Service Innovation through Data Ecosystems – Designing a Recombinant Method

Research Paper

Philipp Hansmeier[1], Philipp zur Heiden[1], and Daniel Beverungen[1]

[1] Paderborn University, Department of Business Administration and Economics, Paderborn, Germany
{philipp.hansmeier,philipp.zur.heiden,daniel.beverungen}@uni-paderborn.de

Abstract. Service research has provided robust support for designing service systems in which service providers and customers co-create value-in-use for mutual benefit. However, with the rise of ecosystems—driven by new information technologies such as public data spaces—service innovation increasingly extends beyond service systems to encompass service ecosystems. While service science has started to explore the broader conceptual implications of this shift, its concrete impact on service innovation and service system engineering methods remains vague. In this design science research paper, we identify key implications of the shift towards service ecosystems for service innovation. We posit that service innovation needs to include analyzing the broader service ecosystem and accounting for the repercussions of service system transformation that occur on an ecosystem level. We design the RE-SIDE (recombinant service innovation through data ecosystems) method and apply it to an innovative service that is enabled by a cultural data space.

Keywords: Service Ecosystem, Data Ecosystem, Data Space, Service Engineering, Design Science Research

1 Introduction

Service innovation enables co-creating superior value through recombining operand and operant resources (Beverungen et al., 2018; Vargo & Lusch, 2004). In the extant literature, however, service innovation has predominantly been discussed at the service system level. A variety of methods have been proposed to structure the service innovation process (e.g., Lee & AbuAli, 2011; Zhang et al., 2003), comprising, for instance, market and customer need analysis (e.g., Porter, 2008; van der Lelie, 2006), and service blueprinting (e.g., Bitner et al., 2008; Shostack, 1982). However, the scope of the available service innovation methods is limited to service systems (Maglio & Spohrer, 2008) that support dyadic interactions, with actors being people or organizations.

Beyond the service system level, service ecosystems add a layer of complexity to service innovation methods. For instance, public data spaces (Beverungen et al., 2022) can bring together numerous customers and providers, providing them with profound

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opportunities for innovation and interaction. In the automotive and agricultural sectors, for instance, service ecosystems are emerging based on data spaces like Catena-X and Agri DataSpace, enabling actors to co-create value through data exchange (Agri Dataspace, 2024; Catena-X, 2024). Beyond value co-creation, service ecosystems can also help to establish new innovation practices through data sharing (Wang, 2021) if the actors can establish new organizational innovation practices. From a technological perspective, the extant literature defines data ecosystems as socio-technical systems that are fundamentally driven by digital infrastructures that enable participants to share their (personal and non-personal) data while retaining data sovereignty (Heinz et al., 2022; Möller et al., 2024). For instance, data might be shared to foster advanced analytics or enrich datasets (Jarke et al., 2019). Data ecosystems can promote innovation in service ecosystems—a continuously evolving set of loosely coupled actors developing and implementing service innovations (Chae, 2019; Vargo et al., 2017; Wang, 2021).

We posit that technological and organizational aspects must align to promote service innovation on an ecosystem level. From conducting a structured literature review (vom Brocke et al., 2009) as a preliminary study, we identify that current service innovation methods fall short of considering the interplay of data ecosystems and service ecosystems. In a design science research approach (Hevner et al., 2004), we set out to *develop a method for service engineering on an ecosystem level*. We follow the research process of Vaishnavi and Kuechler (2008) to design RE-SIDE—a service engineering method for recombinant service innovation through data ecosystems. We demonstrate the method with the case of a data space for cultural events that fosters establishing a "culture wallet" service. We derive one overarching proposition and four testable propositions as prescriptive knowledge for the design of service innovation on an ecosystem level that builds on a data ecosystem as enabling technology.

The paper is structured as follows. In Section 2, we discuss the extant literature and frame our research problem. In Section 3, we describe and justify our design science research approach. In Section 4, we present our results comprising the suggestion, development, demonstration, and evaluation. We conclude the paper in Section 5.

