivation of possible lean management strategies, we are guided by Normann et al. (Normann & Ramirez, 1993) who define strategy as the art of creating value. In dynamic networks strategy is not longer a matter of positioning a fixed set of activities along a value chain. The key strategic task is the reconfiguration of roles and relationships among the actors in order to mobilize the creation of value at a profit (Normann & Ramirez, 1993). For solving this strategic task, the paper first elaborates the core principles of lean management approaches and then supplements them in a second step by a service lens for introducing the mechanisms of co-operation and value co-creation in complex networks of relationships. Based on this knowledge base design principles and design patterns that enable companies to adapt their strategies

are derived. Drawing on the elaborated principles and patterns lean management strategies for the specific need of the organization are developed.

Research Methodology

This research is aligned to the research question: "how to improve value co-creation in the context of lean management by applying cross-company Value Stream Mapping in dynamic networks? As means of theory building a “conceptual paper” with "theory adaptation" as type of research design is chosen (Jaakkola, 2020; MacInnis, 2011; Meredith, 1993). For outlining the set of knowledge necessary to describe and analyze the key variables and the core principles of lean management the approaches of Value Stream Mapping and Process Mining have been selected as domain theory.

Service-Dominant Logic, Service Science, Viable Systems Approach and Service Dominant Architecture have been selected as method theories (Barile & Polese, 2010a; Mele, Pels, & Polese, 2010; Jim Spohrer & Maglio, 2010; Jim Spohrer, Maglio, Vargo, & Warg, 2022; S. Vargo & Lusch, 2016). The service lens is chosen for elaborating insights, perspectives, logical explanations and mechanisms to explain the key variables of co-operation and value creation in dynamic networks (Jaakkola, 2020; MacInnis, 2011).

The paper integrates the perspectives of the domain and the method theories, for expanding the scope of lean management approaches by service perspectives. This methodology is intended to generate novel insights and to amend lean management approaches and strategies in dynamic networks. To this end, a knowledge base of domain and method theories is built up, which serves to research and develop design principles and patterns. Design principles as generalized outcomes are part of the abstract domain. Design patterns systematically explain general designs that address recurring design problems e.g. in the context of lean management approaches. Design patterns describe these problems, the solutions, when to apply the solutions, and give implementation hints. Based on design patterns, the solution is adapted to the specific need and implemented as an instance to solve the problem in a particular context (Alexander, 1977; Arthur, 2009; Gamma, Helm, Johnson, & Vlissides, 1995; Gregor, Chandra Kruse, & Seidel, 2020; Lee, Pries-Heje, & Baskerville, 2011; Weiss, 2023). Finally, the findings are categorised along "Porter´s three waves" classification in order to derive lean management strategies and the accompanying reconfigurations of roles and relationships for different organizational constellations (Michael E Porter & Heppelmann, 2014).

Domain Theory - Lean Management

Lean Management, Lean Thinking Principles and Value Stream Mapping

The concept of lean was introduced by Krafcik in 1988 (Brezing, 2025; Krafcik, 1988; Womack, Jones, & Roos, 2007). In his research, Krafcik characterizes production systems using the examples of Ford and Toyota. While Ford applied an "buffered" approach with maintaining large inventories for machine downtimes and quality issues Toyota operated with a "lean" production policy aiming for minimal buffers. These characteristics build on the work of Shimada & MacDuffie´s who described the American production system as "robust" in the sense of unresponsiveness to variability and the Japanese system as "fragile" (Krafcik, 1988; Shimada & MacDuffie, 1986). Focusing on efficiency through task specialization and waste reduction, are already originated in Ford’s assembly line at the early 1900s. This laid the foundation for further lean principles by emphasizing continuous flow and productivity. Toyota adapted Ford’s ideas and created the Toyota Production System (1940s-1970s) introducing

concepts like Just-In-Time, Kaizen (continuous improvement), and Jidoka (automation with human oversight). The focus of the Toyota Production System shifted to eliminating waste while maximizing customer value. In the 1990s lean management principles popularized globally by emphasizing their applicability beyond manufacturing. This development was supported by books like Womack´s "The Machine That Changed the World" (Womack et al., 2007). By eliminating unnecessary steps, aligning all steps of an activity in a continuous flow, recombining labor into cross-functional teams dedicated to that activity, and continually striving for improvement, companies can develop, produce, and distribute products with less of the human effort, space, tools, time, and overall expense. They can also become vastly more flexible and responsive to customer desires (Womack & Jones, 2003). Womack & Jones summarized lean thinking in five principles (Brezing, 2025; Womack & Jones, 1994; Womack et al., 2007):

1. Value: The focus should be on what truly adds value from the customer's perspective. Value is the starting point for lean management and can only be defined by the customer. "Value is created by the producer" (Womack et al., 2007, p. 16). For this it is necessary to know what the customer is willing to pay for. On this basis the value of the specific product is to identify. "Lean thinking therefore must start with a conscious attempt to precisely define value in terms of specific products with specific capabilities offered at specific prices through a dialogue with specific customers" (Womack et al., 2007, p. 19).

2. Value Stream (Mapping): For each product it is to identify the value stream. The value stream is the set of all activities required for the specific product or service. In order fully to understand the different value streams, it is necessary to map these intercompany and intracompany value-adding processes. The value-adding processes make the product or service more valuable to the consumer. Value Stream Mapping is predominantly known as a method for process analysis with the aims to add value and reduce waste. The value stream analysis almost always reveals three types of action. First, steps that unambiguously create value; second, steps that do not create value but are unavoidable and third streps that do not create value and are avoidable. Anything that doesn't add value is to weed out. It's about streamlining the process from beginning to the end (Hines & Rich, 1997; Womack & Jones, 2003).

3. Flow: After the value has been specified and the value stream for a specific product has been mapped it's time for the next step. In this step it is to make the remaining, value-creating steps flow and to make sure that the value flow as process flows with no interruptions. Flow is about successive operations in the closest proximity, so as to minimize e.g. transportation and to maximize the pressure of flow of work (Arnold & Faurote, 1915, p. 22). Every task has to move efficiently to the next so that all the activities needed to order and provide a product occur in continuous flow. To improve the flow, it is better to focus on the product and its needs, rather than the organization.

4. Pull: Let the customer pull value from the producer instead of pushing products to the customer. Make only products when there is a demand from the customer. Even if the transformation from push to pull emerges in phases it helps to improve value and to reduce waste from overproduction. Womack and Jones illustrate this with the example of overproduced physical books, which are disposed of after they have not been sold. Instead the push of printed books the request based electronic transfer of the text from the "publisher" to the computer of the customer is one appropriate solution and "will be found once the members of the publishing value stream embrace the fourth principle of lean thinking: pull" (Womack & Jones, 2003, p. 25).

5. Perfection: Keep pursuing perfection by refining and improving the process of reducing waste and enhancing value over and over again. After the value for the customer has been specified, the entire value stream has been identyfied, and the value-creating steps for products to flow continuously have been made, something strange begins to happen. Recognising what has been achieved in terms of reducing effort, time, space, costs and mistakes, while at the same time increasing value for the customer, leads to a new awareness. The awareness of perfection, the fifth principle of lean thinking. The most fundamental step to perfection is maybe the transparency generated in a lean system. All actors, e.g. subcontractors, suppliers, distributors, customers, employees, can see everything, and discover better ways to create value (Womack & Jones, 2003).

By operationalyzing these lean thinking principles lean organizations are freeing up substantial amounts of resources. Beginning with the rethinking of customer value they continually revisit the value question. It is about Kaizen as continuous incremental improvement which seeks to continually improve product development, order-taking, and production activities (Womack & Jones, 2003). The ability to do that successfully depends on how well all the various processes required to connect with customers, to process orders, to deliver it, to send out the invoice etc. are managed. Those processes taking place inside multiple systems and applications, operated by employees in numerous departments are all incredibly complicated. Therefore, transparency and knowledge about the processes is at the core of lean management.

Business Process Management, Process Mining, Object Centric Process Mining

As related methodologies Business Process Modeling (BPM) and Value Stream Mapping (VSM) are used to analyze and improve organizational processes, but they differ in focus and scope. BPM is used to design, analyze, and optimize workflows in line with a conceptual "ideal" view - often visualized as target operating model (TOM) - of processes. In contrast to VSM it seeks to document and improve specific business processes by creating visual representations of how business processes work and how they should work. The BPM models created for documentation, analyzis and improvement are static models of processes, whers VSM methods like Kanban focus on dynamic models for dynamic workflows and continuous improvement (K. Martin & Osterling, 2014; Womack & Jones, 2003, p. 232).

Process mining combines the specific process focus of BPM with the dynamic and continuous improvement of VSM. In addition, it applies data-driven techniques and algorithms to analyze how processes actually operate. Van der Aalst and Weijters use the term process mining for the method of distilling a structured process description from a set of real activities (W. Van der Aalst, 2012; W. M. Van der Aalst & Weijters, 2004). Process mining focuses on automated process discovery by uncovering insights into the real execution of processes, identifying inefficiencies, deviations, and bottlenecks. As the word "mining" implies, it's all about digging for something of value - the euros, time, and effort hidden inside processes - and the data that can lead to the improvements. Process mining can reveal the source of process pain. Process mining sifts through process data that can be found in various transactional IT systems. It maps out how all the objects that are part of a process activities interact with one another and flow through the series of events that are part of that process. Thus, process mining facilitates a level of visibility into complex processes that can otherwise be nearly impossible to achieve. Because process mining view is based on data, not human observation, it's objective (Kaelble, 2024). It aims to discover, monitor and improve business processes by extracting knowledge from event logs readily available in today’s information systems. Over the last decade there has been a strong growth of event data and process mining techniques have matured significantly. The generated knowledge enables insights for improving business processes with e.g. time predictions, performance analysis or recommendation services (W. Van der Aalst, 2012; W. M. Van der Aalst, Schonenberg, & Song, 2011). Events take place in business processes that are recorded to generate information and knowledge. An event is the actual instance of changes that happen at a particular moment in time. Activities describe what happens in a process; they describe the "what" of an event in the sense of what activity was executed at that point of time. And objects describe "who or what" is involved in the activities. The terms are illustrated in figure 2 using the target operating model for the business process of the activity "document submission" of the insurance industry. In step 1 the activity starts with the customer submitting documents digitally, e.g. scaning and submitting the document with a customer app. The activity is demonstrated using the red line in figure 2. The objects involved in this activity are numbered from 1 "self service" to 6 "output".

