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From sharing to profiting: Exploring the interplay between value creation and strategic appropriation in data ecosystems

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Abstract

This study explores the interdependency between collaborative value creation and value appropriation within data ecosystems, focusing on how organizations can effectively share and utilize data for mutual benefits. It examines the factors that influence the capacity to create value from shared data and the strategies for appropriating value from such data sharing. Through qualitative analysis of a healthcare data ecosystem, the research identifies key determinants of value creation capacity and outlines four central elements of value appropriation strategies (VAS): selective partnering, data tailoring, benefit safeguarding, and control enforcement. The findings reveal how shared data's latent potential interacts with an actor's potential to foster value creation capacity, while also highlighting the interdependencies between these concepts and VAS. This study contributes to understanding the conditions that facilitate mutual benefits in data ecosystems and the mechanisms that ensure organizations can appropriate a fair share of the value creation they contribute to.

Keywords Data ecosystems · Value appropriation · Value creation · Data sharing

JEL classification M10 · O30

Introduction

Data ecosystems are transforming industries by enabling unprecedented opportunities for value creation through data sharing. As organizational value creation increasingly relies on interconnected data, these ecosystems drive innovation, enhance decision-making and give rise to novel business models (de Reuver et al., 2024; Oliveira et al., 2019). The core value of data ecosystems lies in their ability to enable value creation that individual organizations could not achieve independently (Levy et al., 2003; Loebbecke et al., 1999). By bringing together a diverse set of complementary actors (Jacobides et al., 2018) with different capabilities and data (Oliveira et al., 2019; Susa et al., 2023b), data ecosystems leverage the unique properties of data as a strategic

resource (Aaltonen et al., 2021; Alaimo et al., 2020; Priego & Wareham, 2024; Shapiro & Varian, 1999). This opportunity led to the formation of data ecosystems reaching from governmental identification services (Degen & Teubner, 2024), over agricultural applications (Gil et al., 2025) to sectors such as mobility (Möller et al., 2024) and healthcare (Campmann et al., 2025; Hussein et al., 2023). Healthcare is a particularly rich context for data ecosystems, as organizations across the sector—ranging from service providers and insurers to medical device manufacturers—generate and utilize diverse forms of sensitive and operational data (Nienstedt et al., 2023; Rothe et al., 2023). From patient records to machine-generated diagnostics, the ability to integrate and leverage these data sources opens up new avenues for innovation, efficiency, and improved health outcomes.

However, despite the evident potential of data sharing, organizations frequently refrain from sharing data, thereby limiting the realization of data ecosystems' full capacity for value creation (Fassnacht et al., 2023; Nienstedt et al., 2023; Trkman & Desouza, 2012). Specifically, data sharing organizations face the threat of opportunistic behavior from the organizations receiving the data (Clemons & Hitt, 2004; Das & Teng, 2001; Loebbecke et al., 1999) that can result

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in a loss of competitive advantage (Das & Teng, 2001). For instance, service providers sharing patient data with manufacturers can improve care outcomes and induce innovation. However, once patient data are shared, manufacturers might use these data to expand their services at the cost of the service providers. As a consequence, service providers often refrain from sharing data in the first place. This illustrates that the capacity for value creation of data ecosystems is only realized if organizations perceive sufficient means for appropriating value from sharing data (Ho & Ganesan, 2013; Torres de Oliveira et al., 2021). Against this backdrop, strategic considerations regarding value appropriation are a necessary precondition for a data ecosystem's emergence (Gelhaar & Otto, 2020; Nienstedt & Trenz, 2023).

Strategy research describes value appropriation strategies (VAS) (Asmussen et al., 2021; Teece, 1986), that is, strategic approaches to influence “environmental factors, excluding firm and market structure, that govern an innovator’s ability to capture the profits generated by an innovation” (Teece, 1986, p. 287). Such VAS concern employing isolating mechanisms (Lepak et al., 2007), exercising power (Bowman & Ambrosini, 2000), making use of absorptive capacity (Morgan et al., 2013), or capitalizing on the access of resources (Lavie, 2006). However, when accounting for the specific characteristics of data, it becomes apparent that traditional VAS can hardly be applied to data ecosystems. For instance, unlike tangible resources, data can be used by multiple organizations beyond their original collector (Alaimo et al., 2020) for hardly predictable value creation (Kallinikos et al., 2013; Lehrer et al., 2018), and their value is uncertain until after they have been shared (Arrow, 1962). However, traditional VAS often require ownership enforcement, equitable exchange, and effective control over the use of the resource. To better understand how data sharing organizations can appropriate value from data used beyond their direct control (Pisani et al., 2010; Susha et al., 2023b; van Panhuis et al., 2014), it is essential to develop a contextualized understanding of VAS for data sharing in ecosystems.

When combining the theoretical perspectives on data ecosystems and VAS, a substantial issue arises for data sharing organizations: While the specific characteristics of data drive value creation opportunities, the inherent uncertainty regarding the actual value creation impedes subsequent value appropriation. Hence, this necessitates the investigation of how the specific characteristics of data sharing in ecosystems determine the capacity for value creation in data ecosystems. Reversely, the value creation capacity of data ecosystems will not fully unfold unless organizations feel like they are getting something substantial out of the sharing of data. We aim to uncover how organizations that share data can appropriate value from the subsequent value creation of other organizations. Thereby, we work towards

uncovering mechanisms that facilitate mutual data sharing benefits in data ecosystems. We do so by addressing the following research questions:

RQ1: What determines the capacity to create value from shared data in ecosystems?

RQ2: How can value created from data sharing be appropriated?

RQ3: What characterizes the interdependencies between the value creation capacity and value appropriation strategies?

To address the scarcity of research on how to navigate the convoluted dynamics of value creation and appropriation in data ecosystems, we employed inductive reasoning on in-depth qualitative data derived from a case study through the application of grounded theory techniques. Specifically, we embed our analysis in the case of a health data ecosystem exhibiting key aspects of data sharing in ecosystems. First, it reflects the key characteristic of data ecosystems (Adner, 2017; Oliveira et al., 2019) to contain a heterogeneous set of actors working together with data to achieve a focal value proposition—the treatment of patients. Second, organizations in the observed ecosystems share data for diverse reasons, reaching from economic rationales of profit-driven organizations to the societal impact by public organizations. This enables us to investigate various competitive dynamics and the interplay of different kinds of created and appropriated value. Third, to achieve the creation of value, organizations in this case share a broad set of different data. Taking into account different kinds of data such as machine data or highly sensitive health data of individuals, we can observe various aspects of data sharing reaching from strategic considerations to potential privacy risks from sharing individuals’ data. Consequently, the analyzed case is best suited for analyzing VAS in data ecosystems, as it reveals a wide array of aspects of data sharing in ecosystems that prove relevant beyond the individual case.

Our study advances the understanding of value creation and appropriation in data ecosystems by disentangling their interdependencies. First, we contribute to theory by identifying data potential and actor potential as fundamental determinants of value creation capacity, thereby contextualizing structural ecosystem elements with the unique characteristics of data. Second, we introduce four core elements of VAS—selective partnering, data tailoring, benefit safeguarding, and control enforcement—providing a structured framework for organizations to enable data sharing and subsequent value appropriation. Third, we reveal a circular dynamic between the capacity to create value and VAS, demonstrating how organizations must continuously recalibrate their VAS to sustain participation and competitiveness in data ecosystems. These insights have implications for the management in and of data ecosystems along

three dimensions. First, we emphasize the importance of strategic decisions before sharing data to ensure value appropriation. Second, we outline how organizations can enhance their ability to create value by strengthening their position within the ecosystem, expanding strategic data sharing links, and leveraging complementary capabilities. Third, we open up avenues for dynamic and decentralized data ecosystem governance, where organizations can achieve a sustainable balance between value creation and appropriation without relying on rigid, centralized control.

Theoretical foundation

During the inductive theorizing process of this study, two main literature streams emerge as a sensitizing device for the observed phenomenon of value creation and appropriation in data ecosystems. First, emerging research on data ecosystems helps us to understand how the opportunities of multiple actors working together and the specific characteristics of data shape value creation in ecosystems. Second, to better understand the appropriability of value created within data ecosystems, literature on value appropriation is used to sensitize the collected data. We reflect on these two streams together to develop a theoretical preunderstanding of value appropriation in data ecosystems that serves as starting point for our empirical study.

Data ecosystems

As an emerging topic in the information systems domain, research on data ecosystems is still at an early stage (Möller et al., 2023; Schoormann et al., 2025; Strobel et al., 2024). Data ecosystems are defined as “sociotechnical complex networks in which actors interact and collaborate with each other to find, archive, publish, consume, or reuse data as well as to foster innovation, create value, and support new businesses” (Oliveira et al., 2019, p. 589). In this sense, research describes various opportunities to create value in data ecosystems given that actors share data in the ecosystem. Data sharing in ecosystems can enable the development of data products (Scheider et al., 2023), improvements of economic aspects, or improvements in the quality of services (Oliveira et al., 2019). Research on data sharing in supply chains highlights a multitude of opportunities to create value for supply chain partners or to reduce costs (Lee et al., 2000), ultimately improving their overall performance (R. Klein & Rai, 2009).

Different actors working together to create value (Moore, 1993) can be investigated through the lens of business ecosystems theory (Adner, 2017; Jacobides et al., 2018). As data ecosystems are described as “specific subsets [of business ecosystems] where the focal value proposition is enabled by data sharing” (de Prieëlle et al., 2022, p. 941), we

draw on the structuration by Adner (2017) distinguishing four central elements that characterize the creation of value in ecosystems. That is, *actors* undertake *activities* that flow through *links* between actors determining the actor’s *position*. Once one actor in an ecosystem enhances the offerings of another actor within the ecosystem, they are named complementors (Jacobides et al., 2018) whose interactions are mediated by technology (Wang, 2021). Complementing existing research stressing the independence of actors working together in data ecosystems (Guggenberger et al., 2025; Jussen et al., 2024), this understanding of ecosystems informs our research in that it allows us to disentangle conditions that determine the capacity for value creation.

Research on value creation from shared data suggests that this value is contingent on organizations’ capabilities to work with data along three main dimensions (e.g., Günther et al., 2017; Legner et al., 2020). First, organizations’ ability to create value is enhanced by developing technological capabilities to collect, store, and analyze data (Legner et al., 2020). Second, since multiple stakeholders are involved in activities of data-driven value creation, establishing effective data governance mechanisms becomes central (Günther et al., 2017; Zhang et al., 2022). These mechanisms become increasingly important as the regulatory environment requires a transformation in how organizations approach data handling (Labadie & Legner, 2023). Third, when developing operational capabilities as outlined above, organizations should consider strategic aspects to ensure effective value creation (Zhang et al., 2022). For instance, integrating their environments, organizations need to develop organizational models and consider stakeholder interests to transform data into value (Günther et al., 2017). In this sense, organizations need to be able to adapt their value propositions to the data they can access or influence the extent of their access (Günther et al., 2022). Taken together, these findings indicate that the opportunities for value creation in a data ecosystem may depend on the heterogeneous characteristics and capabilities of the participating actors.