2 Theoretical Background

2.1 Service Innovation in Ecosystems

Service innovation is the process of developing, providing, and implementing new or improved service concepts that meet emerging customer needs and deliver additional value and outcomes through the incorporation of novel ideas and technologies (Gebauer et al., 2008; Jian & Wang, 2013). Service innovation is rooted in both service engineering and service management. From an engineering perspective, service innovation emphasizes the design of artifacts (Johansson-Sköldberg et al., 2013; Simon, 1969). In this earlier understanding, services can be engineered as they are treated similarly to tangible products (Jaschinski, 1998). Service management views service innovation as a means of creating experiences and value (Johansson-Sköldberg et al., 2013;

Ramaswamy & Ozcan, 2016). As such, service management focuses on the solution desired by customers (Johansson-Sköldberg et al., 2013).

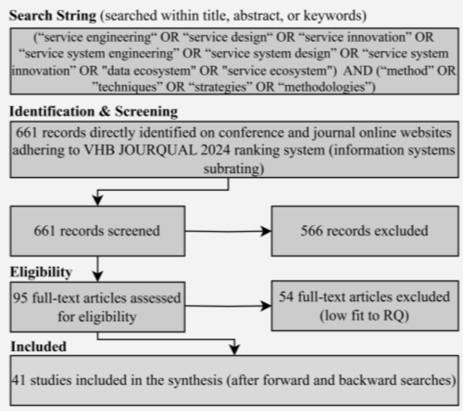
Innovation can be shaped by diverse environmental and institutional arrangements or the interactions between resource-integrating actors (Edvardsson et al., 2018). This means that service innovation is considered an expanded scope that involves multiple actors at an ecosystem level (Jacobides et al., 2018). We posit that a service ecosystem is a socio-technical realm in which multiple actors co-create value, pointing beyond dyadic configurations. It follows that a service ecosystem involves loosely coupled, heterogeneous, and independent actors, institutions, and digital technologies that (ideally) collectively form an (innovative) ecosystem output based on their joint value co-creation activities (Granstrand & Holgersson, 2020; Vargo et al., 2017; Wang, 2021).

From a service-dominant logic (S-D Logic) perspective, service is co-created through the integration of operand (e.g., data, technology, artifacts) and operant (e.g., knowledge and skills) resources in service ecosystems (Vargo & Lusch, 2004). For differentiation, we, therefore, propose a layered perspective on ecosystems that distinguishes a data ecosystem and a service ecosystem perspective. Drawing on Möller et al. (2024) and Heinz et al. (2022), we view data ecosystems as socio-technical systems that foreground the technical infrastructure and practices of data sharing and use. They enable users to integrate, transfer, manage, and analyze data (Heinz et al., 2022; Möller et al., 2024)—thus forming a technological infrastructure for data-driven value co-creation. Complementary to that, the service ecosystem perspective focuses on value co-creation—foregrounding how value is co-created through the integration of operand and operant resources (Vargo & Lusch, 2004). Here, data originating from the data ecosystem layer is an operand resource, whereas operant resources such as skills, knowledge, and interactions (Vargo & Lusch, 2004) determine how value is co-created with other actors in a service ecosystem.

An Information Systems (IS) perspective can serve to reconcile the technological perspective of a data ecosystem with social concepts such as sovereignty (Hompel & Schmidt, 2022; Rajabifard et al., 2002). This view acknowledges that data ecosystems are more than pure data storage but can also be viewed as operand resources (Guo et al., 2023; Halevy et al., 2006). For this purpose, cloud computing, digital platforms, mobile applications, and other technologies can be interconnected, allowing seamless data exchange if the actors subscribe to technical compliance and joint data standards (Gelhaar & Otto, 2020; Gieß et al., 2023; Guo et al., 2023). In a data ecosystem, the actors involved can maintain diverse relationships with one another while contributing and accessing data to and from the ecosystem, which facilitates value co-creation.

2.2 A Review of Current Service Systems Engineering Methods

Most current service engineering methods refer to settings that include few actors in service systems, whereas they do not address more complex service ecosystems. In particular, they lack consideration for how actors initially become aware of one another and how systemic change happens over time. We conducted a systematic literature review (vom Brocke et al., 2009) to elucidate current service innovation methods on an ecosystem level and their implications on the design of new methods. Figure 1 summarizes the search process with information on the search string, the databases used, and the inclusion and exclusion criteria used for processing the papers (Moher et al., 2009).