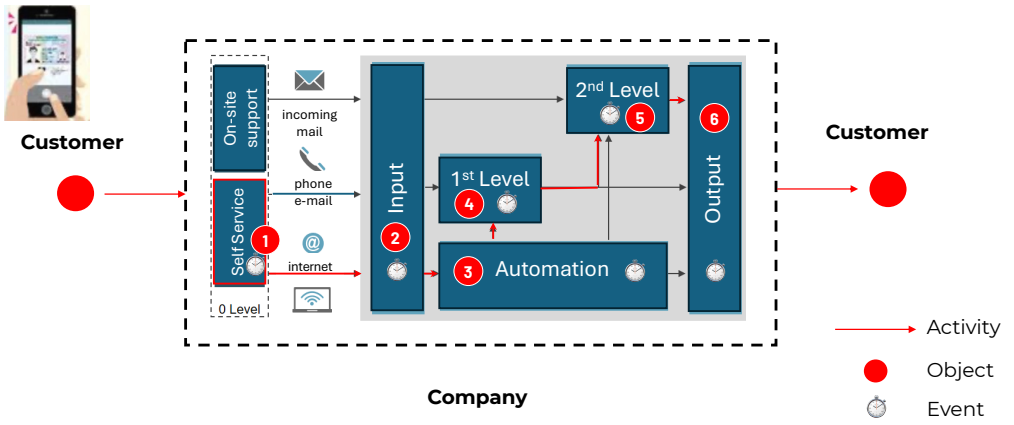

Figure 1 Target Operating Model (TOM) of Insurance

Figure 2 shows how the target operating model of figure 1 is interpreted as business process model (upper half of figure 2) and process mining (lower half of figure 2). Event logs and timestamps are generated in the IT systems and actual instances of the activity.

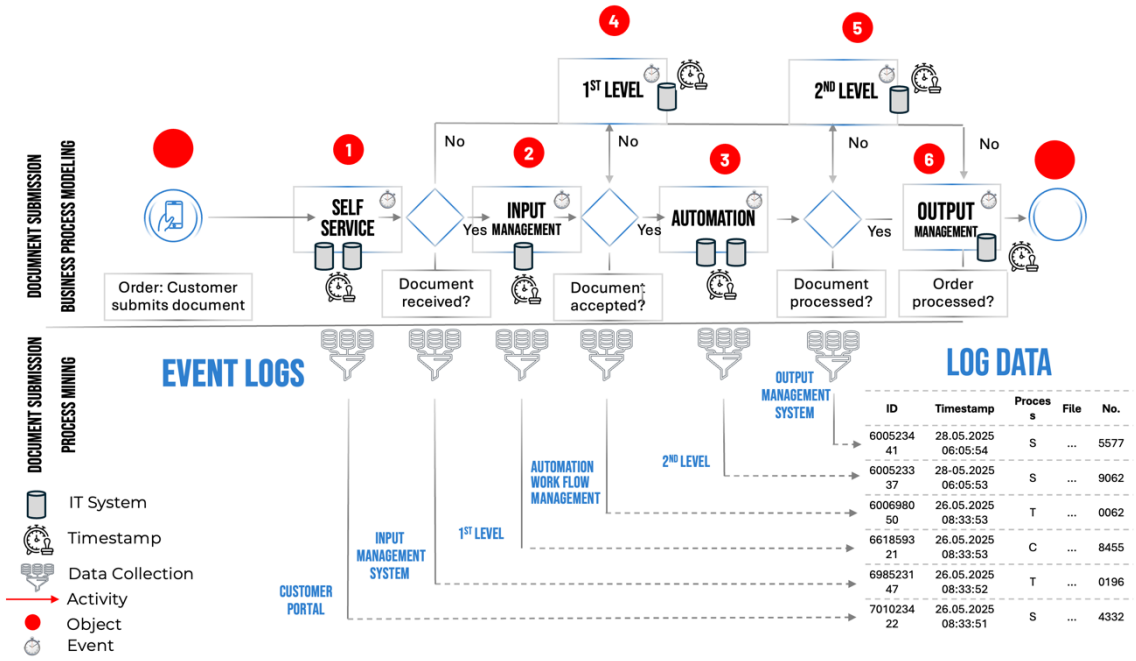

Figure 2 From Business Modelling to Process Mining

Traditional approaches for process analysis with process mining tend to focus on one type of object and the events referred to this object. This simplifies modeling and analysis, by merely describing the lifecycle of one object in terms of its activities. However, there are often multiple objects of different types involved in a process. Object-centric process mining (OCPM) takes a more holistic approach to process analysis by considering multiple objects and its interdependencies. This way OCPM can be used to discover, analyze, and improve highly intertwined processes (W. Van der Aalst, 2023). Each event may refer to any number of objects. OCPM techniques collect the data of multiple objects as input and enable for multi-perspective process models. According to Van der Aalst (W. Van der Aalst, 2023)

object-centricity improves the traditional process mining in three ways: first, IT system agnostic event logging as foundation for generic, combinable and reusable data; second, transparency about the dependencies of the objects. In contrast to traditional process mining where interactions between objects are not captured, and objects are analyzed in isolation; third, creation of “on demand” views for e.g. process discovery, conformance checking, performance analysis or process prediction.

Summarised OCPM techniques faciltate (1) process models based on real-life activities, event data and multiple object perspectives; (2) transparency and a holistic perspective on objects, considering interdependencies with other objects; (3) conformance checks of processes by comparing a process model with event data; (4) analyzing complex relationships between objects; (5) performance analyzis and simulation e.g. for load management, by replaying event data on models; (6) process improvements can be predicted for the whole process or individual process instances by the creation of digital process twins; (7) actions to address performance and compliance problems can be started.

Object-centric approaches are basically applicable in inter-company and network constellations. E.g. for tracking inter-company transactions or sharing resources this can be helpful. Different states of a transaction can be modeled and monitored. Object constellations refer to interconnected relationships and interactions among various objects that can be part of different legal entities (e.g. organizations). Thus, OCPM facilitates the analysis of multiple objects that interact in dynamic, complex many-to-many networks. Object constellations rely on object-centric event logs which structure the data to reflect these interrelationships (Berti & van der Aalst, 2023; Ghahfarokhi, Park, Berti, & van der Aalst, 2021).

In real life modeling object-centric interrelationships faces several challenges. Primarily due to the complexity of data integration across organizations. The advantage of OCPM by unifying data in the company turns to the challenge to integrate data across organizations and to unify and set the standard for an object-centric data model. Existing model heterogenity with different process mining methodologies and data models leads to missing standards for describing and operationalizing complex many-to-many and one-to-many relationships between objects and their interactions over time. This ends in prohibitive transaction costs and prevents OCPM scaling across companies. To realize synergistic effects the first companies startet to build IT-solutions on top of the process mining, e.g. to cut costs across supply chains and the OCEL standard for object-centric event logs was recently proposed (Berti & van der Aalst, 2023; Ghahfarokhi et al., 2021; W. M. Van der Aalst, 2023; W. Van der Aalst, 2023).

Method Theories - A Service Lens

Already in 1995 Evert Gummesson emphasized the shift in focus from goods to services. "Customers do not buy goods or services; they buy offerings which render services which create value" (Gummesson, 1995, pp. 250-251). This shift dated the traditional division between goods and services out and redefined services from a customer or beneficiary perspective: activities render services and things like goods or technologies render services (Gummesson, 1995). This shift substantiated the change from an industrial society to a service society, which had already been proclaimed in marketing, particularly in relationship marketing. Its core is mutually beneficial and seen as relationships, networks and interaction. Starting from dyadic relationships between customer and company it evolved to many-to-many marketing where the boundaries between companies and the boundaries between customer and companies are blurred and customer take an active role (Grönroos, 1994; Gummesson, 1994; Gummesson & Polese, 2009).

The fact that goods, activities, technologies and services appear together has left many confused over the years. It was Steve Vargo and Bob Lusch and their Service-Dominant Logic (S-D Logic) that offered a coherent way for these thoughts. Goods, activities, technologies and all the other resources and their services are integrated and replaced by service (in the singular). Service is understood as the application

of resources (knowledge, competencies, goods, technology...) for the benefit of another and oneself (J Spohrer, Maglio, Bailey, & Gruhl, 2007; Jim Spohrer et al., 2022; Stephen L Vargo & Lusch, 2018; Stephen L. Vargo & Lusch, 2004). Service is the basis of social and economic exchange and relates to almost every other concept. Service is at the core of co-operation understood as a relationship between actors that exists in a specific situation due to goal interdependence (Bastiat & Huszar, 1964; Deutsch, 1949; Jim Spohrer et al., 2022, p. 12; Stephen L. Vargo & Lusch, 2004). Life therefore can be described as "interaction in networks of relationships" (Gummesson, 2017) and service is the fundamental basis of exchange (Stephen L. Vargo & Lusch, 2004, 2008; S. Vargo & Lusch, 2016)

To expand the scope of lean management approches in the context of dynamic networks various theories, concepts and approaches to service are considered the following. We pick the service lens because zooming into the properties, processes and mechanisms of service is central for analyzing actor situations, actor engagement, and actor to actor relationships, e.g. companies in the context of lean management and value creation in dynamic networks. The four service perspectives presented in this paper all deal with models and point a systemic nature of value creation. First, models in people´s mind (Service-Dominant Logic); second models of the world (Service Science); third, models interpreting organizations or entities as systems capable of maintaining their viability (Viable Systems Approach) and fourth, models embedded as architecture in organizations structures and cultures (Service Dominant Architecture) (Jim Spohrer et al., 2022; Wieland, Polese, Vargo, & Lusch, 2012).