Approaches to value creation in data ecosystems must also take into account the special characteristics of data. First, data can afford a variety of applications meaning that the value that can be created from data can hardly be determined before it is being used in the value creation process (Kallinikos et al., 2013; Lehrer et al., 2018). Data are editable, constantly updatable, portable, and refigurable (Alaimo & Kallinikos, 2022; Kallinikos et al., 2013). This means, data can be changed in the course of sharing by either the sharing or the receiving organization. Therefore, it is difficult to assess the value creation opportunities without being able to access the data. This characteristic is reflected in the notion that data are experience goods (Shapiro & Varian, 1999) and, therefore, the value of data can hardly be determined before they are shared, eventually leading to a paradox situation (Arrow, 1962).

Second, when working with data, ownership cannot easily be enforced. Data are highly mobile and can be replicated without significant marginal costs (Shapiro & Varian, 1999). This characteristic of data relates to a non-rivalry between sharing organizations as the same data can be used by multiple actors without one impeding the other (Alaimo et al., 2020), inducing opportunities to create more value in data ecosystems (Levy et al., 2003; Oliveira et al., 2019). As a consequence of the prior characteristics, data ecosystems can shift value creation from the organization originally possessing the data to other organizations using the data (Möller et al., 2024).

Lastly, research argues that “data-based objects [...] are projected from relations between data to the reality as much as that reality is represented by the data” (Aaltonen et al., 2021, p. 421). This ontological perspective on data implies that once data are shared, they can be combined and (re-) interpreted (Marjanovic & Cecez-Kecmanovic, 2017). As a result, actors sharing the data are concerned about that receiving actors might use data for unintended purposes (Galliers et al., 2015). Taken together, it becomes apparent that considerations on value creation and data sharing must reflect the characteristics of data itself.

The capacity of a data ecosystem to enable value creation is contingent on the actors’ willingness to share data. However, whether or not actors share data in ecosystems depends on the assessment of benefits and barriers (Azkan et al., 2020; Gelhaar & Otto, 2020; Gelhaar et al., 2023; Jussen et al., 2024). While actors perceive various benefits from engaging in data ecosystems, ranging from social aspects, over legal obligations, to economic rationales (Gelhaar et al., 2023; Susha et al., 2023a, 2023b), organizations also perceive barriers to sharing data, often hindering them from participating in data ecosystems (Fassnacht et al., 2023; Nienstedt et al., 2023; Trkman & Desouza, 2012). The barriers to data sharing involve a range of operational challenges, including the need for additional investments in information technology infrastructure (Nienstedt et al., 2023), concerns about data availability and quality (van Panhuis et al., 2014), and uncertainties regarding the roles and responsibilities among the organizations involved (Fassnacht et al., 2023; Vesselkov et al., 2019). Often relating to the absence of sufficient means for value appropriation, organizations are faced with opportunistic behavior from the receiving organizations (Clemons & Hitt, 2004; Das & Teng, 2001; Loebbecke et al., 1999) that can result in a loss of competitive advantage (Das & Teng, 2001). This illustrates that once actors cannot appropriate value from their participation in data ecosystems, alternative reasons not to participate in such ecosystems become largely irrelevant. Consequently, appropriating value is a necessary precondition for data ecosystem participation. Against this backdrop, strategic considerations regarding value appropriation are critical (Gelhaar & Otto, 2020; Nienstedt & Trenz, 2023).

While literature on data ecosystems exhaustively describes opportunities for value creation (Oliveira et al., 2019), reasons why actors do not engage in data ecosystems (Gelhaar et al., 2023; Susha et al., 2023a, 2023b), and structural elements of ecosystems shaping value creation (Adner, 2017), little is known about what determines the capacity to create value in data ecosystems and what means ensure the effective appropriation of value created from shared data. To further inform our investigation of possible VAS, we discuss literature on value appropriation in the following.

Value appropriation

In line with literature on value creation and appropriation (e.g., Bowman & Ambrosini, 2000; Jacobides et al., 2006; Mizik & Jacobson, 2003; Snihur et al., 2021; Teece, 1986), we define value appropriation as the process of capturing profits from created value. This definition highlights the relationship between value creation and appropriation: value creation increases the pie while appropriation determines who gets what size of a slice from it. Consequently, only value that has been created can be appropriated (Bowman & Ambrosini, 2000; Kern & Gospel, 2023).

Investigating the processes of value creation and appropriation in greater detail, research finds that a focus on value appropriation can lead to short-term profit increases but bears the risk of long-time losses (Mizik & Jacobson, 2003). However, when organizations cannot appropriate sufficient value, organizations have no reason to engage in value creation (Lepak et al., 2007; Mizik & Jacobson, 2003). Hence, appropriating value is a necessary precondition for value creation and a key issue for business strategy (Chen & Miller, 2015; MacDonald & Ryall, 2004).

In order to appropriate value, organizations can employ VAS, defined as strategic approaches to influence “environmental factors, excluding firm and market structure, that govern an innovator’s ability to capture the profits generated by an innovation” (Teece, 1986, p. 287). In the light of the organizations’ need to appropriate value, research describes various approaches that may facilitate value appropriation.

First, organizations can employ isolating mechanisms (Lepak et al., 2007) such as patents and copyrights to prevent imitation to appropriate value (Ceccagnoli et al., 2012; Teece, 1986). Thereby, organizations can ensure that value they create cannot easily be created and, hence, appropriated by other organizations. In the context of data ecosystems, this approach is limited in two ways. On the one hand, the inherent generativity of data (Kallinikos et al., 2013; Lehrer et al., 2018) implies that what is created from shared data might not be determinable prior to the sharing of data. This becomes even more significant as data are combined with other data from within the ecosystem (Oliveira et al., 2019).

On the other hand, once data are shared, the sharing actor can hardly control, nor monitor how the data are used for value creation. This paves the way for opportunistic behavior of the receiving actor (Clemons & Hitt, 2004; Das & Teng, 2001; Loebbecke et al., 1999). Therefore, creating value from data leads to a situation in which traditional isolation mechanisms such as patents, copyrights, and other ways to enforce ownership, cannot be applied without limiting data's generativity.

Second, organizations can use bargaining power to appropriate value by influencing pricing and negotiation dynamics in competitive environments (Bowman & Ambrosini, 2000; Lavie, 2006). For less powerful actors to appropriate value from significantly more powerful actors, strategy research highlights the importance of coalitions in handling value issues resulting from creation-appropriation dynamics (Adegbesan & Higgins, 2011; Asmussen et al., 2021). In data ecosystems, monetization is explored as a means of value appropriation (Beverungen et al., 2022; Jussen et al., 2024). However, this comes with limitations as, for instance, in cases of publicly available data or data donation only commercial actors appropriate value in terms of profits (Beverungen et al., 2022; Loebbecke & Picot, 2015). Further, the inherent generativity of data (Kallinikos et al., 2013; Lehrer et al., 2018) impedes pricing decisions in that the value of the data only surfaces once it is already shared (Arrow, 1962; Shapiro & Varian, 1999). As a consequence, due to data's non-rivalrous and generative nature, bargaining power alone does not suffice for value appropriation in data ecosystems.

Third, research following the resource-based view of the firm (Lavie, 2006) argues that access to the resources used for value creation is necessary to appropriate value from it (Verwaal et al., 2009). Consequently, once organizations collaboratively create value by sharing resources such as technologies or financial means, the relative scale and scope of resources influence value appropriation (Dyer & Singh, 1998; Lavie, 2006). For instance, in a collaboration where an organization is only provided with the types of resources it already possesses, its ability to appropriate value from this collaboration is limited (Lavie, 2006). However, due to data's high mobility and replicability, ownership cannot easily be enforced (Shapiro & Varian, 1999). Therefore, in contrast to other resources, the fact that data sharing organizations have access to their data does not imply that they will be able to appropriate value from it.

Fourth, research describes the establishment of absorptive capacity as an approach for value appropriation. Absorptive capacity is defined as the "learning capability that measures a firm's ability to identify, evaluate, assimilate, and exploit external knowledge" (Lavie, 2006, p. 645). Hence, in order to appropriate value from shared resources, organizations must develop learning capabilities

to recognize and appropriate value from partners' resources (Morgan et al., 2013). This perspective is also applied to value appropriation in platform ecosystems (Oh et al., 2015; Schrieck et al., 2021; Song et al., 2018). For instance, Schrieck et al. (2021) find that technology-related and relationship-driven capabilities enable platform owners to balance value creation and appropriation. Data ecosystems emerge based on the realization that data collected by one actor can be used for value creation among other actors (Oliveira et al., 2019). Hence, focusing on absorptive capacity limits the potential for collaborative value creation (Levy et al., 2003; Loebbecke et al., 1999) of complementary actors (Jacobides et al., 2018), and thus, the potential of data ecosystems.

Overall, we observe that existing VAS do not reflect the specific characteristics of data sharing in ecosystems. In traditional strategic management literature, value creation and value appropriation have often been treated as sequential processes. However, the unique characteristics of data introduce fundamental challenges to this separation. Unlike physical goods, data are non-rivalrous, infinitely replicable, and can generate unpredictable value once combined with other datasets (Lehrer et al., 2018; Shapiro & Varian, 1999). This means, in data ecosystems, value appropriation concerns must be addressed before or during value creation, rather than after it.

Theoretical preunderstanding: Value appropriation in data ecosystems

Synthesizing the literature on data ecosystems and value appropriation above allows us to develop a theoretical preunderstanding of value appropriation in data ecosystems. While both value appropriation and data ecosystems have individually received significant attention in prior research, our contextual understanding of value appropriation in data ecosystems is limited. In data ecosystems, the actor collecting the data is not always the one using the data to create value (Möller et al., 2024). Consequently, the receiving actor's value from using data shared with it can exceed the value provided in exchange (if any) for these data, eventually leading to an uneven distribution of the created value (Bowman & Ambrosini, 2000; Lepak et al., 2007). In this sense, literature on data ecosystem provides arguments that data can be used by diverse actors to create value, but lacks an understanding of how this value can be appropriated. Rather, it emphasizes the need for effective VAS for actors to participate in such ecosystems (European Conference for Information Systems): (Azkan et al., 2020; Gelhaar & Otto, 2020; Gelhaar et al., 2023; Nienstedt et al., 2023).