Inclusion and Exclusion Criteria		
Criterion	**Inclusion**	**Exclusion**
Direct reference to research question	Yes.	No.
Study type	Peer reviewed VHB JOURQUAL 2024 ranking conference and journal articles. Below B only if contentwise fit.	Non-scientific literature.
Article type	IS and service related articles.	Any other journal types.
Language	English.	Any other.
Time period	Publications until May 2025.	/
Relevance	Service innovation and ecosystem related	Any other.
Citation number	No limit set.	/

Figure 1. Literature review search strategy with inclusion and exclusion criteria

Our initial findings reveal that the early literature describes the service innovation process as a sequence of phases. For instance, Lee and AbuAli (2011) outline a traditional innovation process that starts with elucidating customer needs and market analysis that guides the innovation process. Zhang et al. (2003) take a similar perspective but take on the lens of problem-solving. Beyond that, industry standards like the DIN PAS 1082 prescribe service innovation in business networks with a stage-gate process.

The second wave of research focuses on service systems engineering (e.g., Anke et al., 2020; Beverungen et al., 2021), referring to the engineering setting in which service will eventually be co-created. For instance, Vasantha et al. (2012) include the stages of (1) context specification, (2) relevance communication to stakeholders, (3) innovation process design, (4) development, and (5) life cycle consideration. Beverungen et al. (2018) introduce a method for recombinant service system engineering. The DIN SPEC 33453 is an industry-standard that was established by the German service science community, providing an agile reference process including analysis, design, and implementation. Unlike DIN SPEC 33453, the ecosystem environment—especially partners and resources—must be monitored even more intensively than in traditional service engineering, as there are more actors, connections are faster and tighter, and changes, such as single business model shifts, have more immediate and widespread impact.

More recent approaches have begun to explore new vistas of service innovation in ecosystems. Still, they often start with an ideation phase and prototype development, linking to potential ecosystem actors for co-creation practices (Elia et al., 2020; Picaud-Bello et al., 2022; Quero et al., 2025) before requesting information, sharing resources, and delivering the output by transferring knowledge and resources (Elia et al., 2020; Kari et al., 2025). Other approaches emphasize integration, value realization, adaptation, and moderation as important aspects (Wang, 2021). Recent papers reflect on data sharing at an ecosystem level as a prerequisite for service innovation (Möller et al.,

2024) but also offer first (design) principles that guide value co-creation networks (Blaschke et al., 2019) and explore continuous value shaping (Böhmann et al., 2025).

These methods fall short of capturing the complexity of ecosystems that involve a broader set of actors and resources. Unlike service systems, ecosystems include poly-directional interactions that can involve dozens or hundreds of actors, resulting in dynamic, complex, and temporary effects that are beyond any single actor's control. Also, existing methods downplay the important role of digital data in service ecosystems.

3 Research Method

We apply design science research (DSR) (Hevner et al., 2004) to develop a method for service engineering on an ecosystem level. DSR is a problem-solving paradigm that focuses on the creation and evaluation of artifacts—such as models, methods, and systems (March & Smith, 1995)—to address identified problems within a specific context. It combines rigorous scientific methods with practical relevance, aiming to generate both useful solutions and scientific knowledge (Hevner et al., 2004). We utilize the design science research paradigm because it enables us to develop an innovative artifact—in this case, a method for service engineering in ecosystems—by building on the existing knowledge base of methods, theories, and concepts (Hevner et al., 2004). We can, thus, provide a solution to the stated problem, while researchers and practitioners can use this method to engineer their services in ecosystems. Additionally, we apply the method in an appropriate context, evaluating its usefulness (Peffers et al., 2012).

In detail, we follow the proposed five steps for design science research by Vaishnavi and Kuechler (2008), comprising the steps of (1) awareness of the problem, (2) suggestion, (3) design and development, (4) evaluation, and (5) conclusion. As described with the results of our structured literature review, following vom Brocke et al. (2009) in the previous Section, we identified the problem that existing service engineering methods do not account for the complexity of service ecosystems. Through this analysis of the problem space (Maedche et al., 2019), we were able to identify service engineering methods as rivaling artifacts that do not appropriately account for our identified problem. We make use of these service engineering methods in the second step by suggesting areas for improvement. In the third step, we then present our designed method by showing two frameworks that illustrate how services can be engineered in service ecosystems based on using data from data ecosystems. In the first framework (Figure 2), we depict how service ecosystem engineering takes place on a single-actor (micro) level based on the DIN SPEC 33453, a reference model for engineering digital service systems. While we identified this industry standard to be the most robust one in our literature review, it offers a foundation for digital service systems, whereas ecosystems demand a broader lens that accommodates multiple actors, new innovation phases, and expanded service innovation practices. In the second framework (Figure 3), we move to a multi-actor (macro) level, considering actors as people or organizations (Wang, 2021). Together, these frameworks present our designed method RE-SIDE (recombinant service innovation through data ecosystems) for data-driven service innovation within ecosystems. We prototypically evaluate our artifact by demonstrating its purpose and results in the context of a data space for cultural events (German Federal Government, 2023), showing that it can be used for engineering the innovation of a "culture wallet" that enhances cultural participation and social inclusion. We conclude our design science research process by outlining the contribution of our designed method.

