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RESEARCH ARTICLE OPEN ACCESS

Big Data, Open Data, and Open Innovation

Managing Data Sovereignty: An Organizational Competence for Successful Open Value Creation

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ABSTRACT

Managing big data benefits organizations via efficient and effective data-driven decision making, productivity gains, customization potential, or innovation opportunities. Data-driven innovation opportunities are particularly valuable in open value creation (OVC), that is, the collaboration of independent stakeholders who open their boundaries to share data and knowledge to jointly create value they could not have achieved in isolation. At the same time, however, incumbents often struggle with the implementation of data sharing in the broader stakeholder ecosystem. In this exploratory study, based on an abductive qualitative study with 27 expert interviews and three industry roundtables with 19 experts, we explore how the concept of organizational data sovereignty could serve as an organizational competency to address the data challenges for OVC. Using the strategy-as-practice framework, we define organizational data sovereignty as the self-determined and intentional exercise of control over an organization's data assets and show which data sovereignty practices, in line with practitioner and praxis conditions, support inter-organizational sharing and management of big data in OVC. Specifically, we identify key practices for implementing data sovereignty, such as constituting the special value of data and establishing a consistent value assessment for data. When designed and applied in the right organizational framework that allows for openness, agility, and interdisciplinarity, they enable industrial enterprises to realize the potential of OVC.

1 | Introduction

Many companies today are pursuing digitalization ambitions, such as complementing physical goods with digital offerings or using data streams from their processes for new types of innovation (Ceipek et al. 2021; Petruzzelli, Murgia, and Parmentola 2022). These initiatives are fundamentally based on “big data,” that is, large and complex data sets, including structured and unstructured data, that are characterized by their large volume, great variety, high velocity of change, and demand for high veracity (Cappa et al. 2021). One strategy of companies to increase the value of big data is to pool and share large amounts of data when one company's data does

not provide enough volume, variety, or veracity, as typical for training artificial intelligence (AI) or machine learning (ML) models (Dąbrowska et al. 2022; van Dyck et al. 2023; Rindfleisch, O'Hern, and Sachdev 2017). Therefore, big data is not limited to an intra-organizational perspective, as it often requires extended interactions with external stakeholders such as suppliers, customers, or complementors, up to seizing opportunities for joint value creation and value capture based on data exchange (König 2017; Minssen, Rajam, and Bogers 2020; Trabucchi, Buganza, and Pellizzoni 2017). In the context of open innovation, the idea of open value creation (OVC) involves opening the boundaries between different organizations to share information and knowledge

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enabled by data sharing (Cappa et al. 2019; Chesbrough, Lettl, and Ritter 2018). OVC involves collaborative efforts between independent stakeholders who rely on their capabilities for joint value creation and capture (Chesbrough, Lettl, and Ritter 2018; Bharadwaj et al. 2013). Its benefits have been demonstrated in different settings and for different types of stakeholders, including suppliers, customers, competitors, or research institutions (Alexy et al. 2018; Barczak et al. 2022; Minssen, Rajam, and Bogers 2020; Petruzzelli, Murgia, and Parmentola 2022).

A recent example of such an open exchange of large amounts of industrial data is the emergence of “interconnected digital twins.” Digital twins are virtual representations of industrial assets and processes that are updated and synchronized with a certain specificity and frequency throughout their lifecycle (Fukawa and Rindfleisch 2023). Digital twins are increasingly interconnected, which means that they are shared between organizations to facilitate more effective decision making, enable more efficient processes, and develop new products and services (van Dyck et al. 2023). Companies such as Siemens or Nivida use the term “industrial metaverse” for this OVC among a large number of industrial actors (Endres, Indulska, and Ghosh 2024).

These calls for open data sharing with external stakeholders contrast with the strategic behavior of many industrial incumbents, which tend to take a more restrictive approach (Smith and Beretta 2021; Moschko, Blazevic, and Piller 2023). Many firms view data, and the strategic advantages associated with it, as a proprietary resource. Openness is perceived as a threat to their competitive advantage (Alexy et al. 2018). Moreover, data sharing can be an invasion of privacy and a loss of confidential or competitively valuable information (Betzing et al. 2020; Hummel et al. 2021; Trabucchi et al. 2023). In addition, organizations must first establish an appropriate infrastructure for collecting, storing, sharing, and analyzing data. They also consider legal and insurance requirements to protect themselves from claims for damages because of data breaches or to protect intellectual property (Cappa et al. 2021; Trabucchi, Buganza, and Pellizzoni 2017). Therefore, data governance is crucial to manage the opportunities of data openness as well as the fear of losing data control (Jarke, Otto, and Ram 2019; Cappa et al. 2022).