Our theoretical preunderstanding of data sharing in ecosystems is presented in Fig. 1. A data ecosystem consists of actors connected through data sharing links (Adner, 2017;

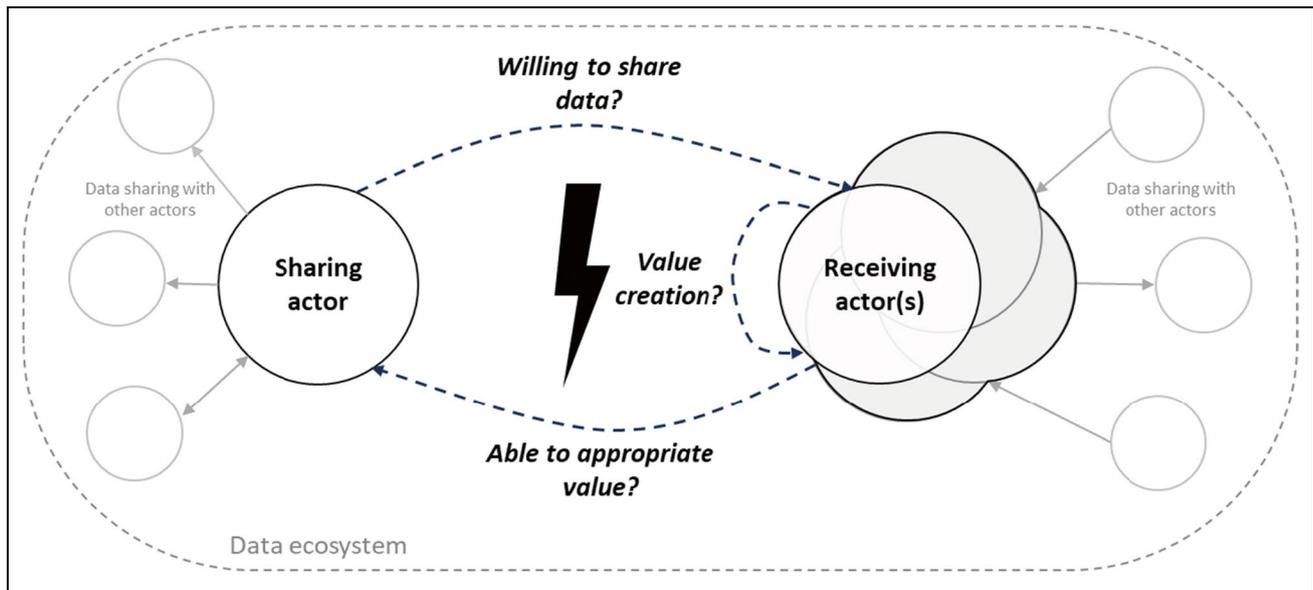


Fig. 1 Theoretical preunderstanding of data sharing in ecosystems

Oliveira et al., 2019). Each link represents data shared by a sharing actor with a receiving actor or a network of actors.¹ Receiving actors combine the shared data with their own primary data or with data collected from other actors to create value (Oliveira et al., 2019). Consequently, sharing actors try to appropriate the created value (Susha et al., 2023b). However, due to a lack of appropriation strategies (Jacobides et al., 2006; Mizik & Jacobson, 2003), this appropriation is often not possible, leading to the unwillingness of actors to share data in the first place and the restriction of value creation.

Bridging the theoretical perspectives on value creation and appropriation in data ecosystems, we observe that it remains unexplored how the specific aspects of value creation from data in ecosystems reflect on VAS. As the balancing of value creation and appropriation is central to strategy of individual actors and, hence, an important driver for the emergence of data ecosystems, our research aims to shed light on the process of VAS in the context of data ecosystems.

Empirical study

To address the scarcity of research on how to navigate the phenomenon of value creation and appropriation in data ecosystems, we employed inductive reasoning on in-depth

¹ Over time, organizations participating in a data ecosystem can take on both roles, be a sharing actor and a receiving actor. However, the focal problem of this study concerns the perspective of the sharing actor challenged with the appropriation of value created by the receiving actor based on the shared data.

qualitative data derived from a case study through the application of grounded theory techniques (Glaser, 1992; Urquhart et al., 2010).

Case: A healthcare data ecosystem

We investigate the case of a specific data ecosystem of actors surrounding an orthopedic treatment process in the German healthcare system. We consider this case to be revelatory for our study for three main reasons. First, the ecosystem entails a heterogeneous set of complementary actors working towards the treatment of patients as a common value proposition (Adner, 2017; Jacobides et al., 2018). That is, to realize the treatments, service providers work together with publicly funded organizations like research institutes, semi-private organizations like insurance companies, and profit-oriented organizations like manufacturers of medical products (see actors indicated in Table 1). Second, there is a significant conflict between complementarity and competition in the activities needed to realize the treatment of patients. For instance, to realize orthopedic care, historically a manufacturer of medical products collaborated with service providers in that it solely provided products needed for treatments (e.g., prostheses). However, this complementary relationship evolved over time so that a central manufacturer in our case acquired and founded own sites of service providers, resulting in considerable competitive tensions between the once solely collaborative partners. This puts special emphasis on the challenges in joint value creation and value appropriation. Third, different types of data are collected and shared in the observed case. This includes a

Table 1 Major actors of the case data ecosystem

Actor	Main activities	Primary data sources	Sources of revenue
Insurance company	Examination of cost estimates and payment of corresponding treatments	Longitudinal, high-level data on a wide range of treatments of individual patients	Fees from insured persons, subsidized by the state
Medical product manufacturer	Development and production of orthopedic products	Data on the utilization of installed products	Products are sold to the service providers
Service provider	Conduction of treatments, coordination of treatment process, and referrals to other service providers	In-depth data on individual treatments of patients	Reimbursement by the insurance companies
Research institutes	Creation of public knowledge about new treatment processes	Diverse sets of pseudonymized data, often highly aggregated	Publicly funded

variety of patient-specific health data (e.g., diagnoses, contact information, or images) as well as data relevant to contexts beyond healthcare (e.g., financial data, machine data, or other data for the digitized production).

The way in which the main activities of the involved actors relate to the sharing and utilization of data in the case can be understood when delving into a typical treatment process. When patients in the case require orthopedic care, they usually visit a doctor’s office for an initial evaluation or directly consult a specialized service provider. At the service provider, patients reveal personal data such as name, address, and email by presenting their health insurance card provided by their insurance company. During the consultation, a treatment professional tailors a proposed plan to a patient’s specific needs and future mobility prospects. The corresponding

data are then added to the patient’s record within the service provider. Given that the German healthcare system operates on a reimbursement model, service providers must first contact the patient’s insurance company to secure funding before treatment can begin. This process involves submitting cost estimates and justifications for the proposed treatments. Once approval is obtained, the necessary orthopedic products are ordered from medical product manufacturers. Reflecting on the described process, Fig. 2 illustrates how data from the patient journey are collected and shared within the observed data ecosystem. That is, an individual service provider, networks of service providers, and insurance companies are able to collect data directly from the patient. These data may then be shared with further actors in the data ecosystem such as manufacturers or research institutes.

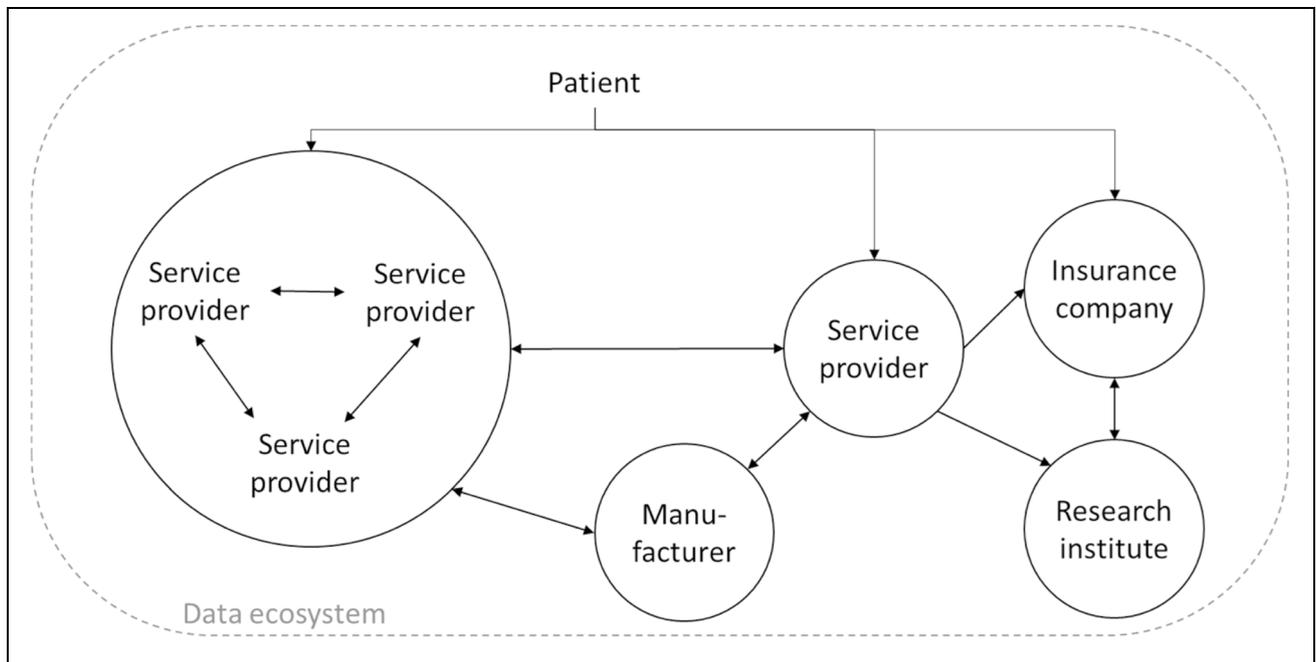


Fig. 2 Illustration of the case data ecosystem

Table 2 Data collection process

Data collection phase	Collected data	Goal
Phase 1: January–March 2022	10 semi-structured interviews, 2 unstructured interviews, and documents	Promote an understanding of data sharing between actors in the ecosystem
Phase 2: March–April 2023	3 semi-structured interviews	Reveal strategies that enable actors to appropriate value from data sharing
Phase 3: August 2023	8 semi-structured interviews	Improve the grasp on the heterogeneity of the actors involved in the data ecosystem
Phase 4: September 2023–February 2024	6 semi-structured interviews and 1 unstructured interview	Reiterating the findings on VAS to increase the depth of our understanding on what determines value appropriation in ecosystems

Data collection

We base our investigation on a comprehensive dataset comprised qualitative data from 30 semi-structured interviews with decision makers from manufacturers, insurances, service providers, merchants, and research institutes, as well as industry experts. The data were collected in four main phases between January 2022 and February 2024 (see Table 2).