4 Results

4.1 Suggestion: New Phases and Data Flows

The DIN SPEC 33453 presents a robust method for service systems engineering, focusing on a single actor (organization or person) striving to engineer a (smart) service system. Due to this focus on single organizations, the method lacks consideration of the ecosystem level that comprises more complex resource configurations. More specifically, the DIN SPEC 33453 lacks sufficient *guidance for identifying appropriate actors* within the ecosystem to facilitate collaboration practices. To some extent, the process assumes that key actors—service providers, suppliers, partners, and customers—can be identified based on previous interactions, which appears unrealistic in ecosystems that contain actors with numerous roles (Lipkin & Heinonen, 2022). We argue it is challenging to identify suitable actors for data exchange or value co-creation in an ecosystem (Hansmeier & Beverungen, 2024). We conclude that a method for service engineering in service ecosystems needs to include an **ecosystem analysis phase** to inspect, scan, and assess the ecosystem.

Second, the DIN SPEC 33453 falls short of information regarding *potential ecosystem evolution*. It lacks an ongoing phase to re-evaluate actors, including their operand and operant resources (Vargo et al., 2017; Vargo & Lusch, 2004). Ongoing evaluation is crucial since ecosystems are transformed as new data, services, and actors join the ecosystem. We argue that ecosystem transformation roots in service system transformation, which can have a cascading effect on the ecosystem level, initiating an emergent evolution of the structure and function of the service ecosystem. Hence, not only rules and governance mechanisms but also data, services, and relationships are affected over time. To initiate or observe the ongoing shift on an ecosystem level, we argue that an **ecosystem transformation phase** must be considered to capture the iterative, adaptive changes required to align evolving service systems within the broader ecosystem.

Third, the DIN SPEC 33453 centers on engineering digital service systems without addressing *interactions and joint collaborations* required among multiple actors in an ecosystem. A lack of consideration of multi-actor interaction means that critical facets of collaboration—such as providing or accessing data and value propositions—are not thoroughly reflected. A method for data-driven service innovation in ecosystems needs to **clearly record data flows, service provision, and service consumption**.

Finally, the DIN SPEC 33453 recommends *data-driven approaches, but it does not delve deeply into that area*. For instance, data interoperability for effective communication and data exchange across multiple actors remains a key requirement for data ecosystems (Gelhaar et al., 2021). For a thriving ecosystem, well-defined technical (data) standards and interfaces are necessary to facilitate seamless data sharing by means of transactions (Gelhaar et al., 2021). A lack of interoperability within the ecosystem hinders not only data exchange but also data-driven innovation practices. Consequently, a data-driven service innovation method must indicate **concrete dataflows that feed the service innovation practices** between distinct ecosystem actors.

4.2 Development: A Method for Service Engineering in Service Ecosystems

To take up these requirements, we propose adding two phases to the DIN SPEC 33453: (1) an ecosystem analysis phase and (2) an ecosystem transformation phase to be placed around the service system transformation phase (Figure 2).