Service Dominant Logic

Service-Dominant Logic (S-D Logic) (Stephen L Vargo & Lusch, 2018; Stephen L. Vargo & Lusch, 2004) is narrative and process of value cocreation and thus of co-operation and coordination in dynamic networks. It takes a broader view of the context and role of economic exchange in society to try to understand how value is cocreated through systems of exchange. S-D Logic maintains that this exchange is better understood in terms of service-for-service than in terms of goods-for-goods or goods-for-money. S-D Logic therefore is a logic in the sense of a conceptual lens for observing the world and understanding how it works. It is also sometimes referred to as a mental model or a paradigm. By introducing concepts of value-in-use and value co-creation rather than the value-in-exchange and embedded-value in goods as concepts of Goods-Dominant Logic, S-D Logic embraces a paradigm shift. With S-D Logic Vargo and Lusch (Jim Spohrer et al., 2022; S. L. Vargo & Lusch, 2011; Stephen L. Vargo & Lusch, 2008) also established the concept of an actor language and generic actors instead of parties with pre-designated roles like customer or company. This change has wide-ranging implications because it signals that all actors fundamentally are engaged in doing the same things. They integrate resources and engage in service exchange, all in the process of cocreating value. S-D Logic is about the process and outcome of actors (e.g., people and organizations) applying their resources, such as knowledge, for the benefit of others in exchange for others providing service for them. In S-D logic, rather than something that is embedded, value is an outcome, a change in the well-being determined by the beneficiary, e.g. the iondividual or organization as the focal system.

More precisely, S-D logic is based on five specific axioms: (1) service is the basis of exchange, (2) value is always cocreated by a multiple actors including the beneficiary, (3) actors obtain new resources through resource integration, (4) value is a measure of the well-being of a focal beneficiary, and (5) institutions (e.g., social norms, rules, norms) play an important role in the coordination of actors and resources. The actor-to-actor orientation of S-D Logic also implies several other things. It confirms that value creation takes place in networks, since it implies that the resources used in service provision typically, at least in part, come from other actors, as specified in axioms 2 and 3. Further S-D Logic implies a dynamic component to networks, since each integration or application of resources changes the nature of the network. This suggests that a static network understanding alone is inadequate and that a more dynamic systems orientation is necessary. And, along with the dynamic systems orientation, S-D Logic suggests the existence of institutions as result of recurrent resource integration and service for service exchange. As rules and mechanisms institutions facilitate resource integration and service

exchange through the coordination of actors and resources. Institutions are the rules of the game and shape the interaction of actors. In consequence institutions structure incentives in service exchange (North, 1991; S. L. Vargo & Lusch, 2011). In line with the above, the narrative of value cocreation is about the process of resource-integrating, reciprocal-service-providing actors cocreating value in networked and overlapping systems, governed and evaluated through their institutional arrangements. From a systems perspective also named as service ecosystem understood as a self-contained, self-adjusting system of resource-integrating actors connected by shared institutional arrangements and mutual value creation through service exchange (Stephen L Vargo & Lusch, 2018).

Service Science

Science exists within communities to improve useful models of the world. Service science builds and organizes new knowledge on the subject of service as win-win interactions and outcomes for all actors. The building of better models of responsible actors' processes (mechanisms) for interaction and change is key. As an emerging transdiscipline, service science models service and its essential interrelationships and abstracts them as service systems (responsible actors) interconnected by value propositions (Jim Spohrer et al., 2022, p. 79).

Spohrer et al. summarize the foundations of service systems as follows (Spohrer, Vargo, Caswell, & Maglio, 2008):
1. A system is a configuration of resources, including at least one operant resource, in which the property of the configuration is more than the properties of the individual resources.
2. Operant resources can act on other resources (including other operant resources) to create change.
3. Service is the application of resources (including competences, skills, and knowledge) to make changes that have value for another (system).
4. Value is improvement in a system, as judged by the system or by the system's ability to adapt and survive within an environment.
5. Economic exchange is the voluntary, reciprocal use of resources for mutual value creation by two or more interacting systems.

Spohrer et al. (J Spohrer et al., 2007) define a service system, the basic unit of analysis, as a dynamic value co-creation configuration of resources, including people, organizations, shared information and technology, all connected internally and externally to other service systems by value propositions. A service system is charcterized as an open system 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 capable of improving its own state by acquiring external resources. The service system itself sees value in its interaction with other systems of the network of service (eco) systems. In this context, economic exchange depends on voluntary, reciprocal value creation between service systems (Spohrer et al., 2008).

Viable Systems Approach

Viable Systems focus on the adaptability of a system (e.g. an organization) to ensure its viability within networks. The Viable Systems Approach (VSA) views the organization as a viable system that is able to survive in a particular context. This survival is due to the continual dynamic adaptation of internal processes. Organizations as responsible actors have to be able to respond effectively to external changes (Barile & Polese, 2010a; Mele et al., 2010). For its survival the organization must constantly increase its survival capacity. VSA offers a systemic theory and methodology for interpreting the business arena of the organization. It proposes a behavioural approach for relational interactions of organizations in its context.

The concept of interpreting organizations or firms as a system is not new. Systems theory goes back to the 1950s when Von Bertalanffy et al. (Luhmann, 1984; Parsons, 1951; Von Bertalanffy, 1950) developed an interdisciplinary theory based on the concept of systems. They acknowledged that for the

understanding of complex, emerging phenomena exposed to external influences the analyzis of bilateral relationships is not enough and called for a holistic approach. VSA is considered as a relational approach that configures the organization as an open system built by energetic input-output based on exchanges with the environment (Mele et al., 2010). It explores more specifically corporate management as process that creates and erodes boundaries trying to fulfill a final purpose of survival in a competetive environment (Barile & Polese, 2010b; Gaetano Maria Golinelli, Barile, Spohrer, & Bassano, 2010; Hannan & Freeman, 1984, 1986).

The term 'viability' relates to an actor's reponsible, conscious and targeted behaviours and clearly differs from the concepts of 'living". A responsible actor, seen as a system, is viable when through resource integration, he/she/it establishes and maintains relationships with other systems, looking for structural compatibility (persistence) and co-operation. The concept of viability is the expression of the will to survive in an environment interpreted as dynamic networks. Viability exists within each reponsible actor who is engaged in integrating resources and service exchange within actor to actor networks (Polese, Mele, & Gummesson, 2017). In the process of integrating resources and engaging in service exchange viable systems connect with other systems by sharing institutional arrangements and thus become part of a network of self-adjusting sytems, defined as service ecosystems (S. Vargo & Lusch, 2016). Viability is therefore related to actors behaviours and is strengthened by actor relationships due to service for service exchange (Polese et al., 2017b). Relationships as iterative processes occurre among many actors engaging in service exchange and abandoning the primarily bilateral logic (Gummesson, Mele, & Polese, 2019, p. 5). The accomplishment of viability and viable behaviour depends on the characteristics of the interaction and the co-operative relationship between actors that exists in the specific situation of the viable system. The ability to organize relationships is a main characteristic of viable systems and a core management task. The challenge for the top management therefore is to make decisions that further develop the internal system and at the same time contribute to the balance with external systems (Barile, Pels, Polese, & Saviano, 2012; Hannan & Freeman, 1986). The VSA contributes to the design and management of positive interaction among actors e.g. customer, suppliers and others who are part of a actor to actor network. Like in service system's interactions there is also a need to consider the less visible relationships among all of involved responsible actors which contribute to the competitiveness of the system (Polese, Russo, & Carrubbo, 2009). Each object and node that acts as a part of the business processes represents a relevant partner and supports the whole system in its enjoyment of network advantages for value creation (Barile & Polese, 2010b; Polese et al., 2009). The role of networks and relationships is twofold. Relationships can either represent co-operative situations due to goal interdependence and expand resources and capabilities or competetive situations with negative related goals and threads for the enterprise (Deutsch, 1949).

From VSA perspective the management of the enterprise has to design and to coordinate the relationships created with external systems to better manage the acquisition of resources and the creation of value propositions. The relationships created should influence internal system mechanisms in such a way as necessary to improve mutual value creation and building resources and capabilities necessary for adapting to the changes in the service ecosystem. Or from a enterprise perspective those relationships that are necessary for the continuous feedback to the production processes in order to co-create value propositions. VSA takes a service lens about value co-creation, co-design and co-production among actors. The difference between the approaches of Service Systems and Viable Systems is that Service Systems focus on value creation through interaction in a network, while Viable Systems focus on the adaptability of a system (e.g. an organization) to ensure its viability. The latter contains mechanisms and opportunities to grow, learn, develop and adapt becoming more efficient in the context of dynamic networks (Barile & Polese, 2010a; Gaetano M Golinelli & Gatti, 2001; J. C. Spohrer, 2021).