Throughout the data collection phases, we applied theoretical sampling² to identify relevant interviewees (Glaser, 1992). The interview data were supplemented by secondary interviews, documents, newspaper articles, and webpages. In the first phase of data collection, a substantial amount of qualitative data were gathered to explore the focal phenomenon of data sharing in ecosystems. One major insight from the analysis of the first collection phase was that value appropriation in the ecosystem is a problem containing the interplay of multiple coalitions on multiple levels. Hence, we delved more into this question in phase 2 of our data collection. To account for the heterogeneity of the German health ecosystem, we extended the case by first analyzing further interviews with informants from insurance companies and a research institute in phase 3 to then reiterate and foster our understanding on the focal phenomenon in phase 4. The informants of our primary data collection are listed in Table 3.

To support the data collection, we built our interviews on semi-structured interview guides (Myers & Newman, 2007). The first part of each guide contained general questions regarding the interviewees' position in the organization and their professional background. This part was followed by questions regarding specific experiences (Urquhart et al., 2010) with sharing data. Based on the answers of the interviewees, we then proceeded by asking questions aiming at diving into these experiences to gain rich insights. Further,

we prepared follow-up questions that aimed to invoke interviewees to reflect and extend their answers. The interview guides as outlined above were individualized for the interviewees based on secondary data we collected before each interview. In line with the techniques of the grounded theory methodology (Glaser & Strauss, 1967), parts of the interview guides evolved with the theorizing process throughout the research project. For instance, while early interviews contained questions aiming to understand motivation and hurdles of actors to engage in data sharing, these questions shifted to questions regarding criteria used for evaluating when to share what data. Moreover, we also included more specific questions in later interviews diving into emergent concepts of our theorizing (e.g., regarding partner selection or data tailoring).

Data analysis

We conducted concurrent data analysis and collection in multiple iterations, allowing us to shape data collection based on the findings of prior iterations of data collection and analysis. Specifically, we conducted open, axial, and theoretical coding on a broad set of primary and secondary data (Glaser, 1992). Open coding involved sentence-level and occasionally word-level analysis, as well as constantly comparing statements within and across interviewees (Urquhart et al., 2010). Axial coding allowed us to relate emergent subcategories with categories (see Supplementary information) (Glaser, 1992). Here, analytical moves (Grodal et al., 2021) were employed for abstraction, such as questioning and dropping categories. Theoretical coding then allowed us to characterize the interdependencies between the identified categories. We combined multiple approaches to ensure the credibility of the research process and results.

First, when investigating data sharing relationships between actors of the ecosystem, our data collection compared multiple perspectives from the involved actors. For instance, we triangulated statements from a manufacturer about VAS with data collected from service providers that share data with this manufacturer. Thereby, we made sure

² For instance, insights from Phase 2 indicated that the analysis needed a more holistic view on the heterogeneity of the observed data ecosystem triggering the conduct of interviews with insurance companies to our data in Phase 3.

Table 3 Overview of the informants and interviews of the case study

Informant	Organization	Position of the informant within the organization
I1	Manufacturer of Medical Products	Marketing Manager
I2	Manufacturer of Medical Products	Head of Digital Product Unit
I3	Manufacturer of Medical Products	Data Analytics Expert
I4	Manufacturer of Medical Products	C-Level Manager
I5	Manufacturer of Medical Products	Global Head of Business Unit
I6	Service Provider A	Director Patientcare
I7	Service Provider A	Team Leader
I8	Service Provider B	Managing Director
I9	Service Provider C	Managing Director
I10	Service Provider D	Managing Director
I11	Service Provider E	Managing Director
I12	Service Provider F	Member of the executive board
I13	Coalition of Service Providers	Coalition Manager
I14	Service Provider G	Managing Director
I15	3D Printing Merchant	Managing Director
I16*	Insurance Company A	Unit Director Customer Business Analytics
I17*	Insurance Company B	Head of Corporate Management
I18	Insurance Company C	Unit Director Health System Research
I19	Insurance Company D	Head of Strategic Corporate Development
I20	Insurance Company E	Board Representative
I21	Insurance Company F	Unit Director Corporate Development, Processes and IT
I22	Insurance Company G	Chief Digital Officer
I23	Insurance Company H	Unit Director Controlling, Analytics and Risk Management
I24	Insurance Company I	Head of Strategic Medical Care Control
I25	Insurance Company J	Unit Director Corporate Development, Processes and IT
I26	Service Provider H	Managing Director
I27	Research Institute	CIO Data Management
I28	Consulting Firm	Partner Life Science

Informants marked with * were interviewed twice

that potential biases resulting from the sensitivity of the matter (i.e., the strategic concerns) are ruled out in the analyses (Myers & Newman, 2007).

Second, we conducted a triangulation of subjects by reflecting on the data collected from different informants (Myers & Newman, 2007). In this process, we aimed at both, comparing multiple informants in similar positions (e.g., managers at service providers) as well as critically reflecting on statements from actors with diverse professional experiences to mitigate biases (H. K. Klein & Myers, 1999).

Third, we triangulated data sources by complementing primary data from the interviews with secondary data (see Supplementary information for a detailed illustration). Secondary data used for this matter included manuals of digitized products that share data, forms that determine what data can be shared, websites of each case site as well as blog posts and whitepapers. This allowed us, for instance, to challenge elaborations of interviewees regarding their data sharing behavior or their partner network.

Fourth, multiple researchers engaged in the analysis of the collected data. Data analysis was accompanied by ongoing discussions and comparison of codes with dual meanings to ensure a common understanding of the data (Strong & Volkoff, 2010). Interim findings were discussed jointly by both authors as well as at conferences and workshops. Intensive discussion brought out potential alternative interpretations that we used to challenge and critically reflect on our theorizing.

Finally, we reflected our findings in the light of existing theory on value appropriation and data ecosystems to increase the generalizability of our findings and embed our research into the literature. During this process, we made sure that this preunderstanding did not limit our coding to these categories (Walsham, 1995). Rather, conflicting perspectives were examined using theory as a “sensitizing device” (H. K. Klein & Myers, 1999, p. 75).

Through iterative data collection and analysis, as described above, our understanding evolved over the course of the four phases (see Table 2). Following an inductive

reasoning approach guided by techniques from the grounded theory methodology (Glaser, 1992; Urquhart et al., 2010), across all phases, findings emerged through the investigation of individual actors of the case as well as iterative comparison of the resulting findings. Specifically, we compared the insights from multiple informants in different positions of one specific actor (e.g., manufacturer of medical products), insights across different actors of a similar kind (e.g., multiple service providers), and insights across different kinds of actors (e.g., compare the insights from a manufacturer of medical products with those derived from service providers). Following this process, at first, we were able to understand the motivations and barriers to data sharing among actors in the observed ecosystem. In this phase, we observed value creation and appropriation as factors driving individual actors' motivation to share data. Further diving into how actors share data within an ecosystem in Phase 2 allowed us to understand strategies that enable actors to appropriate value from data sharing. Broadening the scope of actors in our data collection in Phase 3 enabled us to understand and contrast more heterogeneous perspectives within the data ecosystem. Finally, in Phase 4, we revisited the findings on VAS to deepen our understanding of how the factors determining value creation influence value appropriation within ecosystems.

Findings

The in-depth analysis of the presented case reveals three main findings that we shed light on in the following. First, the value creation capacity of data sharing in data ecosystems is determined by the interaction of the potential of shared data and characteristics of the receiving actor. Second, we show how VAS consisting of four central elements enable sharing actors to appropriate value created from data sharing. Third, we reveal that the need for VAS in data

ecosystems is both triggered and shaped by the value creation capacity resulting in a circular dynamic between VAS and value creation capacity.

Value creation capacity

Based on the analysis of the data sharing practices in the described case, we are able to derive an understanding of data potential and actor potential in data ecosystems as well as of how they determine the value creation capacity of the shared data.

Data potential of the prospective sharing data

Data potential of shared data determines the opportunity for additional value creation based on that data. Our data reveals that, if no VAS are applied, the potential is often manifested beyond the sharing actor's reach. Specifically, we find three forms of data potential: its ability to enhance the value proposition, to improve economic efficiency, or to promote industry leaps (see Table 4).

First, the data potential can unfold to *enhance an actor's value proposition* in multiple ways. One way how actors in the case realize the value of data is by using it to innovate their services and products. For example, data are used to better understand the customer (here: patient) and direct research and development processes accordingly. The potential for this understanding of the customer becomes especially evident when data are shared in ecosystems, that is, when various touchpoints with the customer are composed to a holistic view of the customer. To this end, the Unit Director for Customer Business Analytics in a large German insurance company stresses "that the people involved in providing services should ideally have the complete data picture of a patient in order to provide optimal care" (I16). Further, it is also able to use the data to customize products and services by the application of digital manufacturing, where service providers can offer customized products for

Table 4 Forms of data potential

Data potential	Primary beneficiary of data sharing without VAS	Definition	Exemplary manifestations at the beneficiary
Enhance value proposition	Receiver	Shared data enhances customer understanding, drives innovation and customization of products and services	Product or service innovation After sales or upselling Information integration
Improve economic efficiency	Receiver	Shared data optimizes operational efficiency and reduces costs, enhancing economic efficiency through workload management, prediction, and fraud detection	Service process optimization Production cost reduction Workload balancing and prediction
Promote industry leaps	Ecosystem as a whole	Shared data are used so that industry advancements through research are achieved, benefiting all actors	Insights about possible product or service innovation

individual customers. For example, the Managing Director of a service provider states that they send “scans accordingly to an external service provider [...] to create such a 3D print” (I10). Relatedly, informants also describe the opportunity to use data in the treatment process to “upgrade the patient to a higher-quality aid” (I8, Managing Director of a service provider). Especially in the context of medical treatments, being able to identify improvements of certain complements is found to be beneficial.

Further, the observed case suggests that data also hold potential to enhance an actor’s value proposition by enabling after sales activities such as the proactive maintenance of sold products. Actors use data about the treatment to “set a follow-up reminder in the system, that is, regularly everyone with a specific follow-up key is then filtered, and they can be automatically contacted” (I11, Managing Director of a service provider). The need to use data for these purposes is evident, not only as these activities generate additional revenue for the maintaining service provider but also as regulatory devices such as the Medical Device Regulation of the European Union requires certain maintenance activities on a regular basis as mentioned by interviewees of various service providers (see I6, I7, and I9).

In the analyzed case, actors already use their data for exemplary value propositions such as automatic scheduling of follow-up treatments being realized without data sharing between actors. However, there is much more potential in using data from within the data ecosystem. For instance, a manufacturer of digital prostheses implements techniques in each prosthesis that collect rich, longitudinal data about patients’ movement patterns. Through data sharing, service providers are then enabled to analyze and use these data to improve the treatment according to the patients’ needs. Referring to the data collected by a digitalized prosthesis a Managing Director of a service provider argues that “after 10,000 step cycles it’s definitely advisable to replace the joint or something like that. So yes, in this respect, one could probably achieve an increase in the quality of care [once we can access the data from the manufacturer]” (I10). However, it is also possible that these data are analyzed by the manufacturer that then in turn recommends certain ways of treatment (see I3, Data Analytics Expert at a large manufacturer of medical products).