The extended method incorporates elements of Porter's (2008) five forces framework and adds the **ecosystem analysis phase** as a foundational step to scan for effective collaboration partners, including their resources within complex multi-actor ecosystems that match their own needs—for instance, defining the own role and needs, scanning available data offerings, potential partners, usage policies in a data space and making informed collaboration decisions. We chose to integrate elements of Porter's (2008) Five Forces because it enables a comprehensive and structured analysis of ecosystem dynamics, is well established in service research, and serves as a strategic tool for identifying risks and opportunities across a wide range of industries due to its robust nature. Also, the framework's clarity, objectivity, and ease of use make it a time-efficient tool for ecosystem analysis that is accessible even to non-experts (Porter, 2008). The ecosystem analysis phase features *self-evaluation, knowledge development, partner selection and collaboration decision, and collaboration initiation.*

Self-evaluation focuses on defining an actor's role in the ecosystem and clarifying strengths and needs. (1) Actors begin by defining their desired role within the ecosystem and articulating a vision and mission that align with their strategic goals. (2) Next, actors conduct an assessment of their own resources and skills, for example, using a SWOT analysis to evaluate strengths, weaknesses, opportunities, and threats. (3) Finally, a needs assessment is performed to determine which additional capabilities, data, or technological assets are required to effectively participate in the ecosystem and drive innovation. These steps help actors assess their own roles and capabilities within the ecosystem and identify gaps requiring external collaboration before reaching out.

Knowledge Development shifts the focus to understanding the structure, dynamics, and attractiveness of the ecosystem. (4) Actors start by conducting an ecosystem attractiveness analysis, using frameworks such as Porter's Five Forces (Porter, 2008) to assess key factors, including the threat or opportunity of new entrants, the bargaining power of buyers, the influence of substitute products and services, the bargaining power of suppliers and other ecosystem actors, and the level of rivalry within the ecosystem. (5) After evaluating the overall ecosystem, actors proceed with the identification of relevant collaboration partners, mapping key stakeholders using methods such as user stories to gain insights into their roles, resources, and potential synergies. (6) Once potential partners are identified, an initial evaluation of their resources and capabilities takes place, e.g., by using a Fit-Gap analysis. Understanding these dynamics enables actors to navigate the competitive landscape more strategically by assessing whether their operand and operant resources complement the actor's own resources.

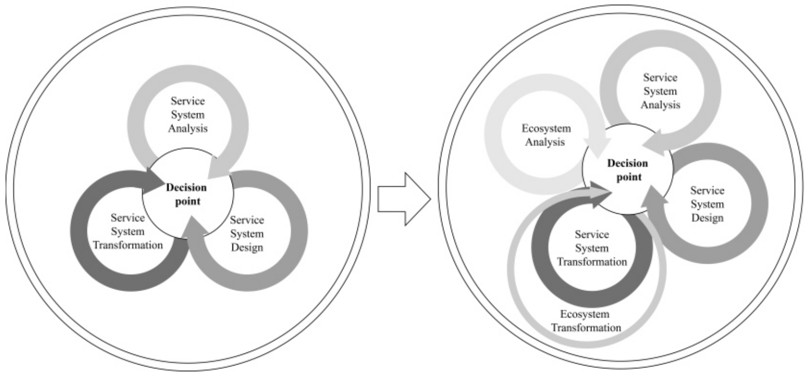


Figure 2 Engineering of service systems (left, DIN SPEC 33453) and ecosystems (right)

Partner selection and collaboration decision help actors decide whether engaging in a partnership is beneficial and ensure that the right partners are chosen. (7) First, actors must decide whether to collaborate by weighing efficiency advantages against strategic positioning and potential risks, applying a cost-benefit analysis. (8) If collaboration is deemed advantageous, actors will proceed with the selection of suitable partners using evaluation methods such as an Impact-Risk Matrix or network analysis.

Collaboration initiation ensures that partnerships are effectively structured and launched. (9) Once suitable partners have been selected, actors begin by engaging in initial collaboration discussions, which may include formulating partnership proposals, hosting exploratory meetings, or organizing workshops, e.g., focused on data and knowledge exchange. (10) The last step involves negotiating joint goals, where all parties align their expectations, establish collaboration frameworks, and define measurable KPIs to ensure that the partnership is oriented toward mutual innovation objectives.