In this context, we propose the concept of data sovereignty as a framework for managers to develop guidelines on how to benefit from big data for innovation and OVC while mitigating the risks of data use (e.g., loss of reputation because of data scandals or loss of competitive advantage because of data breaches). Data sovereignty can be understood as an organization's ability “of being entirely self-determined with regard to its data” (Otto et al. 2017, 86). Data sovereignty has recently received much attention in technology policy discourses at the governmental level (Couture and Toupin 2019; Hummel et al. 2021), often addressing citizens' sovereignty over their personal data. Research in information systems has highlighted the importance of data sovereignty for the co-creation of value, for example, on industrial platforms or in the “Internet of Things” (Koren et al. 2021; Otto 2019). However, in (innovation) management research, the idea of data sovereignty as

a framework for balancing control and openness in innovation ecosystems has not yet been explored (Rummel, Hüsigg, and Steinhauser 2022). In particular, we lack theory on how data sovereignty can enable OVC and data-driven innovation. Furthermore, we lack knowledge on how firms can build and maintain organizational data sovereignty. The motivation of our paper is to address these gaps.

We consider data sovereignty as an organizational competency in the context of data-driven OVC, responding to calls in previous research to investigate our research question of how data sovereignty enables OVC, especially for industry incumbents (Hummel et al. 2021), and how this competency can be built (Zrenner et al. 2019). In doing so, we advance the theory of the openness versus control debate in interorganizational innovation management (Alexy et al. 2018; Ritala and Stefan 2021) through the concept of organizational data sovereignty. We provide a fine-grained framework for data governance in innovation management, shedding light on how the mundane, everyday practices of innovation practitioners shape and refine organizational decisions about which data elements to open or protect. Our work explains how these micro-level practices, taken together, enable organizations to strategically calibrate their data boundaries to maximize value creation and capture potential. We also extend the current discourse on data sovereignty in the policy literature by introducing a managerial perspective. Furthermore, we contribute to previous research on essential competencies in open innovation and value creation in firms, especially in the context of digitization (Dąbrowska et al. 2022; Chesbrough, Lettl, and Ritter 2018). To answer our research question, we rely on an intensive abductive qualitative study with 27 in-depth interviews and a post hoc data collection in the form of three industry roundtables with 19 experts from different industrial firms, enablers (such as software or IT providers), public institutions and associations involved in industrial digitization activities.

Theoretically, we draw on the strategy-as-practice (S-as-P) framework as our theoretical lens. S-as-P creates a shared understanding of the focal actors involved, the practices and routines that guide their actions, the actual practice including the context, and their interdependencies (Whittington 2014) to explain how their interactions in everyday situations generate strategic implications for organizations (Arvidsson, Holmström, and Lyytinen 2014; Mintzberg 1973). S-as-P has already proven to be an appropriate metatheory for digital transformation research (Chanias, Myers, and Hess 2019; Pelletier and Raymond 2020). We contribute to the existing literature at the intersection of data, openness, and innovation by focusing on the practices (i.e., actual actions) of innovation managers in managing the challenges and risks of interorganizational data sharing, such as regulatory compliance, data security risks, complexities of data localization and access, or organizational resistance to data sharing. Although the praxis of digital innovation activities in industrial incumbents (Moschko, Blazevic, and Piller 2023) as well as the role of practitioners have already been considered in previous research (Kurzahls, Graf-Vlachy, and König 2020; Lievens and Blazevic 2021), we still consider these elements to contribute to our understanding of how the interaction of these elements

in everyday situations generates strategic implications for managing the challenges and risks associated with data sovereignty and OVC.

2 | Theoretical Background

Historically, the term sovereignty has its origins in constitutional politics and law. It is increasingly used in academic and policy publications on digital transformation or Industry 4.0, along with terms such as data, digital, or technology sovereignty (Couture and Toupin 2019; Dąbrowska et al. 2022; Hummel et al. 2021). In general, sovereignty refers to “supreme and independent power or authority in government, as possessed or claimed by a state or community” (Dictionary 2023). In the context of big data, data sovereignty is considered an active competency (Alboaie and Cosovan 2017; Esposito et al. 2018), as it requires engagement with relevant data of an organization and its ecosystem. Data sovereignty thus contrasts with related terms such as data privacy or data protection, which imply a passive role of the stakeholders involved (Jarke, Otto, and Ram 2019). Data sovereignty requires companies to be aware of their data and its value to their business, but also to be willing to share data with other stakeholders in the context of OVC. Therefore, the term is associated with innovation (Hummel et al. 2021; König 2017) and the goal of “enabling data richness” (Jarke, Otto, and Ram 2019, 550). Hence, we propose data sovereignty as a meaningful framework to study and manage the interconnected relationship between big data and open innovation, which is the focus of this special issue (Cappa et al. 2022).

However, there is a lack of clarity about how organizations can achieve a higher degree of data sovereignty (Zrenner et al. 2019). First, in an industrial context, the meaning and significance of data depends on its context and use (Esposito et al. 2018). Although data from one company’s production environment may be of particular importance to that company, the same data may not be of additional value to another company. The technical design of IT systems also plays a role. For example, a centralized IT system with uniform data formats and storage locations facilitates discoverability and processability, but conflicts with stakeholders’ desire for control and sovereignty over their data. Similarly, legal uncertainties often arise because geographic location plays an important role in data transfer and storage, creating ambiguity about the application of different (national) laws on data transfer and use (Trabucchi et al. 2023).