Service Dominant Architecture (SDA)

Architecture is understood as process and output of planning, designing and creating buildings and other structures (Alexander, 1977; Gamma et al., 1995; Warg & Deetjen, 2021a). Architectures exist in the culture of organisations and become dominant when they improve the adaptability of organisations to change (Jim Spohrer et al., 2022). The latter, as organizing logic for business processes and IT are also referred to as enterprise architecture. Enterprise architectures provide a longterm view of a companies processes, systems and technologies (Behara, 2023; Ross, Weill, & Robertson, 2006). Solution architectures differ from enterprise architectures, particularly in terms of scope and focus. In contrast to enterprise architectures the scope of solution architectures is not the hole organisation but the process and structure of a specific solution. Solution architectures are designed, built and managed to fulfil specific business requirements of an organisation's business unit. This involves identifying the business, application, data and technology components required for the solution, as well as the interactions and dependencies between all these components (Banerjee & Aziz, 2007; Behara, 2023).

Within actor-to-actor networks architectures devise and facilitate the puposeful participation and coordination of actors in the process of value co-creation (Lusch & Nambisan, 2015). By linking institutional arrangements with (design) patterns Service Dominant Architecture enables the engagement, participation and coordination of actors in the entire, purposeful and organized process. In the sense of Giddens (Giddens, 1984) "duality of structure" SDA is a structure (set of patterns) as medium (design patterns) and outcome (instantiated patterns) of the conduct and processes it recursively organizes (Lusch & Nambisan, 2015; Jim Spohrer et al., 2022; Warg & Deetjen, 2021b). As agile emergent architecture SDA evolves reflexivity over the different stages of the process of creating structures from planning through design to implementation of structures. Implemented by responsible actors - e.g. in form of use cases - the five SDA systems evolve from intangible design patterns (like a construction plan) to tangible patterns and service systems, e.g. as service platform (Bradley, 2018; InformationWeek, 2009; Ross et al., 2006; Stephen L Vargo et al., 2022). SDA prescribes the interplay of actors and resources and defines the rules of exchange. Service Dominant Architecture (SDA) is grounded in S-D Logic and Service Science and provides an organizing logic for reflexively shaping organizations, service platforms, and service ecosystems through five systems as design patterns aimed at making it possible to coordinate actors and to build and orchestrate capabilities in a systematic way. SDA provides a transcending perspective on enterprise architecture by reimagining the enterprise as structure of five patterns in the terms of S-D Logic and Service Science, supporting five specific roles: (1) value co-creation of actors by sense-and-respond interactions, (2) co-production of actors by frictionless onboarding and participation of partners and their resources, (3) rapid integration of operant resources (including employees) for resource density and service innovations, (4) improved insights from data for all stakeholders, and (5) actor coordination by institutions as rules and norms (service catalog) (Jim Spohrer et al., 2022, p. 64).

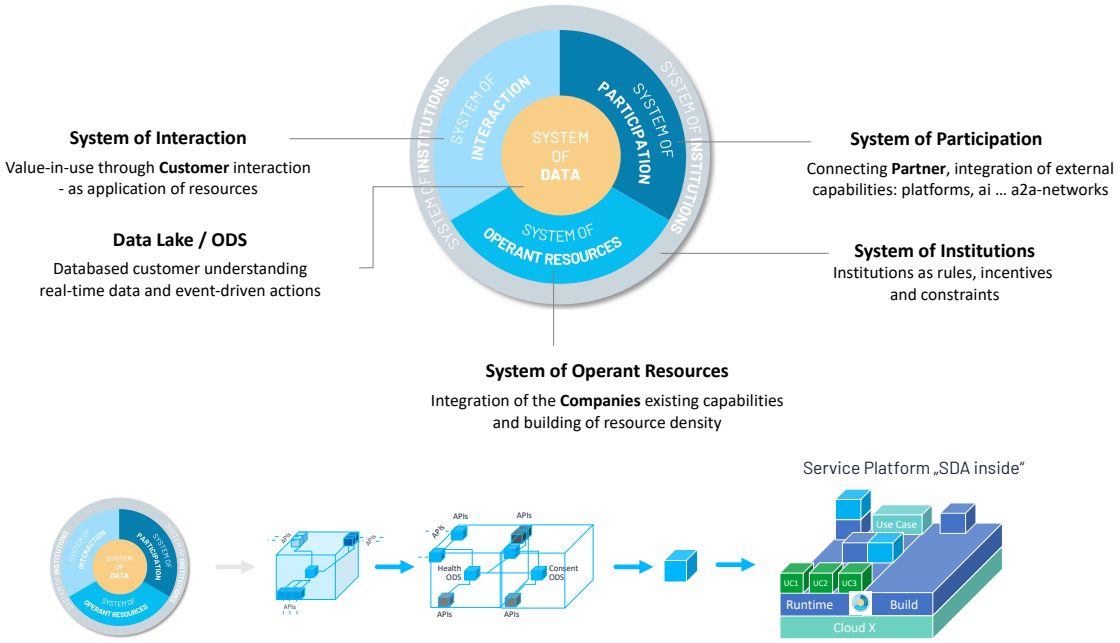

Figure 3 Service Dominant Architecture

In accordance with the Viable Systems Approach SDA enables the accomplishment of viable behavior by making it possible for responsible actors (e.g., individuals, companies, and organizations) to design and create the relationships with external systems, e.g. with purposeful shaped patterns for persistence of internal and external structures. SDA facilitates responsible actors to act in the context of openness and connectivity in a meaningful way and to organize and build actor-to-actor networks in the transdisciplinary process of value co-creation (Jim Spohrer et al., 2022, p.64). Starting with a target process and use case in the first step the roles of the actors are defined and mapped to the five design patterns. In this step the patterns serve as structure (design patterns) like a construction plan. In a second step follows the instantiation as specific technical implementation. In this step out of a target process perspective the missing services - understood as these services which are not enabled by the mapped resources and capabilities of the connected actors - are identified, elaborated and realized as software-microservices. All implemented services are allocated to the five SDA patterns. In this way SDA as structure and output evolves reflexively by service for service exchange and with each use case implemented by responsible actors. After the state of a SDA service system is improved (e.g. by data integration), the system drives value for the other SDA service systems. This mutual value creation of the SDA systems is fostered by the persistence of their structures (figure 3). For example, data are fed into the operational data store (System of Data) as a result of interactions (System of Interaction). Thus, enabling data analytics and advanced forms of collaboration. Resources become accessible, exchangeable and tradeable via the service catalog (System of Institutions), and resource density as precondition for service innovations as new resource combinations is built. According to the properties that differentiates emergent architectures from the traditional approaches SDA recognizes the broader service ecosystem and enables control over the constituents. Thus, SDA provides the fundamental structures, patterns and rules for facilitating the purposeful shaping of organizational enterprise architectures (InformationWeek, 2009; Jim Spohrer et al., 2022, p.65).

Theory adaptation and findings

Table 1 summarises the knowledge base of the domain theory and the method theories arrayed on the following key variables: mindset, value, venue of value creation, role of product, role of customer, role

of company, relationship of actors, and role of networks. By adaptation of the service perspectives the lean management scope is extended to generate novel insights and to amend lean management approaches and strategies in dynamic networks. To this end, based on this theory adaptation design principles as generalized outcomes are carved out.

In contrast to the Goods-Dominant lean management mindset the theories and concepts of service offer an alternative model. Economic activity is conceptualized in terms of service for service exchange and mutual value creation. Value is generated as benefit provided through service as a process. Service provision as a process can include products as carrier for services and input for value but can also create value independently from the sale of products. Gummesson formulated "activities render services, things render services". The shift in focus to services is a shift in the mindset from the means and the producer perspective to the utilization and the customer perspective" (Gummesson, 1995, p. 250). But the Goods-Dominant lean management approaches and the service concepts separates more than the mental model and the mindset. For the latter value is obtained through the application of resources, which are integrated from a wide range of networked actors. Resources are obtained by service-for-service exchange, and the beneficiary as primary resource integrator is the venue of value creation and the only one that must always be involved. In contrast to the lean management approach from the service perspectives all actors are both providers and beneficiaries. Hence, the value chain associated with lean management and Goods-Dominant Logic becomes a “value constellation” (Normann & Ramirez, 1993; Stephen L Vargo, 2021), conceptualized in the service theories as a “service ecosystem,” with the firm and the customer understood as just two of the actors in dynamic many-to-many networks of resource-integrating and service-providing (and service-receiving) actors. In these networks the company is from a service perspective a co-creator of value and not the producer of value as in the case of the lean management approaches.

Theory Key Variables	Lean Management	Service	Extended Design Principles
Mindset	Goods-Dominant; value chain; continuous process improvement (kaizen)	Service-Dominant; value constellation; mutual value creation	Service for service exchange; actor to actor networks
Value	Created by producer	Co-created by many actors - including the beneficiary	Value co-creation; resouce integration
Venue of value creation	Producer; objects; data	Beneficiary	Beneficiary as venue of value creation
Role of product	Output = value	Input -> renders services -> value in use	Product renders services; service provision
Role of customer	Pulls value as product; "willingness to pay"	Co-creates value; interactiv; resource integrator	Customer as co-creator of value
Role of Company	Producer of value; improving process and value; waste reduction	Co-creator; co-producer; reflexively shaping patterns and institutions	Mutual value creation; shaping patterns and institutions (e.g. service platforms); resource density; Service innovations
Relationship of actors	Dyadic; value chain; supply chain; transactional	Actor to actor; many to many; value constellation; relational; coordinated by institutions	Many to many; service for service exchange;
Role of network	Object to object; data generation; inter-company data exchange	Actor to actor; value constellations; service exchange e.g. data, knowledge, technologies etc.	Service for service exchange; pool for "Pull" of resources (employee, data, knowledge, capabilities...)