Second, we find that data also hold potential to *improve economic efficiency* of an actor. For example, data are used to operate more efficiently and hence decrease costs. For instance, an interviewee from a service provider elaborates on how data are used to manage the workshop in a way that it is used “to its full capacity” (I8, Managing Director of a service provider). Analyses based on data from within the data ecosystem can be used by service providers to determine “which of their patients, who are

then segmented [in a dashboard], are cared for by whom of the staff” (I4, C-Level Manager at a large manufacturer of medical products), eventually enabling an optimization of the workforce and workshop processes. Another opportunity is to simply use the data for the “standard processes [as this is] what they’re made for in the first place” (I16, Unit Director Customer Business Analytics). For instance, by utilizing data from other actors within the ecosystem, less redundant data collection about patients’ health records are needed. This saves resources for service providers and patients as well as it offers crucial efficiency gains for the treatment process, as stressed by I16: “However, in addition to research, it is much more important that the people involved in the provision of care ideally have the complete data picture of a patient in order to provide optimal care” (I16, Unit Director Customer Business Analytics). Further, insurance companies can reduce their costs once service providers have a holistic view on the patient that allows them to apply preventive rather than curative treatments that are, in the end, less costly. This is illustrated by the Unit Director Customer Business Analytics stating that “models then enable us to predict the future of the patient. And there we have the possibility to intervene” (I16). Other examples concern the legal application of data in cases where insurance companies can detect fraudulent behavior of service providers or review contracts (see I16).

Third, we find the potential of data to *promote industry leaps* independent of immediate improvements in value propositions or efficiency. This opportunity is often illustrated referring to the patient as a final beneficiary of these leaps. For instance, informants from insurance companies refer to the ability to enable medical research such that, in the end, data sharing “can do something good for the insured” (I19). Another example is illustrated by informants stating that they perceive the “obligation or the responsibility to provide these data” (I17, Head of Corporate Management of an insurance company) to allow for industry-wide knowledge gains about treatment processes serving all patients. Interviewees refer to a multiplicity of such knowledge gains that benefitted the whole industry. For instance, I27, CIO Data Management at a research institute, refers to a current project where their team combines “data from the German Childhood Cancer Registry with data from 13 health insurance companies at the individual level” (I27) to advance cancer research. Other interviewees combine data to develop analyses, interactive dashboards or reports about the health industry as a whole (see I23). As these insights are made publicly available, many actors are enabled to profit from them. All of these examples have in common that the realization of their benefits is not limited to the focal actor but materialize in the entire industry.

The analysis of the presented case exposes various ways in which data hold the potential to enable value creation. For instance, service providers collect in-depth data on individual treatments, insurance companies have access to rather superficial, but longitudinal (often life-long) data or manufacturers can collect rich data on the usage of medical products. As we outlined above, these different kinds of data come with their own data potential. However, this data potential remains latent until an actor in the data ecosystem realizes it. In the following, we describe our findings on actors' characteristics that determine the realization of the latent data potential.

Actor potential of the receiving actor

The analyzed data ecosystem contains a heterogeneous set of actors that is not only reflected in the data collected but in the receiving actor's ability to realize the data potential. Our findings yield insights into what constitutes this potential of the receiving actor in the data ecosystem.

As discussed above, access to complementary data from within the ecosystem increases the latent *data potential* at the receiving actor. Such data can for instance enable a holistic view on the patient. It becomes apparent that it can be beneficial for an actor to have access to data from multiple parties within the ecosystem. That is, the opportunities that emerge from the additional shared data shared by the focal sharing actor (e.g., the service provider) depend on existing data sharing links of the receiving actor (e.g., the manufacturer to other service providers). These existing data sharing links of the receiving actor constitute the *actor position* within the data ecosystem.

Building on this notion, the position in a data ecosystem is qualified by three characteristics. First, like in the example above, links to a number of service providers enable a manufacturer to complement the data effectively, highlighting the importance of having multiple connections within the ecosystem. Second, the volume of data shared through each data sharing link further increases the opportunity to complement the data shared by the sharing actor. For instance, it is described that in order to calculate "prevalence rates [of diabetics] you always need the denominator and say, what do I actually refer my diabetics to" (I27, CIO Data Management at a research institute), implying that one needs a great volume of patient data for this matter. Others elaborate on how the development of applications using artificial intelligence makes them "think about where you have a lot of data that you can use to train the system" (I16, Unit Director Customer Business Analytics in an insurance company). These examples emphasize that the volume of data shared through these sharing links can enhance the actor's ability to derive value from the ecosystem. Third, we find that

the exclusivity of data sharing links characterizes the position of an actor within a data ecosystem. For instance, the Director Patientcare of the investigated manufacturer argues that to realize the data potential of innovating their products, the manufacturer needs "patient proximity, in order to develop products that are market-ready and well-accepted" (I6). However, in the analyzed case, this direct access to the patients is mainly exclusive to the service providers, resulting in a pressure for the manufacturer to expand its position in the ecosystem and get an "objective picture" (I2). Each of these characteristics—number of links, volume of shared data, and exclusivity—plays a distinct role in shaping an actor's position within the data ecosystem.

Although access to data in a data ecosystem is necessary for actors to effectively realize the data potential, it is not sufficient. Rather, actors also need the ability to use that data. For instance, we described how service providers are in a presumably elevated position. However, in the present case, service providers often do not have the resources to effectively use these data to, for instance, improve their products and services. This is illustrated by many informants from the service providers but put to the point by one Managing Director arguing that "we can't do that in-house. External resources have to handle it. Our technical know-how isn't sufficient for that" (I10). In contrast, manufacturers' key activity is the development of their product portfolio to keep their competitive edge in the market. Hence, the manufacturers observed in this case use their resources to develop their ability to derive insights from data as a means of creating novel value propositions.

Synthesizing our elaborations above, we identify two characteristics of an actor that influence its possibility to realize the latent potential of (shared) data in a data ecosystem: the actor's *position* and its *ability* to utilize the data to create value. We refer to the combination of both as the *actor potential*.

When investigating a coalition of service providers, we further find that the actor potential is not limited to individual actors. Rather, this concept refers to a unit of one or more actors that use data collaboratively. When multiple actors in such a unit share data they collect through their individual links, each actor's position is elevated by these respective links. Further, organizations can join their abilities to use data effectively. That is, the latent data potential can be realized by multiple actors that join their abilities and links.

Taken together, this interaction of data and actor potential in data ecosystems determines the *value creation capacity* of data sharing within data ecosystems. The value creation capacity triggers the need for VAS and shapes their design. In the following, we discuss elements of such VAS, subsequently explaining how these elements are influenced by the value creation capacity of the data in the data ecosystem.

Elements of value appropriation strategies

Aiming to find VAS the sharing actor in an ecosystem can apply, four elements serving as the building blocks of VAS (see Table 5) emerged from our data: selective partnering, data tailoring, benefit safeguarding, and control enforcement. Actors can configure specific activities relating to each element to enable value appropriation from data sharing in ecosystems.

Selective partnering

The first element of a VAS is concerned with the question of who data should be shared with. The analyzed case represents a heterogeneous ecosystem with a variety of actors. In that respect, we find that differences in size, market capitalization, and, related, power of the data-receiving actor determine an actor’s considerations on data sharing. To be able to appropriate value from data sharing, the observed data sharing actors apply four interrelated activities in selective partnering.

First, as a means for *competition avoidance*, we observe that service providers prefer sharing data with geographically distant service providers. For instance, when providing services such as the treatment of patients, value is realized by the service provider in physical relations. Due to the specific characteristics of data, however, the sharing of data itself is independent from the physical world. This is illustrated by the Managing Director of a service provider: “I don’t want that the competing treatment facility in our city might also have access to the data or would participate in the data” (I9). Hence, by choosing to share data only with those actors that are physically distant, the sharing actor can align the subsequent value creation of the receiving actor with its own interests.

Second, when engaging in *power avoidance*, sharing actors carefully assess the relative power of the data receiver before sharing data with actors in the ecosystem. They are particularly cautious when the receiving actor is deemed too powerful within the ecosystem, as stated by the Managing Director of a 3D printing merchant: “I see the risk that the bigger my counterpart is, the more difficult it becomes” (I15). In such cases, data-sharing actors may choose to withhold data to maintain their competitive advantage and prevent the receiver from gaining an even stronger position in the ecosystem.

Third, as another activity to counter overpowering data receivers, we find that sharing actors *form coalitions*. Here, the first two strategies are combined: members of the competition are considered to be on “*eye-level*” (I15) with regard to their size and power, while they are also situated in different localities. Further, this selection is characterized by the multi-level nature of data ecosystems. When forming coalitions, actors do not cooperate with all actors in the data ecosystem (e.g., around a central manufacturer), but with specific actors they select. In the current case, for instance, the Coalition Manager of a coalition of service providers states that “it would be desirable for smaller companies to join forces in larger associations and pool their resources for studies, which they can then carry out together” (I13). This will then create a counterweight to the “giants” (I13) such as the observed manufacturer of medical products in the case enables the coalition to exercise political influence, exchange data and pool capabilities—all prerequisites of value appropriation.

Fourth, when selecting with whom to share data in an ecosystem, we find that actors practice *lock-in avoidance* by only sharing data with actors that offer open data interfaces. Here, the rationale is that when engaging with

Table 5 Elements and activities of value appropriation strategies

Element	Definition	Activity
Selective partnering	Sharing actors assess and adjust the relative possibilities of the receiving actors	Competition avoidance Power avoidance Coalition formation Lock-in avoidance
Data tailoring	Sharing actors modify data to restrict or release data	Vertical data trimming Horizontal data trimming Data aggregation or obfuscation Data pre-analysis
Benefit safeguarding	Sharing and receiving actors agree on mechanisms that ensure certain degrees of value appropriation	Immediacy design Reciprocal sharing Trust building Mediated sharing
Control enforcement	Sharing actors enforce control over the value creation of the receiving actor	Monitored data access Legal assurance

“closed systems” (I15, Managing Director of a 3D printing merchant) that only provide proprietary interfaces for joint value creation, with whom data are shared cannot be changed without substantial efforts.

Data tailoring

We further find that the decision of what data to share can be an important element of VAS. Investigating the data sharing practices of actors in the examined data ecosystem in more detail, we find that this element is mostly implemented through activities of trimming the shared data vertically (e.g., sharing only data of individual patients, rather than multiple) and/or horizontally (e.g., reducing the number of attributes shared), the setting of temporal boundaries and the aggregation of data.