The **ecosystem transformation phase** is incorporated around the service system transformation phase. It is triggered by changes to or on the market, like new value propositions, customer needs, demands, or customer readiness, to technology and resource inventions within the ecosystem (Kolagar et al., 2022). Actors may proactively initiate ecosystem transformation by transforming their digital service systems, aiming to reshape aspects of the technological infrastructure, the nature of co-creation practices, or even the ecosystem's rules and governance. Often, however, this transformation is passive and not immediately visible, as it is triggered when service systems within the ecosystems evolve regarding participating actors, resources, available data, and service innovations that gradually diffuse into the broader ecosystem. The ecosystem transformation may attract new actors by means of market expansion but may also deter existing ecosystem actors through the transformation (Kolagar et al., 2022), underscoring the need to continuously observe the ecosystem and anticipate the evolution to seek new service innovation opportunities (Kolagar et al., 2022). As ecosystems evolve over time, redesigning existing service innovations becomes mandatory to align with new ecosystem conditions—actors, resources, but also rules, and governance (Kolagar et al., 2022). Simultaneously, actors must remain vigilant about when to exit the ecosystem. If changes become so substantial that they misalign with an actor's goals or values, they need to be aware of the point at which it may be best to leave the ecosystem.

We view the ecosystem transformation phase as a continuous, iterative process that seamlessly interconnects with the ecosystem analysis phase, enabling actors to observe and shape ecosystem transformation with five steps: (1) To raise awareness of the ongoing "invisible" transformation of ecosystems. Ecosystems do not remain static; rather, they evolve through incremental changes that often go unnoticed at first. Actors must scan the ecosystem, technological advancements, regulatory changes, and emerging user behaviors to position themselves properly. (2) To identify new opportunities and actors for innovation practices. As ecosystems change, new opportunities emerge to be identified and evaluated by actors. (3) To adapt and align services with ecosystem conditions. Actors must assess how their value propositions fit with the evolving ecosystem landscape. (4) To prioritize resources. As the ecosystem evolves, not all resources and capabilities remain equally relevant. Actors must evaluate which resources provide competitive advantages and which have become obsolete. (5) To define and refine actor roles and responsibilities based on resources and competencies. As new actors join and existing ones adapt, actors must re-assess their roles and responsibilities.

Our second framework (Figure 3) refers to the macro perspective of the ecosystem. It comprises three layers. The *ecosystem core* represents a consortium of actors that establishes the ecosystem's governance. It shapes how data can be shared and used for service innovation. The *data ecosystem* is a digital infrastructure enabling data exchange among the actors (Hompel & Schmidt, 2022). In this layer, actors can temporarily provide their data or access data from other actors. Data may be personal, organizational, or public data. Data-based transactions (represented by black arrows) can be uni-directional (from one actor to another), bi-directional (reciprocal relations), or poly-directional (more-dimensional data sharing). New data can trigger the *service ecosystem* to evolve. To illustrate triggers, we use light gray arrows pointing from the data toward the ecosystem's border, symbolizing the ecosystem's evolution. The actors can participate in both ecosystems when positioned at the border of the data and service ecosystems. We also visualize actors that do not engage in the data ecosystem at all while they are part of the service ecosystem. As they do not contribute data, their data offer symbols, and connections are marked as dotted lines. Two arrows along the data ecosystem border emphasize the evolution of the ecosystem. In contrast, actors situated at the intersection of the digital data and service ecosystems temporarily provide or access data, utilizing the data for innovation practices that ultimately lead to new services in the service ecosystem that surrounds the data ecosystem in Figure 3. This configuration highlights the role of the data ecosystem as a data infrastructure (Hompel & Schmidt, 2022), supplying data for innovation practices in the service ecosystem. Actors temporarily provide value propositions that may be accessed by others. Figure 3 visualizes accepted value propositions with black arrows. The gray arrows represent transformational forces impacting the service ecosystem. The two arrows at the edge of the service ecosystem show the dynamic properties of the service ecosystem.