Table 1 Knowledge base, key variables and design principles

By adapting the service lens the scope of lean management is expanded by design principles as generalized outcomes. Putting the network eye-glasses on our noses (Gummesson, 2011) lean management is seen as part of dynamic interactions in complex networks of relationships. This also applies to the phenomenon of value chain-focused lean management approaches. Wearing the network and value-creation constellation eye-glasses broadens the view of lean management from object - and process centricity to the actor perspective (e.g. beneficiary, company) to actor engagement, resource integration and service for service exchange. It is about the emergent properties to "Pull" a broad range of resources from the networks. And thus, to corresponding design principles like illustrated in table 1 are: resource integration, service for service exchange, value co-creation, resource density and service innovations as new combinations of resources.

But how to transform these design principles into capabilities and properties required for the development and implementation of lean management strategies?

As outlined in the context of service innovation by Lusch & Nambisan (Lusch & Nambisan, 2015), architecture plays a central role in facilitating participation and coordination of actors and service exchange. The foundational approach of "architecture as pattern language" (Alexander, 1977) explains architecture as a network of pattern as solutions to typical problems in the architectural process of planning, designing and constructing buildings or other structures. In such a pattern language, patterns implement, embody or rely on specific design principles. They also incorporate the abstract ideas of the principles and formalize them into proven solutions (Gamma et al., 1995; R. C. Martin, 2000). Each pattern describes a specific context, a recurring problem, and a proven solution that can be flexibly applied to various situations (Alexander, 1977). There are different types of patterns like design patterns (Gamma et al., 1995), transformational patterns (Coleman, 1990; Storbacka, Brodie, Böhmann, Maglio, & Nenonen, 2016) or software design patterns (Duell, Goodsen, & Rising, 1997). The patterns differ in their stability and formality. Patterns can arise from repetition and initially have low stability and an informal character. If systematic orders with rules and higher stability emerge from the patterns, these become structures or patterns with structural properties. If these structures and rules solidify into norms with social legitimacy, institutions with higher stability emerge out of these structures and their properties. Institutions can be understood as socially constructed rules, norms and beliefs or in other words as the explicit rules of the game (Edvardsson, Kleinaltenkamp, Tronvoll, McHugh, & Windahl, 2014; North, 1991; Peters et al., 2016; Scott, 2014).
Architecture as a pattern language forms a coherent system of individual patterns, structures and institutions. This system supports the development of complex, adaptable, and sustainable solutions by connecting proven principles and fostering collaboration and learning. A key aspect of modern architectures and their patterns is their adaptability to changing requirements. The concept of 'design for change' plays an important role here. Architecture is understood as both the process and the product of planning, designing, and constructing buildings or other structures (Alexander, 1977; Gamma et al., 1995; Safin, Delfosse, & Leclercq, 2010; Warg & Deetjen, 2021a). By linking institutional arrangements with other patterns architecture (e.g. the demonstrated Service Dominant Architecture) enables the involvement and coordination of actors in the entire and organized process. For example by the definition of rules, tools or formats for service exchange or by patterns for interaction and participation which in case of their application by responsible actors turn into structures, institutions and service systems. In the sense of Giddens (Giddens, 1984) "duality of structure" architecture is both structure (patterns) as the medium (design patterns) and outcome (instantiated patterns as structures) of the conduct and processes it recursively organizes (Jim Spohrer et al., 2022; Warg & Deetjen, 2021b). In summary, architecture plays a foundational role for the transformation and implementation of the elaborated extended desisign principles (table 1). Emergent properties evolve by structuring the interactions and feedbacks among patterns, allowing complex, adaptive, and often unexpected capabilities to arise at the whole-system level of different institutions and patterns. This role of architecture is expressed differently e.g. with different patterns, in the phases of planning, designing and construction of structures. The structural and emergent properties of architecture as structure are both the medium and the outcome of the processes and practices they recursively organise' (Giddens, 1984, p. 25)

(Stephen L Vargo et al., 2022) describe four steps (or orders) in the process of emergence of properties and institutionalization within service ecosystems. These steps explain how new properties and patterns emerge and stabilize in complex social systems such as markets. As demonstrated in figure 4 first-order emergence accounts for the appearance of novel outcomes from ad-hoc resource integration and service for service exchange. Novel outcomes (like new services or solutions) emerge unpredictably from these ad hoc interaction. The first-order outcomes are often fragile and may not persist without further reinforcement by service for service exchange. The emergent outcomes depend on, but differ from, the constituent elements (McLaughlin, 1997; Stephen L Vargo et al., 2022).

Second-order emergence introduces a potential for greater stability and regularity as the emergent property (inter-)acts back on its constitutive elements (Goldstein, 1999; Stephen L Vargo et al., 2022). Repetition and reinforcement create habitual patterns and proto-institutions. Some behaviors become more regular, forming routines as the seeds of institutions.

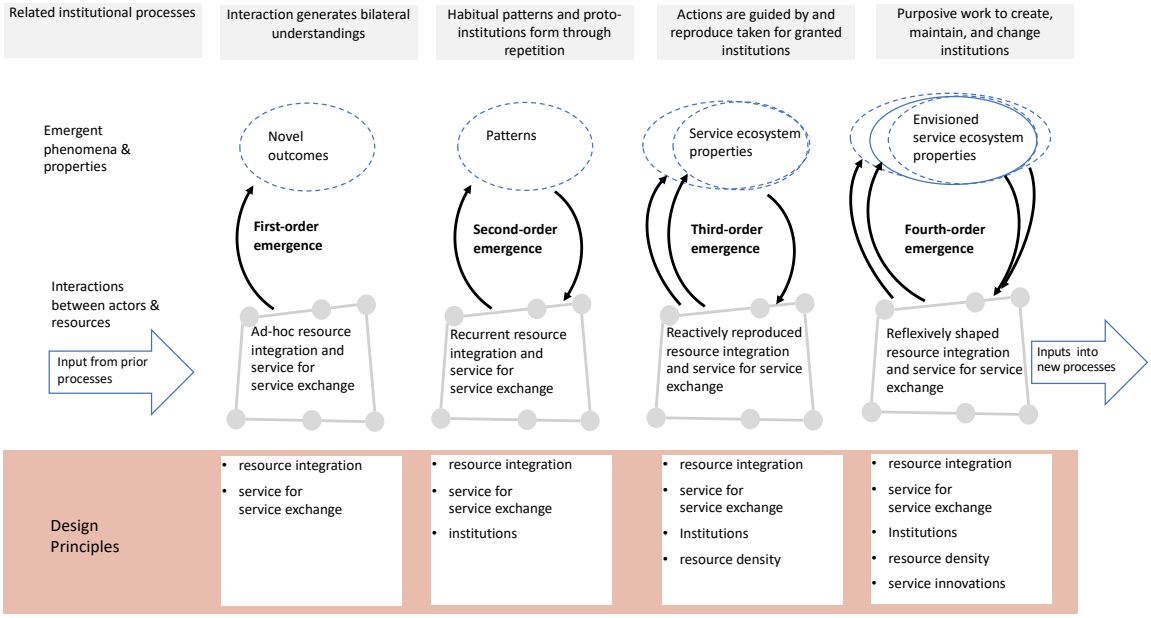

Figure 4 Design principles, emergence and institutionalization processes based on (Stephen L Vargo et al., 2022)

In systems capable of third-order emergence, actors are able to recognize and to reproduce their resource integration and service exchange based on emergent patterns. Such actors exhibit a persistence of internal structures or a type of memory (Ladyman, Lambert, & Wiesner, 2013; R. Martin & Sunley, 2012) that enables pattern recognition. This in turn allows emergent patterns to be reproduced and solidified. Institutions as rules and norms become taken for granted. Institutions guide and stabilize interactions, creating quasi-predictable structures (Barile & Polese, 2010a; Holland, 1992; Stephen L Vargo et al., 2022).

In fourth-order emergence actors intentionally shape resource integration and service exchange to influence the service ecosystem properties. This requires actors with the capacity to envision how their interactions with others affect the service-ecosystem properties. Both the emergence literature and S-D logic recognize this characteristic as reflexivity. Reflexivity and institutional work drive ecosystem evolution or transformation by designing, maintaining or disrupting institutions (Ellis, 2006; Kjellberg, 2018; R. Martin & Sunley, 2012; Stephen L Vargo et al., 2022).

Implications for Lean Management Strategies

In terms of lean management strategies in the context of dynamic networks and in line with the elaborated design principles and findings we distinguish three strategies. The focus of the first strategy is value chain centered ("Porter´s first wave") and on improving single value chains by integrating resources from the network. Recurrent resource integration leads to habitual patterns and proto-institutions like the OCEL format for Object Centric Event Logs.

The second strategy is about the transformation of whole value chains ("Porter´s second wave") by bundling process mining activities, objects and functions on solution platforms which become accepted institutions by being reactively reproduced.
The third strategy reinvents and expands the core mission of lean management. It introduces new value constellations ("Porter´s third wave") like adaptation and scalable learning by extending the scope from a process level to an enterprise and ecolsystem level. Constituting on the properties of first and second order emergence and based on platforms with Service Dominant Architectures, envisioned enterprise capabilities are build.

Value Chain Centered - Making Many Value Chains Better

The first strategy is value chain centered and emphasizes processes and activities that contribute to value creation. The focus is on the observation, modelling and improvement of process activities to increase efficiency, quality and customer satisfaction associated to the specific value chain.

Categorised in the emergence and institutionalization processes of figure 4 this strategy corresponds to the second-order emergence of properties. Inter-company process-mining and recurring resource integration and exchange from activities, data and objects in networks is applied for analyzing complex relationships between processes across organizations. Habitual patterns and proto-institutions emerge by the repetitive application of institututions like the format Object-Centric-Event Logs (OCEL) for storing and exchanging object-centric event data and by backacting of holistic process analysis and inter-company process mining.

The properties of habitual patterns and proto-institutions facilitate "access" as the first level of Hagel´s "Pull" framework. It is about flexible access to known resources, e.g. objects, when the organization knows what is the need (Hagel, Brown, & Davison, 2010, p. 10). This strategy enables organizations to improve many value chains by reducing redundance on an activity level and by increasing standardization of activities.