When actors apply *vertical data trimming*, they select certain data records that they share. One example refers to the elaborations of a Unit Director of an insurance company arguing that one is not “going to transmit all [data about] diabetics but take a representative sample from my diabetic population” (I16). Further examples for such an activity can be found when service providers order products from manufacturers to get individual configurations of a product or when data are needed to prove to the insurance company that a treatment was necessary and thus can be reimbursed.

When actors apply *horizontal data trimming*, they decide not to share specific attributes about certain areas of their data within the ecosystem. For instance, as indicated by a Managing director of a service provider, even if legally entitled to do so, they do not (like to) share “address, phone number, social status, average order volume, average gross profit” (I9). They perceive this information to be “company internals” (I9) coming with the risk of being unable to appropriate any of the value created from this data sharing. However, patient-specific identifiers are shared as they facilitate the creation of appropriable value, such as the ability to commission orders. Another example refers to the Head of Corporate Management from an insurance company, arguing that “as soon as it comes to finances, which could later go into remuneration and contract negotiations” (I17) they refrain from sharing data with actors of the ecosystem.

The *aggregation of data* is found to be another activity contributing to the VAS. This activity is illustrated in the case by the elaborations of the Coalition Manager of a coalition of multiple service providers arguing that when sharing 3D models, service providers pay attention to the question of whether the data receiver can re-engineer the know-how included in the model. Only if they are certain that sharing the 3D model does not allow this spillover, they share data with actors of the ecosystem.

One step further, actors might choose not to provide access to the requested data directly but rather share insights or answers to specific questions derived from the

pre-analysis of the data. This activity ensures that the process of value creation remains with the sharing actor, highlighting the necessity for the sharing actor to have the appropriate actor potential to extract meaningful insights. Simultaneously, it restricts the receiver’s ability to generate new value from the data, as they are only given the end results of an analysis rather than the raw data itself.

Benefit safeguarding

Furthermore, we find that actors can employ activities that guarantee certain degrees of value appropriated from data sharing. We term this element of VAS benefit safeguarding which can encompass activities of immediacy design, reciprocal sharing, trust building, and mediated sharing.

We find that actors can effectively engage in data sharing and reap its advantages by applying an *immediacy design*. This activity refers to settings where data sharing actors ensure that they receive a predefined benefit directly after data sharing. In the case, we find three forms of this activity. First, financial compensation of the data is illustrated by the Managing Director of a service provider stating that “well, I could sell the data to the manufacturer [because] I actually get nothing from the data” (I26). However, contextualizing this general willingness to sell data of some actors in the ecosystem with further statements of actors who are more concerned with collecting data, we observe that often this cannot be realized as data receiving actors are unable to assess what value will be created from the shared data. Hence, second, actors are observed to demand compensation for the additional effort that goes along with the collection of data. For instance, insurance companies engaging in data sharing projects often collect data specifically for the purpose of this project. In these cases, insurances prefer fixed monetary compensations to handle workload rather than selling data per datum. Moreover, we find that actors are compensated with non-financial resources such as products or services in return for sharing their data. In the present case, this is exemplified in several instances, ranging from data sharing during the product ordering process where data are shared so that the product can be “properly adapted to the user’s needs” (I12, member of the executive board of a service provider), over supplying 3D models for printing jobs, to other practical applications.

Further, we find that the activity *reciprocal sharing* can safeguard benefits from data sharing in two ways: obtaining data in return for shared data and gaining insights in exchange for data. In the former, the sharing actor demands the receiving actor to also share their data in return for enabling the sharing actor to create value from these data. Related, in the latter, the sharing actor gets insights derived from its own data (e.g., complemented with further data the receiving actor accesses) as a basis for further value creation.

Another activity to safeguard benefits that emerged from the interviews refers to *trust building*. Informants in the case often state that they base their data sharing decisions on softer criteria such as a “gut feeling” (I26) or the evaluation of the “interpersonal level” (I26) of the relationship between sender and receiver. This is based on the notion that sharing actors perceive no control over the data, or more specifically, about the value creation from that data once it is shared.

Related to the activity of trust building, we find that *mediated sharing* can also ensure value appropriation from data sharing. In cases of mediated sharing, actors do not share data directly with other actors of the ecosystem but through a trusted intermediary. Value emerges from the reciprocity of data sharing as in cases where the trusted intermediary operates as a kind of data platform. That is, a platform that allows multiple actors of a data ecosystem to share and access data.

Control enforcement

Activities of control enforcement influence the process of value creation as a means of value appropriation. The analysis of our data reveals two activities that instantiate this element.

First, we observe that sharing actors enforce control over value creation by allowing only *monitored data access*. In these cases, receiving actors wanting to create value from the shared data can perform analyses on a platform provided by the sharing actor. This allows the sharing actor to continuously evaluate the value creation of the receiving actor and to intervene if the created value is perceived to be insufficiently appropriable.

Second, sharing actors also try to ensure value appropriation from sharing data by establishing means of *legal assurance*. These assurances can take many forms. For example, a Managing Director of a service provider argues that “specific contracts can be made so that these data are only used for these purposes” (I10) implying they do not expect opportunistic use of the shared data. Relatedly, we observe that in a data ecosystem where multiple actors jointly share their data for a specific research purpose, legal mechanisms are installed that grant each data sharing actor the opportunity to give their veto should undesired research purposes arise.

The described elements and activities of VAS emerged as themes from our in-depth investigation of the case. We show that actors in a data ecosystem can approach value appropriation from a multitude of angles: by selecting the right partner, tailoring the data, safeguarding certain benefits, or enforcing control. To deepen our understanding of these elements, we elaborate on how these elements are shaped by and do shape the value creation capacity of data sharing in data ecosystems.

Interdependencies with value creation capacity

In the previous two chapters, we elaborated on two main findings. First, in a data ecosystem, data potential and actor potential constitute the value creation capacity. Second, to establish effective VAS, actors in data ecosystems draw upon four VAS elements, that is, selective partnering, data tailoring, benefit safeguarding, and control enforcement. However, our analysis further indicated that the value creation capacity triggers the need for VAS. In the following, we describe our findings on the interdependencies between the value creation capacity and the VAS elements.

Selective partnering By employing activities of selective partnering, sharing actors adjust the actor potential used for value creation. For instance, when avoiding local competition or too powerful actors, sharing actors choose not to enable certain receiving actors to realize parts of the data potential (e.g., improving the value proposition and, hence, gaining competitive advantage over the sharing actor). Instead, they only enable those actors whose data potential realization seems appropriable, or as the Unit Director Health System Research in an insurance company puts it: “If now some service provider, the pharmaceutical industry, or someone else is conducting research solely for their own purposes, then we might be more inclined to say, well, we won’t participate in that, because what benefit does it bring us?” (I18). Above, we argue that the position of an actor is determined by the specific characteristics of its data sharing links. The activity of coalition formation can be understood in this sense as multiple actors (e.g., service providers), aggregating their data sharing links to eventually improving their position. Thereby, the involved actors enhance their actor potential and, hence, their possibilities to create value compared to the receiving actor. This can result in the coalition being able to engage in value creation steps on their own: “Actually, it would almost be desirable for smaller companies to join together to form larger coalitions and join forces here to do exactly the kind of studies that they can then carry out together. Otherwise, a giant [manufacturer] will do it” (I13, Coalition Manager). This improvement of the position of the sharing actors relates to the activity of power avoidance as collaborations with overpowering actors are avoided. Moreover, by mentioning to form a coalition against a “giant” (I13), the interviewee implies that they would share data with actors that are in a similar position, or as argued by the Managing Director of a 3D printing merchant, on “eye-level” (I15). Such receiving actors are not enabled to use the shared data for value creation that is not appropriable. In sum, by applying activities of selective partnering, sharing actors assess and adjust the actor potential which determines the receiving actors’ possibility to realize the data potential.

Data tailoring Activities of data tailoring influence the data potential of shared data. This relation can be illustrated by an example related to the case where one actor shares only a random sample of its patient data (rather than data about all patients) and omits all contact information. Thereby, the sharing actor trims the data vertically as well as horizontally, ultimately altering the data potential of the shared data. Specifically, the receiving actor can use the data to create value by finding patterns in the data and developing new products from it but not by engaging in after sales activities. Similarly, the activity of aggregating data significantly affects the data potential by limiting the receiver's opportunities to combine that data with other sources to uncover new insights. In essence, by tailoring the shared data, the sharing actor maintains strategic control over the potential of the data to be used for value creation, ensuring that only value is created that is deemed appropriable. The relation between the activities of data tailoring and the data potentials illustrated by I16, Unit Director Customer Business Analytics at an insurance company:

“It is always important to us to focus on the objective of the research collaboration. The purpose for which I intend to use the data must not be compromised as a result. If I restrict the data to the point where it becomes impossible to answer the research question or if the critical nature of the findings is then jeopardized, well, then it's better to refrain from it entirely. So, one has to be careful. But we do practice such options, simply out of the principle of data minimization.” (I16)

The interviewee here highlights the need to tailor the shared data in a way so that the shared data are minimized, while the data potential remains high enough to be used for value creation. Thus, taken together, activities of data tailoring release or restrict the data potential of the shared data.

Benefit safeguarding Benefit safeguarding directly influences the distribution of the value creation capacity. That is, related activities ensure that a certain amount of the created value is appropriated. Actors take these actions to address the inherent uncertainty of the value creation capacity grounded in the data potential and its realization through the actor. This is illustrated by I7, Managing Director of a service provider:

“I would just have the effort. I would have to record it precisely right from the start, I would have to collect the data, transfer it, just so that a supplier could use this data for their purposes. From which I *might* - you could also argue optimistically - perhaps have a better product at some point.” (I7, emphasis added).

To address the uncertainty regarding both, the creation of value by the receiving actor and its appropriability by the sharing actor, an immediacy design can be applied. Here, the sharing actor appropriates value by immediately capturing financial or non-financial resources. Similarly, when engaging in reciprocal sharing, the data potentials of both actors are joined and, in application of each actor's actor potential, used for the creation of appropriable value. Thereby, rather than relying on the data potential to be realized by the receiving actor (e.g., by advancing products and services), sharing actors make use of the ability of the receiving actor to realize the latent potential of shared data directly or creating the value themselves. In that way, the sharing actor ensures a certain degree of value appropriation. When engaging in mediated sharing activities sharing actors ensure that they will appropriate value from sharing data. Further addressing the uncertainty mentioned above, ensuring value appropriation can be achieved by trust building. That is, when sharing actors “first establish a trusting cooperation” (I26, Managing Director of a service provider), they build trust in the receiving actor to use the shared data to create value that can be appropriated. For instance, the Unit Director Customer Business Analytics of an insurance company argues they only share data with actors that “already have experience in dealing with secondary data” (I16) to be more certain of the value creation. In summary, when sharing actors apply activities of benefit safeguarding, they directly distribute a part of the value created from their data.