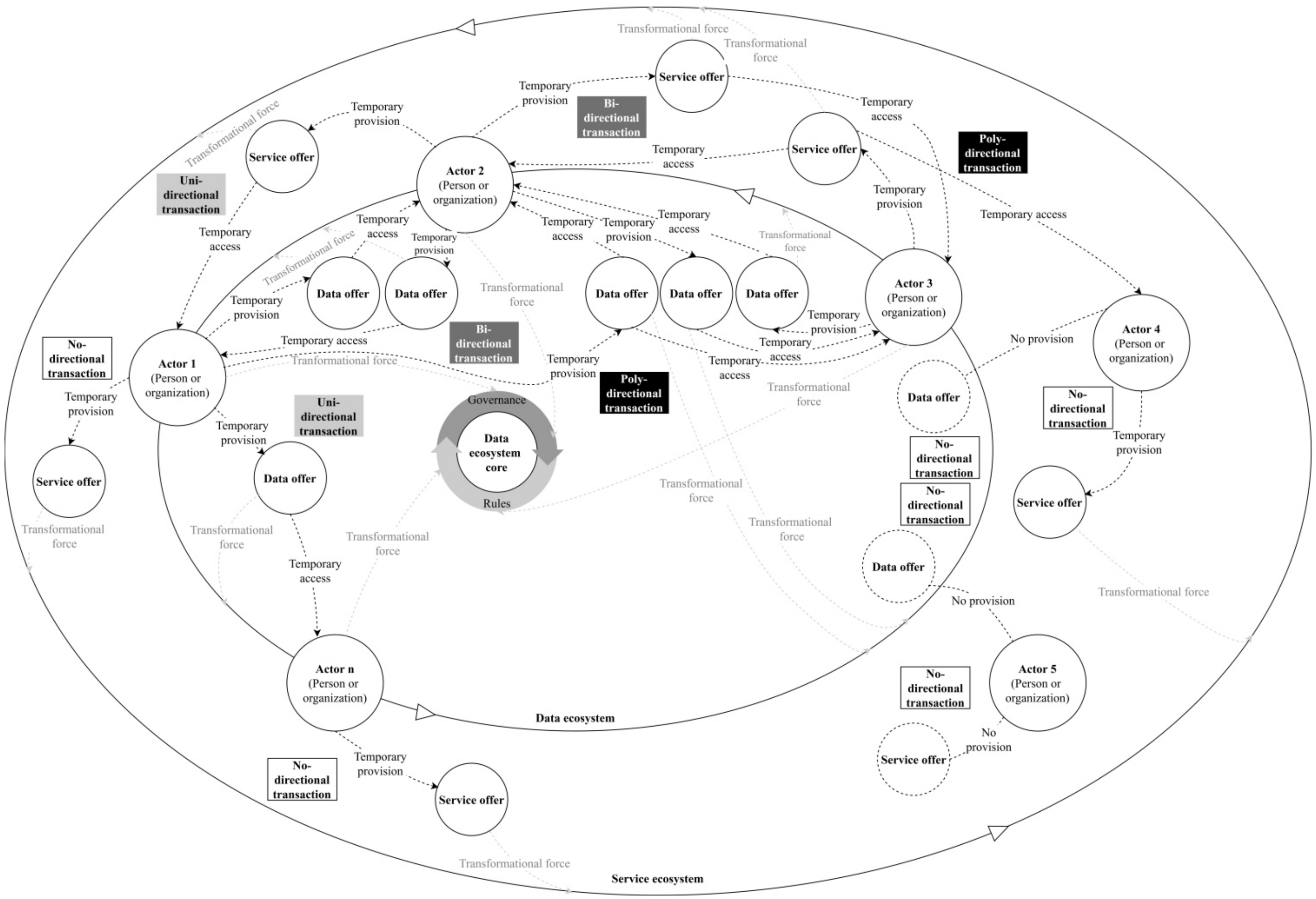


Figure 3. Macro perspective on service innovation in ecosystems

4.3 Demonstration and Evaluation: Culture Wallet

We demonstrate and evaluate the designed RE-SIDE (recombinant service innovation through data ecosystems) method through a real-world case in the cultural and creative industry. The *Cultural Data Space* is aimed at linking digital cultural event platforms and various cultural providers, such as individual artists and cultural institutions (European Commission, 2022; German Federal Government, 2023), facilitating the sharing of event data as part of a broader ecosystem (German Federal Government, 2023). The need for such an ecosystem is driven by the challenges faced in this sector, notably declining visitor numbers (Graefe, 2024), aiming to revitalize the cultural domain. The *Cultural Data Space* is designed to offer personalized recommendations to culture enthusiasts regardless of their location by accessing their regional cultural platform, which we view as an actor in an ecosystem (Figure 3). Cultural providers are encouraged to upload data for upcoming events to their local cultural platform and share the data with other platforms or providers. Customers (and, e.g., travelers) accessing their home platform can then receive live event data relevant to their current location.