Solution Centered - Down to One with Solution Platforms

The second strategy is solution centered and focuses on the standardization and transformation of value chains. The organizational scope is on company-wide functions and solutions to reduce redundancies of activities and objects within processes and to unify value chains - "down to one". The aim is to make all processes of the company better, e.g. by consolidating and improving similar activities and objects on one process mining platform. The focus of process mining solution architectures is to design, build and manage solutions for process related business requirements. Solution platforms are used for pulling and integrating capabilities out of the network and for bundling these capabilities (e.g. AI solutions, data infrastructures, models, rules) and thus for fostering the lean management principles like customer-driven production or kanban system with the same solutions for all processes and value chains. AI-based analysis, process visualization across systems, digital twins of processes are examples. These solution platforms also support and expand the functionalities for modelling, analyzing and improving processes between companies.

Categorized in the emergence and institionalization process of figure 4 this strategy correspondends to the third order emergence. Organizations as actors are able to reproduce their resource integration and service exchange in the context of process mining based on the patterns of the solution platform. The actions are guided by the solution platform and the properties of the platform are accepted as granted institutions. Regardless of whether the solution platform is part of the organisation or is used ‘as a service’, the actors in this category are characterised by a persistence of their internal structures, which enables pattern recognition and the application of the properties of the solution platform.

In regard to Hagel´s "Pull" framework this strategy goes beyond "access" to network resources and matches with level two "attract". As demonstrated in figure 5 on behalf of the Celonis process mining solution platform, organizations are enabled to draw on properties analytics, apps, process data, models, KPIs etc.. Including properties the organizations were not previous aware of. Key features are serendipity, relationships and platforms like shown in figure 5.

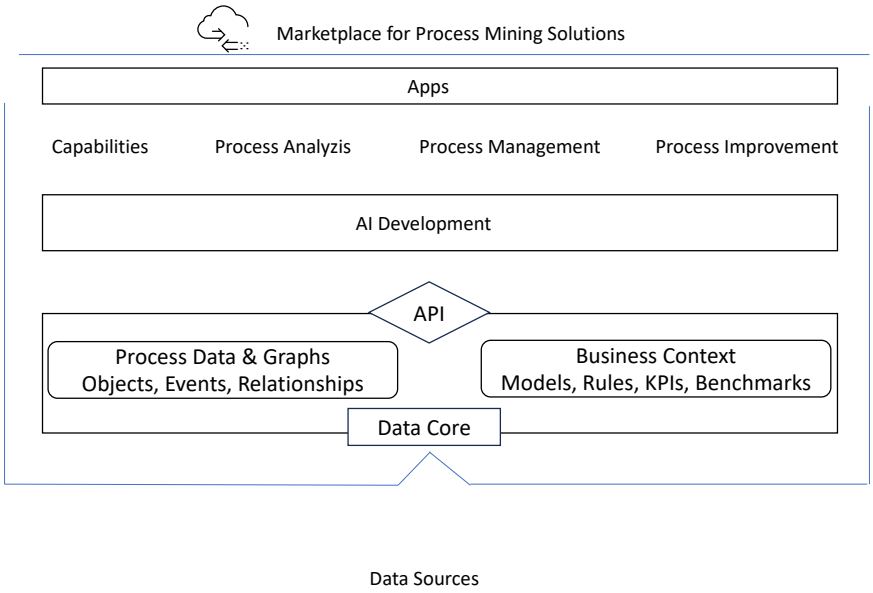

Figure 5 Process Mining Solution Platform based on Celonis (Celonis, 2025)

Attracting properties from the service ecosystem allows organizations to benefit from unexpected discoveries and connections that can lead to innovation and accelerated organizational learning.

Value Constellation Centered - Leading with Context and Service Platforms

The third strategy is value constellation centered. The organizational scope is to expand the companys core mission on an enterprise and ecosystem level. Strategy three is about scalable learning and continuously building knowlege for improving and shaping value constellations as roles and relationships within dynamic networks.

Categorized in the emergence and institionalization process of figure 4 this strategy correspondends to "Fourth-order" emergence. This strategy is characterized by intentionality. By purpositive engagement to create, maintain or change institutions. In this category actors purposeful apply architectures to shape resource integration, service for service exchange and institutions. Adaptation and pattern recognition are intentionally fostered. Actions are self-referential, intentionally and reflexitiv. The service for service exchange is reflexively shaped. Beyond the persistence of internal and external structures, which enables pattern recognition, actors are aware of the properties and their role in producing them. As a consequence of intentionallity the heterogeneity of properties (e.g. technical services) arises not only from their functional diversity, but also from the envisioned variance of their non-functional requirements. Properties in the areas of scalability, robustness, and resilience are foreseeable from a business perspective and significantly shape institutiones e.g. in the software implementation. One example is a business service such as "checking an address for correctness". In some application

contexts, this service requires massive scaling and, in others, the strict avoidance of false positives. Both requirements need actor awareness in regard to the properties, e.g. required precautions in the technical implementation, and its role in producing them.

It is about "breathing organizations" evolving the "Pull" of resources and capabilities out of the network to improve the viability and adaptability of the organization on an enterprise level. It matches with level three "achieve" of Hagel´s "Pull" framework. It is about achieving the full potential of an organization. It goes beyond accessing resources or attracting people or solutions. "Achieve" is about leveraging organizational capabilities to learn more rapidly, to improve and innovate.

As shown in figure 6 in this strategy solution platforms for lean management are not a final "output" but a central "input" (e.g. celonis connected via the "system of participation") for developing the organization with service platforms. The scope of this strategy is about the ongoing process to gain adaptation advantages by learning, unlearning, and adapting knowledge and skills to thrive in a rapidly changing environment. The co-production of value is shifted to an enterprise and ecosystem level. Additional resources (e.g. AI based document recognition) are integrated. Customers are mobilized to engage in the value co-creation process, for example, by scanning documents with their devices, as shown in Figure 6.

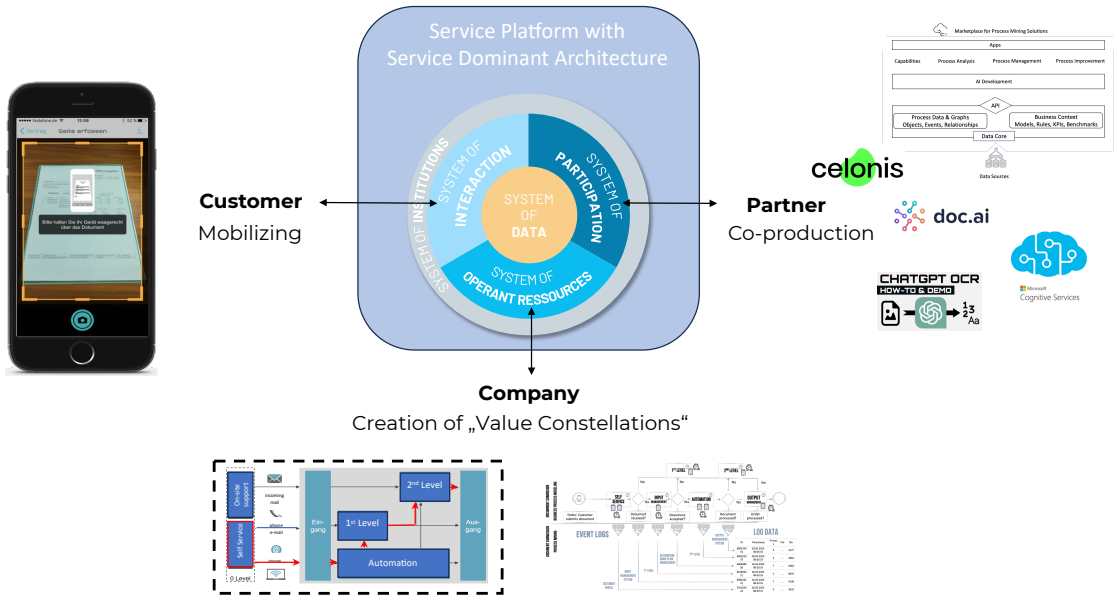

Figure 6 Enterprise service platform based value constellation

Finally, as characteristic for value constellations the roles and relationships among actors are reconfigurated. Relationships to partners and customers are actively redesigned to better align capabilities with customer needs, rather than merely optimizing a fixed position in a linear value chain.

Table 2 compares and briefly summarizes the three strategies.

Strategy (Porter et al., 2014)	Focus	Emergence Order (Vargo et al., 2022)	Key Enablers	Network "Pull" Level (Hagel et al., 2010)	Organizational Scope
Value Chain Centered	Improving value chains; "Making many value chains better "	2nd Order	Inter-company process mining, Object Centric Event Logs (OCEL)	Access	Process level, (recurring actions)
Solution Centered	Platformizing capabilities across processes; „Down to one with solution platforms"	3rd Order	Process mining platforms, AI tools	Attract	Company-wide; (patterns, institutions)
Value Constellation Centered	„Leading with context and service platforms"; adaptation, breathing organization, scalable learning	4th Order	Service Dominant Architectures, reflexivity, actor coordination	Achieve	Enterprise & ecosystem level, (reflexivity)

Table 2 Comparing the three lean management strategies

Conclusions and Outlook

This paper sets out to rethink lean management strategies through a service-dominant perspective, reframing traditional value chain-focused approaches considering dynamic, networked environments. By applying a service lens grounded in Service-Dominant Logic (S-D Logic), Service Science, the Viable Systems Approach (VSA), and Service Dominant Architecture (SDA), the classical lean management mindset is extended toward value creation constellations and service ecosystems. The integration of these theoretical perspectives enabled the development of design principles and patterns to support strategic adaptability, co-creation, and long-term viability in increasingly complex organizational settings.