Control enforcement Similarly, activities of control enforcement directly affect the value creation. The interdependence between value creation capacity and activities of control enforcement is characterized by the implementation of explicit measures that ensure the distribution of created value from data sharing. This is driven by the sharing actors' desire to maintain “data sovereignty” (I10, Managing Director of a service provider) and, thereby, to be able to control the value creation. For example, in cases where actors implement legal assurances, they explicitly determine how the created value is distributed among the actors. In these kinds of legal assurances, the sharing actor controls the value creation by explicating the latent data potential and limiting its realization to a degree that is perceived as appropriable. Correspondingly, in cases of monitored access, the value creation from the shared data is closely tracked, as argued by I16, Unit Director Customer Business Analytics of an insurance company:

“[When granting monitored access,] we can see through tracking procedures which queries have been designed, which data has been touched, what has been done. [...] Then we can also see what has happened to the data. [...] Everything is logged.” (I16)

Here, combining complementary data from various sources within the ecosystem becomes harder (if not impossible), hindering the capitalization of the position of the receiving actor, effectively limiting the value creation capacity.

Reflecting on our findings, we uncover that elements of VAS influence three levers of value creation in data ecosystems: the data potential, the actor potential, and the value creation capacity (see Fig. 3). The data potential is found to be restricted or released by the element of data tailoring while the actor potential is adjusted by the activities of selective partnering. Finally, the elements of benefit safeguarding and control enforcement directly distribute or restrict the value creation capacity.

Discussion

The goal of this study was to disentangle the conditions that determine the capacity for value creation and to uncover mechanisms that facilitate mutual data sharing benefits in data ecosystems. We started out with a theoretical preunderstanding that actors must be able to appropriate value to participate in data ecosystems and, thereby, enable value creation through data sharing (see Fig. 1 in the theoretical foundation). Through our empirical study, we elevate this theoretical preunderstanding of data sharing in data ecosystems by detailing the interrelation of value creation and appropriation in data ecosystems and showing how VAS shape and are shaped by this interrelationship. We discuss these findings, as depicted in Fig. 4, in the following.

The value creation capacity represents the prospect that data sharing will translate into the creation of new value (Gelhaar et al., 2023). Prior literature has established the link between data sharing and value creation opportunities of the involved actors and data ecosystems as a whole (Oliveira et al., 2019). Our findings draw a more fine-grained picture and suggest that this value creation capacity is constituted by an interplay of two components that are important in the context of data ecosystems, namely, data potential and actor potential. Thus, the value creation capacity depends on the characteristics of the shared data (Aaltonen et al., 2021;

Alaimo et al., 2020; Priego & Wareham, 2024; Shapiro & Varian, 1999), the characteristics of the receiving actor (e.g., Günther et al., 2017; Legner et al., 2020), as well as their interrelation.

Prior literature describes various examples how value can be created in data ecosystems (Oliveira et al., 2019; Scheider et al., 2023), which we characterize as data potential in three forms: enhancing the value proposition, increasing the economic efficiency, or promoting industry leaps. Our findings suggest that, independent of the actual value creation, certain potential is inherent in the shared data. This data potential is one aspect that needs to be considered when making decisions on data sharing and reflects the specific characteristics of data as being generative (Kallinikos et al., 2013; Lehrer et al., 2018). Nevertheless, the data potential remains latent until adequate receiving actors exploit it for value creation.

Our findings suggest that the actor’s potential to turn data potential into value is determined by the ability of an actor to utilize shared data effectively, which is shaped by the capabilities of the actor and its position in the data ecosystem. Capabilities are a recognized prerequisite for effective data utilization (Günther et al., 2017; Legner et al., 2020). We further specify the position of an actor (Adner, 2017) in data ecosystems through context-specific characteristics such as the volume, exclusivity and number of links. In this sense, the ability to access other data sources and combine sources from multiple actors is instrumental to value creation (Oliveira et al., 2019). Thereby, we yield insights into why certain actors unleash the capacity to create more or different value from the same shared data.

Our findings reveal four elements of VAS based on the notion that data sharing actors need to appropriate value to participate in data ecosystems (Gelhaar et al., 2023), that is, to capture profits from created value (Jacobides et al., 2006; Mizik & Jacobson, 2003). These elements either influence value creation directly or indirectly by shaping data or actor potential. Regarding the former, we find that the sharing actors can employ activities regarding benefit safeguarding to effectively distribute the created value. Although ownership of data cannot easily be enforced (Alaimo et al., 2020; Shapiro & Varian, 1999), trust building or immediacy designs are activities that can

Fig. 3 Interdependencies of VAS elements with value creation capacity in ecosystems



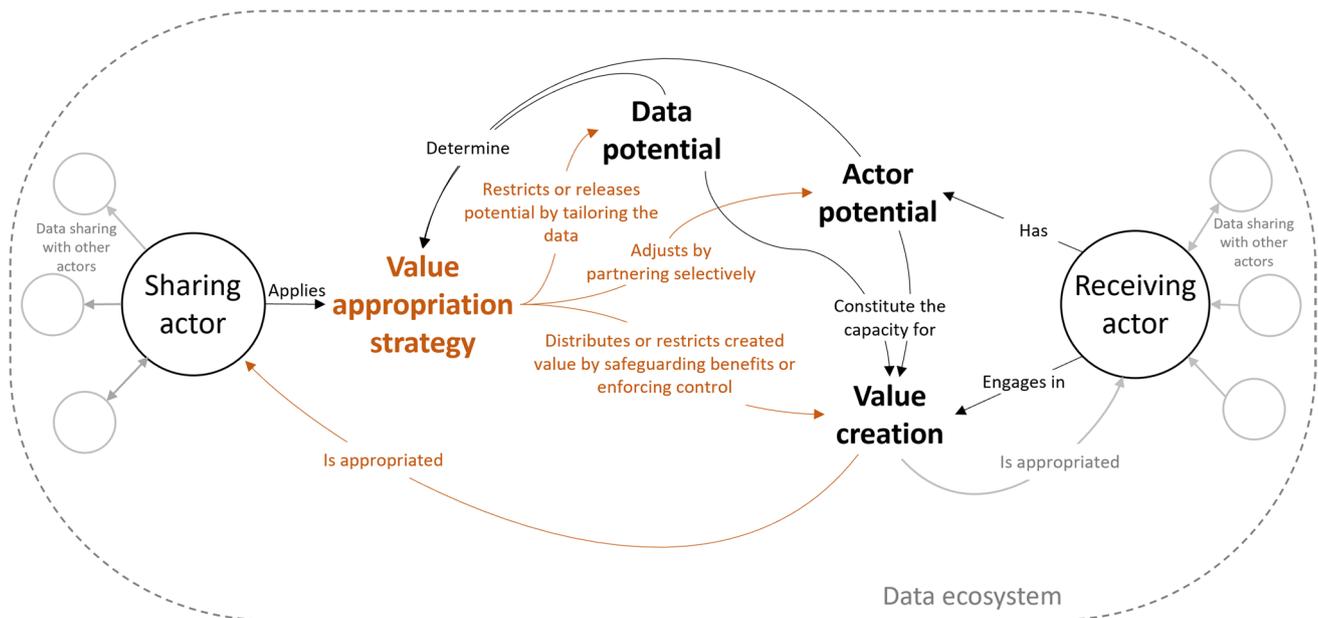


Fig. 4 The creation and appropriation of value from data sharing in ecosystems

enable the sharing actor to appropriate value. In a similar fashion, control enforcement activities aim at the control of access to resources as means to ensure value appropriation (Verwaal et al., 2009). This represents an isolating mechanism (Ceccagnoli et al., 2012; Teece, 1986) that can hardly be achieved without explicit measures, as maintaining control over a highly mobile and infinitely reproducible resource such as data is difficult (Shapiro & Varian, 1999). These measures include activities like monitored data access that do enable sharing actors to oversee the data utilization, thereby being able to appropriate value (Verwaal et al., 2009). However, when explicit measures are taken to distribute the value creation capacity, the key opportunities of data ecosystems often are restrained. For instance, while the editability and combinability of data can be a source of value creation (Alaimo & Kallinikos, 2022; Kallinikos et al., 2013), monitored access restricts the degree to which actors can take advantage of this opportunity. At the same time, pre-defining the appropriable value through immediacy design may bear the risk of not benefiting from the generative potential of shared data (Kallinikos et al., 2013; Lehrer et al., 2018). Hence, activities that directly restrict or distribute the value creation can only be one element of VAS and need to be complemented by further activities.

We understand the data potential as a constitutional part of the value creation capacity. Hence, to ensure the appropriation of created value, sharing actors can implement VAS activities that directly restrict or release the data potential. Prior literature described exclusive access to resources as an approach to appropriate value (Verwaal et al., 2009).

However, sharing data means giving others this access (Shapiro & Varian, 1999) and thereby opportunities to appropriate its value. To accommodate this, actors can tailor the shared data by, for instance, trimming the data horizontally and/or vertically, which we interpret as a strategic use of the refigurability of data (Alaimo & Kallinikos, 2022; Kallinikos et al., 2013). Other activities such as data aggregation and data obfuscation reduce the interpretability of data (Aaltonen et al., 2021) and the resulting threat of data being used for unintended purposes (Galliers et al., 2015), further restricting data's potential to be combined and used to make (unintended) analyses. Thus, the understanding of the data potential determines strategic decisions about data tailoring.

The sharing actor can also strategically influence actor potential by determining with whom data are shared. Reflecting our findings regarding partner selection with the literature, two main observations become apparent. On the one hand, selective partnering considers the potential of a receiving actor to create value. In general, when more value is created, more value can be appropriated (Bowman & Ambrosini, 2000; Kern & Gospel, 2023). In the context of our study, this means when sharing data with actors that are in an elevated position and are capable of creating more value from shared data (e.g., Günther et al., 2017; Legner et al., 2020), the potentially appropriable value increases. On the other hand, however, research has acknowledged the threats of opportunistic behavior of receiving actors (Clemons & Hitt, 2004; Das & Teng, 2001; Loebbecke et al., 1999). For instance, a powerful receiving actor can use its power to decrease the sharing actors value appropriation (Bowman & Ambrosini, 2000; Lavie, 2006). Consequently, our findings

reveal that avoiding receiving actors that are deemed too powerful function as activity of VAS. We show that, instead, the formation of coalitions can counteract power imbalances between sharing and receiving actors. While the discussed VAS activities of partner selection modify the actor potential, the actor potential of the receiving actor also determines VAS. That is, to make strategic decisions regarding selective partnering, sharing actors must evaluate whether the receiving actor is able to create appropriable value.