Utilizing our method, data from the data ecosystem can be used for data-driven service innovation. An example of such an innovative service is a *Culture Wallet*, a service designed as a digital stamp card that is enabled by a digital wallet. This digital card displays available nearby events and tracks attended events. To enable this functionality, not only event data but also information on individual event attendance and personal preferences needs to be shared by actors such as digital cultural platforms, as well as visitors within the data ecosystem. This data sharing allows regular visitors to receive extra services and rewards, such as a discount, after attending a specified number of events in the service ecosystem. Implementing these features requires integration with ticketing systems, access to documented event attendance data within the data ecosystem, and the running of the *Culture Wallet* service in the service ecosystem. While this service is available, it requires consent to process personal data, and users may choose to opt-out. To offer this service, actors such as cultural event platforms must engage in the service innovation process as well, as outlined in Figure 2 (r).

As the cultural platform develops the *Culture Wallet*, it must assess its own capabilities and needs (*self-evaluation*) and analyze the ecosystem to identify any missing resources, such as data on event attendance in other regions (*knowledge development*). Next, nearby cultural providers interested in participating in the *Culture Wallet* are selected (*partner selection and collaboration decision*) before negotiating joint goals (*collaboration initiation*) and subsequently starting a joint service systems analysis. Once a functional prototype has been evaluated, the service system transformation phase begins. As the *Culture Wallet* is introduced to the ecosystem, the service ecosystem is also affected by the new service, attracting new ecosystem actors who may wish to participate. Other cultural actors seeking to identify service innovations like the *Culture Wallet* must continuously stay aware of emerging developments. They should assess how their services align with the *Culture Wallet* and adapt their roles in the ecosystem accordingly—especially if they notice, for example, that their own stamp card system is becoming less effective. If the cost-benefit analysis proves favorable, they may decide to discontinue certain tasks or services in favor of more integrated solutions.

While this demonstration of our RE-SIDE method is a useful first step, designed artifacts have to be evaluated to verify their utility, quality, and efficacy (Venable et al., 2016). As such an evaluation is time-consuming and resource-intensive, we instead make use of our demonstration and derive testable propositions, i.e., truth statements to be verified in empirical evaluations of our artifact (Gregor & Jones, 2007). The overall proposition is that *(P_0) organizations applying RE-SIDE are able to engineer service innovations that fit their ecosystem*, aligning with our solution to our problem. However, as this proposition is hardly testable, we derive four testable propositions that relate to our identified problem and the two ecosystem layers. For the service ecosystem layer, we focus on the poly-directional interactions (Beverungen et al., 2022; Lipkin & Heinonen, 2022; Wang, 2021) and propose that organizations applying RE-SIDE are able to *(P_{1a}) constantly identify further actors for possible cooperation in their ecosystem*, and *(P_{1b}) have improved knowledge of their own positioning, strengths, and potentials in the ecosystem*. For the data ecosystem layer, we focus on the data enabling service innovation (Gelhaar et al., 2021; Hompel & Schmidt, 2022) and propose that organizations applying RE-SIDE are able to *(P_{2a}) constantly identify more data and their flows in their data ecosystem*, and *(P_{2b}) utilize these data for to engineer service innovations*. These four testable propositions account for comparison to existing methods for service engineering. While propositions P_{1a} and P_{2a} should be evaluated using quantitative data, propositions P_{1b} and P_{2b} require a qualitative analysis with experts and applicants of RE-SIDE.

5 Conclusion

In this paper, we present RE-SIDE, a method for service engineering in service ecosystems that goes beyond current service systems engineering methods. Thereby, we contribute prescriptive knowledge in the form of central elements of a nascent design theory (Gregor & Hevner, 2013), i.e., purpose and scope, constructs, the method itself, and testable propositions (Gregor & Jones, 2007), showing how to incorporate an ecosystem level into service engineering. Subsequent research can build on our ideas to empirically analyze the complex interactions between idiosyncratic service engineering projects and their complex ramifications on an ecosystem level as soon as data spaces have reached a sufficient level of maturity to explore these phenomena. Managers benefit from our results when engineering new ecosystem services with RE-SIDE. We see our method as a tool to understand ecosystems through data sharing. By updating the DIN SPEC 33453, we provide a starting point for navigating service engineering, analyzing ecosystems, and tracing changes. Despite these contributions, our method needs to be subjected to empirical evaluation. As all data spaces/ ecosystems are still under development, we settled on providing quantitative and qualitative propositions that can be evaluated empirically in the future.

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