The research culminates in the articulation of three lean management strategies in line with "Porter's three waves" of IT transformation: "value chain centered", "solution centered", and "value constellation centered". The first strategy is "value chain centered" and focuses on improving existing value chains through data-driven process mining and inter-company transparency. It enhances operational efficiency and supports standardized formats such as Object-Centric Event Logs (OCEL) for improved cross-organizational collaboration. The second strategy is "solution centered" and leverages solution platforms to consolidate and streamline functions across multiple value chains, reducing redundancies while enabling scalable process innovation. Here, solution architectures and AI tools are instrumental in institutionalizing best practices and aligning processes across departments or actors.

The most advanced strategy is "value constellation centered" and extends lean management to the ecosystem level. It encourages organizations to reflexively shape their institutional environments and resource integration patterns through emergent architectures. Service Dominant Architecture plays a foundational role in the envisioned coordination of actor interactions and in driving value co-creation through patterns, structures, and institutional arrangements. This strategy supports organizational learning and adaptability, enabling enterprises to "pull" capabilities from dynamic networks and thrive amid constant change.

Looking ahead, the paper underscores the vital role of architectural thinking, especially pattern-based and agile emergent architectures, as both a construction plan and evolutionary force and instantiated structures in organizational design. These architectures are not static outputs but dynamic inputs in the ongoing management of organizations as viable systems. They mediate the transition from informal

patterns to formalized institutions, thereby fostering service innovations as emergent combinatorial evolutions in the course of increasing resource density through purposeful resource integration on service platforms.

Future research and practice should explore how organizations can more systematically adopt Service Dominant Architectures in conjunction with process mining and object-centric approaches. Doing so promises a deeper institutional embedding of adaptability, resource density, and service innovation. Moreover, greater attention should be given to the reflexivity of actors within service ecosystems, particularly how they intentionally influence their own actions, structures, or persistence within dynamic network environments.

The convergence of lean principles, service science, and digital process mining heralds a shift from rigid efficiency toward intelligent adaptability. Organizations that succeed in this transition will not only reduce waste but also generate novel value through collaborative, responsive, and resilient configurations. Ultimately, the service lens reveals that the future of lean management lies not in perfecting isolated chains, but in orchestrating rich, evolving constellations of value co-creation across dynamic networks.

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References

Alexander, Christopher. (1977). *A pattern language: towns, buildings, construction*: Oxford university press.

Arnold, Horace Lucian, & Faurote, Fay Leone. (1915). *Ford methods and the Ford shops*: Engineering Magazine Company.

Arthur, W. Brian. (2009). *The nature of technology: What it is and how it evolves*: Simon and Schuster.

Banerjee, Jaidip, & Aziz, Sohel. (2007). SOA: the missing link between enterprise architecture and solution architecture. *SETLabs briefing, 5*(2), 69-80.

Barile, Sergio, Pels, Jaqueline, Polese, Francesco, & Saviano, Marialuisa. (2012). An introduction to the viable systems approach and its contribution to marketing. *Journal of Business Market Management, 5*(2), 54-78.

Barile, Sergio, & Polese, Francesco. (2010a). Linking the viable system and many-to-many network approaches to service-dominant logic and service science. *International Journal of Quality and Service Sciences, 2*(1), 23-42.

Barile, Sergio, & Polese, Francesco. (2010b). Smart service systems and viable service systems: Applying systems theory to service science. *Service Science, 2*(1-2), 21-40.

Bastiat, Frédéric, & Huszar, George Bernard. (1964). *Selected essays on political economy*: Van Nostrand Princeton.

Behara, Gopala Krishna. (2023, 20230308). Enterprise Architecture vs. Solution Architecture. *Architecture & Governance Magazine*.

Berti, Alessandro, & van der Aalst, Wil MP. (2023). OC-PM: analyzing object-centric event logs and process models. *International Journal on Software Tools for Technology Transfer, 25*(1), 1-17.

Bradley, Charles. (2018). An Introduction to Agile Emergent Architecture - Always Intentional.

Brezing, Christian. (2025). The History of Lean Management. Retrieved from https://www.lcmd.io/en/blog/the-history-of-lean-management

Celonis. (2025). Celonis Process Mining Platform.

Coase, Ronald H. (1937). The nature of the firm. *Economica, 4*(1993), 396-405.

Coleman, James S. (1990). *Foundations of social theory*: Harvard university press.

Deutsch, Morton. (1949). A theory of co-operation and competition. *Human relations, 2*(2), 129-152.

Drucker, Peter F. (1995). Concept of the Corporation. With a New Introduction by the Author. In: New Brunswick: Transaction. 2nd Printing.
Duell, Michael, Goodsen, John, & Rising, Linda. (1997). *Non-software examples of software design patterns.* Paper presented at the Addendum to the 1997 ACM SIGPLAN conference on Object-oriented programming, systems, languages, and applications (Addendum).
Edvardsson, Bo, Kleinaltenkamp, Michael, Tronvoll, Bård, McHugh, Patricia, & Windahl, Charlotta. (2014). Institutional logics matter when coordinating resource integration. *Marketing Theory, 14*(3), 291-309.
Ellis, GFR. (2006). On the Nature of Emergent Reality,(w:) P. Clayton/P. Davies (red.), The Re-Emergence of Emergence. In: Oxford.
Gamma, Erich, Helm, Richard, Johnson, Ralph, & Vlissides, John. (1995). Design Patterns - Elements of reusable object-oriented software. *Reading: Addison-Wesley*.
Gartner. (2019). Market Guide for Process Mining. Retrieved from https://assets-global.website-files.com/609ce44d3dfdab98b5019cf9/6141f0f5cfa3b70ccbb56c76_Market_Guide_for_Process_Mining.pdf
Ghahfarokhi, Anahita Farhang, Park, Gyunam, Berti, Alessandro, & van der Aalst, Wil MP. (2021). *Ocel: a standard for object-centric event logs.* Paper presented at the European Conference on Advances in Databases and Information Systems.
Giddens, Anthony. (1984). *The constitution of society: Outline of the theory of structuration*: Univ of California Press.
Goldstein, Jeffrey. (1999). Emergence as a construct: History and issues. *Emergence, 1*(1), 49-72.
Golinelli, Gaetano M, & Gatti, Mauro. (2001). The firm as a viable system. *Symphonya. Emerging Issues in Management*(2), 38-63.
Golinelli, Gaetano Maria, Barile, Sergio, Spohrer, Jim, & Bassano, Clara. (2010). *The evolving dynamics of service co-creation in a viable systems perspective.* Paper presented at the The 13th Toulon-Verona Conference proceedings of the International Conference in Coimbra, Portugal.
Gregor, Shirley, Chandra Kruse, Leona, & Seidel, Stefan. (2020). Research perspectives: the anatomy of a design principle. *Journal of the Association for Information Systems, 21*(6), 2.
Grönroos, Christian. (1994). From scientific management to service management: a management perspective for the age of service competition. *International Journal of Service Industry Management, 5*(1), 5-20.
Gummesson, Evert. (1994). Service management: an evaluation and the future. *International Journal of Service Industry Management, 5*(1), 77-96.
Gummesson, Evert. (1995). Relationship marketing: its role in the service economy. *Understanding services management, 244*, 68.
Gummesson, Evert. (2011). *Addressing service complexity and value through network theory: Many-to-many marketing*. Paper presented at the The Naples Forum on Service, Capri, Italy.
Gummesson, Evert. (2017). From relationship marketing to total relationship marketing and beyond. *Journal of Services Marketing, 31*(1), 16-19.
Gummesson, Evert, Mele, Cristina, & Polese, Francesco. (2019). Complexity and viability in service ecosystems. In (Vol. 19, pp. 3-7): SAGE Publications Sage UK: London, England.
Gummesson, Evert, & Polese, Francesco. (2009). B2B is not an island! *Journal of Business & Industrial Marketing, 24*(5/6), 337-350.
Hagel, John, Brown, John Seely, & Davison, Lang. (2010). *The power of pull: How small moves, smartly made, can set big things in motion*: New York: Basic Books.
Hanelt, André, Bohnsack, René, Marz, David, & Antunes Marante, Cláudia. (2021). A systematic review of the literature on digital transformation: Insights and implications for strategy and organizational change. *Journal of management studies, 58*(5), 1159-1197.
Hannan, Michael T, & Freeman, John. (1984). Structural inertia and organizational change. *American sociological review*, 149-164.
Hannan, Michael T, & Freeman, John. (1986). *Where do organizational forms come from?* Paper presented at the Sociological Forum.
Hines, Peter, & Rich, Nick. (1997). The seven value stream mapping tools. *International Journal of Operations & Production Management, 17*(1), 46-64.
Holland, John H. (1992). Complex adaptive systems. *Daedalus, 121*(1), 17-30.
InformationWeek. (2009). Gartner Advises Enterprises To Adopt An 'Emergent Architecture'. Retrieved from https://www.informationweek.com/data-management/gartner-advises-enterprises-to-adopt-an-emergent-architecture-
Jaakkola, Elina. (2020). Designing conceptual articles: four approaches. *AMS Review*, 1-9.