Integrating the discussion on the data and the actor potential, it becomes apparent that both concepts do not determine VAS independently from another and must be considered in conjunction. For instance, when engaging in the activity of competition avoidance, sharing actors have to assess which receiving actors are able to realize an unintended form of data potential. Sharing actors might refrain from sharing certain data with actors that aim to improve their own economic efficiency but lack the capability or position to innovate using these data. Nevertheless, they may share data with actors who have the potential to use the data to innovate on products that eventually will be available to the sharing actor. Hence, our findings reveal a new understanding of the design of VAS for data sharing as being determined by both, the data potential of the shared data and the actor potential of the receiving actor.

Reflecting on the dynamic discussed above, we find that value creation and appropriation in data ecosystems are interrelated processes (Bowman & Ambrosini, 2000; Kern & Gospel, 2023; Mizik & Jacobson, 2003). We advance this understanding by revealing how the specific characteristics of data ecosystems (Möller et al., 2024; Oliveira et al., 2019) result in a circular dynamic in which the VAS implemented by the sharing actor influence the value creation capacity and its appropriability that, in turn, determines the VAS itself.

Implications for theory

Our findings aim to contribute to literature by advancing knowledge on value creation in data ecosystems, uncovering the constitutional elements of VAS, and revealing the circular dynamic between value creation capacity and VAS in data ecosystems. These contributions refine existing theory by integrating literature on the specific characteristics of data sharing in ecosystems and value appropriation.

Determinants for value creation in data ecosystems

Our study has revealed two building blocks of the capacity of an actor to create value, namely the data potential and the actor potential. We, thereby, contextualize the understanding of the structural elements of business ecosystems (Adner, 2017) with the characteristics of data, that is, their

generativity (Kallinikos et al., 2013; Lehrer et al., 2018) and refigurability (Alaimo & Kallinikos, 2022; Kallinikos et al., 2013). This points to the importance of the position of an actor in the data ecosystem for its capacity to create value. This position, characterized by the data links to other actors in the ecosystem, determines the opportunities to access complementary data. Our study in this way advances knowledge on value creation in data ecosystems (Oliveira et al., 2019) by explaining how the potential of an actor in a data ecosystem and the potential of shared data influence the opportunities for value creation. This elevated understanding may prove valuable as a lens for researchers seeking to address issues of value creation and appropriation in data ecosystems. Consequently, we propose:

Proposition 1: An actor's capacity to create value is contingent on its actor potential (i.e., its position in the ecosystem and its capabilities) and the data potential of the accessible data.

Appropriating value created from data sharing by combining elements of VAS

Our findings suggest that value created from sharing data can be appropriated by applying VAS. Specifically, we uncover the constitutional elements of VAS in data ecosystems and their functioning. Here, prior research stresses the need for organizations to appropriate value (Chen & Miller, 2015; van den Broek & van Veenstra, 2018) and describes the opportunities to strategically appropriate value from created value by leveraging control over resources (Verwaal et al., 2009), power (Bowman & Ambrosini, 2000), absorptive capacity (Lavie, 2006) or by implementing isolating mechanisms (Lepak et al., 2007). However, the generativity of data (Kallinikos et al., 2013; Lehrer et al., 2018) and the challenge to enforce ownership on them (Alaimo et al., 2020; Shapiro & Varian, 1999) impair these approaches in the context of data ecosystems.

Hence, it remained unclear how value appropriation can be realized in data ecosystems. We address this gap by characterizing four distinct elements of VAS in the context of data ecosystems, namely selective partnering, data tailoring, benefit safeguarding, and control enforcement. These elements allow organizations to optimize value appropriation in data ecosystems by strategically balancing openness and retention of data sharing. We contribute to the discourse on the strategic management of value appropriation in the face of inherent competitive dynamics within ecosystems (Mizik & Jacobson, 2003). Our findings showcase how the uncovered elements of VAS enable organizations within ecosystems to actively balance value creation and appropriation. Building on the discussion of the elements of VAS, we propose:

Proposition 2: VAS influence value creation and appropriation directly or indirectly. That is, either indirectly by shaping data potential and actor potential or by directly distributing or restricting the value creation capacity.

Proposition 3a: Activities of data tailoring delimit value creation to appropriable aspects through restricting or releasing the potential of shared data. These activities will be more effective when sharing actors anticipate the potential of the shared data within a data ecosystem.

Proposition 3b: Activities of selective partnering influence the actor potential within the ecosystem by directing shared data to those actors expected to create appropriable value. These activities will be more effective when actors anticipate the potential of actors within a data ecosystem.

Proposition 3c: Activities of benefit safeguarding facilitate data sharing by mechanisms that ensure value appropriation. These activities will be more effective when actors anticipate the value creation capacity within a data ecosystem.

Proposition 3d: Activities of control enforcement allow data sharing by mechanisms that control value creation. These activities will be more effective when actors anticipate the value creation capacity within a data ecosystem.

The circular dynamic between value creation capacity and VAS

We reveal that the interdependency between value creation capacity and VAS is characterized by a circular dynamic. Extant research on data ecosystems highlights that whether organizations participate in data ecosystems depends on individual motivations (Azkan et al., 2020; Gelhaar & Otto, 2020; Gelhaar et al., 2023) resulting from the evaluation of risks and benefits of engaging in data sharing (Nienstedt et al., 2023). Our study shows that VAS can serve both purposes, safeguarding benefits and mitigating risks from data sharing.

Reversely, however, elements of VAS then influence the value creation capacity which in turn alters the necessity and possibility for VAS. While prior literature acknowledges the need for balancing the interrelated processes of value creation and appropriation (Mizik & Jacobson, 2003), we show that mere balancing both aspects may not reflect the specificity of data ecosystems (Oliveira et al., 2019). Here, the interconnection between creation and appropriation is found to be circular and self-reinforcing. Our study advances the understanding of this interplay (Mizik & Jacobson, 2003) as a central building block for enabling data sharing in ecosystems and the effective usage of data. Hence, we propose:

Proposition 4: The interrelationship between value creation and appropriation in data ecosystems is circular, whereby the adoption of VAS shapes the capacity for value creation, which in turn influences the need for VAS.

Managerial implications

The identified opportunities and challenges of value appropriation in data ecosystems have implications for the management in and of data ecosystems along three dimensions.

Approach data sharing strategically to appropriate value

Our findings show that when organizations want to appropriate value from sharing data, considerations preceding the actual data sharing are necessary. By proactively evaluating the value creation capacity of data sharing, organizations can position themselves to appropriate value from their data sharing initiatives and mitigate potential risks associated with it. This proactive approach highlights the importance of adopting a comprehensive strategy that addresses not only value creation but also appropriation in the early stages of data sharing. Our insights allow managers to make informed decisions when sharing data within ecosystems by providing insights into how data and actor potential shape the value creation capacity and, hence, the need for VAS.

Further, the interrelationship of value creation and appropriation in data ecosystems requires managers to continuously monitor these dynamic to configure suitable VAS. Specifically, practitioners can build on the VAS elements of selective partnering, data tailoring, benefit safeguarding, and control enforcement to ensure effective value appropriation from sharing data in data ecosystems.

Strategically improve value creation from shared data in ecosystems

Additionally, managers can apply our findings to improve on their organization's capacity to create value in data ecosystems. Specifically, we find that in addition to building data processing capabilities, the position of an organization in the ecosystem determines its potential to create value. Hence, our findings propose that the capacity to create value can be increased strategically by improving its position in the ecosystem, that is, by seeking new and stronger links to other organizations within the ecosystem.

Another opportunity for managers to enhance value creation is to recognize the importance of effective value appropriation for all actors in the ecosystem. This results from our finding that value appropriation by data sharing actors enables value creation of the receiving actor. Further, as our

findings indicate that the anticipated actor potential of the sharing actor determines its VAS, receiving actors may alter their communication regarding their capabilities to create value.

Use the dynamics of value creation and appropriation to govern data ecosystems

Our study opens up avenues for dynamic decentralized data ecosystem arrangements that acknowledge diversity within data ecosystems. We demonstrate that decentralized governance of data ecosystems can emerge through the self-regulating application of VAS, enabling dynamic balance between value creation and appropriation without centralized control. Consequently, data ecosystems in which actors manage to effectively balance value appropriation and creation by applying value appropriations strategies will create more value.

Nevertheless, our findings can also be of use for improving centralized governance through, for instance, the implementation of data platforms to mediate data sharing. Grounded in our insights, such solutions may establish VAS elements like, for instance, the opportunity to engage in data tailoring or partner selection to enable actors to balance value creation and appropriation.

Limitations and further research

While this study provides an in-depth investigation of the creation and appropriation of value created within data ecosystems, it also comes with limitations that call for further research. First, although we identified elements of VAS enabling data sharing through the appropriability of collaboratively created value, these elements are characterized by the limitation of both, the volume of data shared (data tailoring) and the range of partners that can utilize the data (selective partnering). Hence, VAS can set boundaries to the overall value creation of a data ecosystem. Pushing these boundaries, further research might investigate specific configurations that maximize value creation while maintaining the appropriability of value by the sharing organizations. Related, future research might uncover contextual factors that condition specific VAS configurations and determine their effectiveness.

Second, though the selected case is revelatory in that it comprises a wide array of heterogeneous actors, a wide array of data types being shared, and a variety of purposes that data are used for, situating our empirical study in this single case sets boundaries to the generalizability of our findings. In this sense, further research might investigate how our assertions stand in contexts beyond healthcare. That is, whether all elements of VAS we observed in this

very heterogeneous ecosystem also occur in more uniform ecosystems, or how the interplay between data potential and actor potential unfolds in contexts with less regulation and data protection. Also, as our findings emerged from the case of a decentralized ecosystem, further research might investigate how VAS apply in more centralized data ecosystems such as when data are shared through intermediaries (Möller et al., 2024). Thereby, this research may bridge our findings with literature on platform governance mechanisms (Oh et al., 2015; Schreieck et al., 2021; Song et al., 2018).

Third, our understanding of value appropriation is focused on the process of capturing profits (e.g., Bowman & Ambrosini, 2000; Mizik & Jacobson, 2003; Snihur et al., 2021; Teece, 1986). However, researchers recently called for broadening the scope of value creation and appropriation from this profit-centric perspective to also include social and ecological dimensions (Bansal et al., 2024). Our understanding of different forms of data potential can be instrumental for further research when looking into the specificities of social and ecological value to understand its interrelation with value creation and VAS in data ecosystems.

Lastly, our findings indicate that the value creation capacity of data sharing in ecosystems does both drive the need for and shape the design of VAS. In this sense, further research might explore how this process evolves over time. Specifically, further research might investigate how the ability of an actor changes with an alternating position within the ecosystem or whether and when the circular dynamic eventually ends up in a stable state.

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Data Availability The data underlying this study are not publicly available in order to protect the confidentiality of participants.

Declarations

Conflict of interest The authors have no relevant financial or non-financial interests to disclose.

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