Kaelble, Steve. (2024). *Process Mining For Dummies, Celonis 2nd Special Edition*.
Kjellberg, Hans. (2018). Attending to actors and practices: Implications for service-dominant logic. In (pp. 466-482): Thousand Oaks, CA: Sage.
Krafcik, John F. (1988). Triumph of the lean production system. *MIT Sloan Management Review, 30*(1), 41.
Ladyman, James, Lambert, James, & Wiesner, Karoline. (2013). What is a complex system? *European Journal for Philosophy of Science, 3*, 33-67.
Lee, Jong Seok, Pries-Heje, Jan, & Baskerville, Richard. (2011). *Theorizing in design science research.* Paper presented at the Service-Oriented Perspectives in Design Science Research: 6th International Conference, DESRIST 2011, Milwaukee, WI, USA, May 5-6, 2011. Proceedings 6.
Luhmann, Niklas. (1984). *Soziale systeme: grundriss einer allgemeinen theorie*: Suhrkamp.
Lusch, Robert F, & Nambisan, Satish. (2015). Service Innovation: A Service-Dominant Logic Perspective. *MIS Quarterly, 39*(1), 155-175.
MacInnis, Deborah J. (2011). A framework for conceptual contributions in marketing. *Journal of Marketing, 75*(4), 136-154.
Martin, Karen, & Osterling, Mike. (2014). Value stream mapping: how to visualize work and align leadership for organizational transformation. *(No Title)*.
Martin, Robert C. (2000). Design principles and design patterns. *Object Mentor, 1*(34), 597.
Martin, Ron, & Sunley, Peter. (2012). Forms of emergence and the evolution of economic landscapes. *Journal of Economic Behavior & Organization, 82*(2-3), 338-351.
McLaughlin, Brian P. (1997). Emergence and supervenience. *Intellectica, 25*(2), 25-43.
Mele, Cristina, Pels, Jacqueline, & Polese, Francesco. (2010). A brief review of systems theories and their managerial applications. *Service Science, 2*(1-2), 126-135.
Meredith, Jack. (1993). Theory building through conceptual methods. *International Journal of Operations & Production Management, 13*(5), 3-11.
Nadkarni, Swen, & Prügl, Reinhard. (2021). Digital transformation: a review, synthesis and opportunities for future research. *Management Review Quarterly, 71*, 233-341.
Normann, Richard, & Ramirez, Rafael. (1993). From value chain to value constellation: Designing interactive strategy. *Harvard business review, 71*(4), 65-77.
North, Douglass C. (1991). Institutions, Institutional Change and Economic. In: Cambridge.
Parsons, Talcott. (1951). The social system. *IL The Free Press of Glencoe Google Scholar*.
Peters, Christoph, Maglio, Paul, Badinelli, Ralph, Harmon, Robert R, Maull, Roger, Spohrer, James C, . . . Demirkan, Haluk. (2016). Emerging Digital Frontiers for Service Innovation. *Communications of the Association for Information Systems, 39*(1).
Polese, Francesco, Mele, Cristina, & Gummesson, Evert. (2017). Value co-creation as a complex adaptive process. *Journal of Service Theory and Practice, 27*(5), 926-929.
Polese, Francesco, Russo, Giuseppe, & Carrubbo, Luca. (2009). *Service Logic, Value Co-Creation and Networks: Three Dimensions Fostering Inter-Organizational Relationships: Competitiveness in the Boating Industry.* Paper presented at the Proceedings of the 12th QMOD and Toulon-Verona Conference.
Porter, M. E. (2001). Strategy and the Internet. *Harvard business review, 79*(3), 62-79.
Porter, M. E., & Millar, V. E. (1985). How information gives you competitive advantage. *Harvard business review, 63*(4), 149-160.
Porter, Michael E, & Heppelmann, James E. (2014). How smart, connected products are transforming competition. *Harvard business review, 92*(11), 64-88.
Reinkemeyer, L, & Davenport, T. (2023). Transform business operations with process mining. *Harvard business review*.
Rigby, Darrell K. (2025). The power of strategic fit. *Harvard business review, March-April 2025*.
Ross, Jeanne W, Weill, Peter, & Robertson, David. (2006). *Enterprise architecture as strategy: Creating a foundation for business execution*: Harvard Business Press.
Safin, Stéphane, Delfosse, Vincent, & Leclercq, Pierre. (2010). Mixed-reality prototypes to support early creative design. *The Engineering of Mixed Reality Systems*, 419-445.
Schumpeter, Joseph. (2017). *Theorie der wirtschaftlichen Entwicklung*: Duncker und Humblot.
Schumpeter, Joseph. (2021). Capitalism, socialism and democracy.
Scott, W Richard. (2014). Institutions and organizations: Ideas. *Interests, and Identities*.
Shimada, Haruo, & MacDuffie, John Paul. (1986). Industrial relations and" humanware"--Japanese investments in automobile manufacturing in the United States.

Spohrer, Vargo, Stephen L, Caswell, Nathan, & Maglio, Paul P. (2008, 2008). *The service system is the basic abstraction of service science.* Paper presented at the Proceedings of the 41st Annual Hawaii International Conference on System Sciences (HICSS 2008).
Spohrer, J, Maglio, PP, Bailey, J, & Gruhl, D. (2007). Steps toward a science of service systems. *Computer, 40*(1), 71-77.
Spohrer, J. C. (2021). Service Science & Service Innovation. Blog Retrieved from http://service-science.info/archives/5443 (2021)
Spohrer, Jim, & Maglio, Paul (Eds.). (2010). *Toward a Science of Service Systems: Value and Symbols*.
Spohrer, Jim, Maglio, Paul P, Vargo, Stephen L, & Warg, Markus. (2022). *Service in the AI era: Science, logic, and architecture perspectives*: Business Expert Press.
Storbacka, Kaj, Brodie, Roderick J, Böhmann, Tilo, Maglio, Paul P, & Nenonen, Suvi. (2016). Actor engagement as a microfoundation for value co-creation. *Journal of Business Research, 69*(8), 3008-3017.
Van der Aalst, Wil. (2012). Process mining: Overview and opportunities. *ACM Transactions on Management Information Systems (TMIS), 3*(2), 1-17.
Van der Aalst, Wil MP. (2022). Process mining: a 360 degree overview. In *Process Mining Handbook* (pp. 3-34): Springer.
Van der Aalst, Wil MP. (2023). Twin Transitions Powered By Event Data.
Van der Aalst, Wil MP, Schonenberg, M Helen, & Song, Minseok. (2011). Time prediction based on process mining. *Information Systems, 36*(2), 450-475.
Van der Aalst, Wil MP, & Weijters, A. J. M. M. (2004). Process mining: a research agenda. *Computers in industry, 53*(3), 231-244.
Van der Aalst, WMP. (2023). Object-Centric Process Mining: Unraveling the Fabric of Real Processes. Mathematics 2023, 11, 2691. In.
Vargo, S. L., & Lusch, R. F. (2011). It's all B2B... and beyond: Toward a systems perspective of the market. *Industrial Marketing Management, 40*(2), 181-187.
Vargo, Stephen L. (2021). Beyond circularity—A Service-dominant (SD) logic perspective. *Circular Economy and Sustainability, 1*(1), 257-260.
Vargo, Stephen L, & Lusch, Robert F. (2018). *The SAGE handbook of service-dominant logic*: SAGE Publications Limited.
Vargo, Stephen L, Peters, Linda, Kjellberg, Hans, Koskela-Huotari, Kaisa, Nenonen, Suvi, Polese, Francesco, . . . Vaughan, Claudia. (2022). Emergence in marketing: an institutional and ecosystem framework. *Journal of the Academy of Marketing Science*, 1-21.
Vargo, Stephen L., & Lusch, Robert F. (2004). Evolving to a New Dominant Logic for Marketing. *Journal of Marketing, 68*(January), 1-17.
Vargo, Stephen L., & Lusch, Robert F. (2008). Service-dominant logic: continuing the evolution. *Journal of the Academy of Marketing Science, 36*(1), 1-10.
Vargo, Stephen, & Lusch, Robert. (2016). Institutions and axioms: an extension and update of service-dominant logic. *Journal of the Academy of Marketing Science, 44*(1), 5-23.
Vial, Gregory. (2019). Understanding digital transformation: A review and a research agenda. *The Journal of Strategic Information Systems, 28*(2), 118-144.
Von Bertalanffy, Ludwig. (1950). The theory of open systems in physics and biology. *Science, 111*(2872), 23-29.
Warg, Markus, & Deetjen, Ulrike. (2021a). Human Centered Service Design (HCSD): Why HCSD Needs a Multi-level Architectural View. In *International Conference on Applied Human Factors and Ergonomics* (pp. 249-256): Springer.
Warg, Markus, & Deetjen, Ulrike. (2021b). *Why co-creation in service ecosystems needs an architectural view*. Paper presented at the 30.th RESER International Congress and Coval Conference, Alcala, Spain.
Weijters, AJMM, & van der Aalst, Wil MP. (2001). *Process mining: discovering workflow models from event-based data.* Paper presented at the Belgium-Netherlands Conf. on Artificial Intelligence.
Weiss, Peter; Warg, Markus; Zolnowski, Andreas. (2023). *Service Design Patterns for Transforming Business with Service Dominant Architecture (SDA): Insights from a Longitudinal Case Study*. Paper presented at the XXXIII. International RESER Conference, Sierre Switzerland.
Wieland, Heiko, Polese, Francesco, Vargo, Stephen L, & Lusch, Robert F. (2012). Toward a service (eco) systems perspective on value creation. *International Journal of Service Science, Management, Engineering, and Technology (IJSSMET), 3*(3), 12-25.
Womack, James P, & Jones, Daniel T. (1994). From lean production to lean enterprise. *Harvard business review, 72*(2), 93-103.

Womack, James P, & Jones, Daniel T. (2003). Banish waste and create wealth in your corporation. *Recuperado de http://www. kvimis. co. in/sites/kvimis. co. in/files/ebook_attachments/James, 56*.

Womack, James P, Jones, Daniel T, & Roos, Daniel. (2007). *The machine that changed the world: The story of lean production--Toyota's secret weapon in the global car wars that is now revolutionizing world industry*: Simon and Schuster.