This diversity of data sovereignty challenges suggests an industrial practice through “a mix of technical approaches, methods, and governance rules” (Jarke 2017, 12). This includes an awareness of the nature of data among the stakeholders involved (König 2017) and the consequences of its use. Similarly, the technical parameters of an IT infrastructure could enable data sharing via standardized architectures and interfaces without sacrificing ownership control (Otto 2019). Furthermore, (national) legal frameworks for companies and industry-specific jurisdictional requirements are pointed out as drivers of data sovereignty (Vaile 2014), as well as individual training among the actors involved (Meyer 2016) to fight organizational resistance. The various data sovereignty challenges and potential solutions ask for a strategic framework, in which we propose

organizational data sovereignty to describe an organization’s competency in the self-determined use and handling of data.

Organizational data sovereignty requires not only a technological consideration in companies, but rather competencies and resources for firms’ (digital) innovation and OVC management. Here, the S-as-P perspective offers the opportunity to understand how the mundane, everyday practices of data sharing for (open) value creation enacts a company’s digital strategy (Arvidsson and Holmström 2017; Besson and Rowe 2012; Bharadwaj et al. 2013). In this view, “strategy is conceptualized as a situated, socially accomplished activity, while strategizing comprises those actions, interactions and negotiations of multiple actors and the situated practices that they draw upon in accomplishing that activity” (Jarzabkowski, Balogun, and Seidl 2007). OVC between interorganizational stakeholders necessitates strategic practices from innovation managers to navigate the diverse concerns and interests at play (Reypens, Lievens and Blazevic 2021). Innovation managers must employ a repertoire of data sovereignty practices to facilitate secure data sharing that resonate with their own as well as stakeholders’ concerns. To do so, the S-as-P discourse pays particular attention to three essential elements (Huang et al. 2014; Jarzabkowski 2004):

- *Practitioners* are the key actors in initial and ongoing strategizing who are part of the focal organization or external, relevant stakeholders.
- Their actions are directed by *practices* that can be characterized as established explicit or implicit processes or routines that can be traced back to previous norms and traditions within and outside the organization.
- The *praxis* describes the set of de facto activities of creating and enacting strategy, which in reality may deviate from practices, for example, because of unpredicted incidents.

In the next section, we use this differentiation as an analytical framework to analyze exploratory findings on how different firms built and managed data sovereignty when using big data for OVC (Chanias, Myers, and Hess 2019; Pelletier and Raymond 2020).

3 | Research Method

To explore from an (innovation) management perspective how data sovereignty can be defined and built in industrial companies to enable OVC, we rely on a qualitative, abductive design of expert interviews and roundtable (focus group) discussions (Edmondson and McManus 2007; Sætre and Van de Ven 2021). We engaged in an iterative process of moving back and forth between empirical observations and our evolving theoretical understanding of organizational data sovereignty. This abductive reasoning allowed us to continuously refine our theoretical conceptualization based on the insights and perspectives shared by the experts in the main study and the roundtable participants in the post hoc study. By adopting this adaptive approach, we were able to account for unexpected findings, incorporate contextual nuances, and develop a more comprehensive understanding of our phenomenon (Bamberger 2018). Our sample consists mainly of industrial incumbents, but also of so-called digitization

enablers (e.g., software or network technology providers), public institutions and associations dealing with data sovereignty issues (e.g., research institutions or business associations).

Prior to the data collection, all authors were already actively involved in the field of digital innovation and transformation. Although the first and third authors regularly attended practitioner meetings to discuss issues related to data-driven, open innovation, the second author was not as involved and therefore maintained a more distant, objective perspective.

A total of 27 interviews were conducted. Table 1 provides an overview of all interviews conducted, including what type of organizations interviewees worked at. The interviewees all held a senior or executive position related to digitization, and involved in the use of data to create value in an intra- or

inter-organizational environment. These employees put organizational data sovereignty into practice in their daily tasks and routines and hence have the agency to implement data-driven OVC projects.

Although we followed an interview guide, the direction of the conversation was based on the experts' preferred topics (Spradley 2016). More detailed questions were asked about data sharing, collaboration, the companies' competencies in data processing and analysis, as well as tensions and how to deal with them. Finally, we asked in a very open way what could be improved with regard to (the implementation of) digitization activities. We deliberately did not use terms such as data or digital sovereignty to avoid one-dimensional or exclusively technology-oriented answers and socially desirable answers. The recorded interviews were transcribed verbatim.

TABLE 1 | Expert interviews conducted.

Expert #	Size	Category	Position	Duration
1	Large	Industry	Senior Manager Innovation	51:37
2	Large	Industry	Manager Digital Activation & Enablement	69:44
3	Large	Industry	Head of Digitalization—Production & Assets	58:02
4	Large	Industry	Head of Innovation Management	56:12
5	Large	Industry	Business Operations Leader	70:32
6	Large	Industry	Project Engineer	64:49
7	SME	Industry	Head of IT	84:03
8	Large	Industry	Senior IoT & Digital Innovation Manager	41:26
9	Large	Enabler	Vice President External Cooperation	53:30
10	Large	Industry	Global Strategy & Business Dev. Manager	74:45
11	SME	Misc.	Innovation Manager	56:22
12	Large	Industry	Manager for Digitalization	66:53
13	Large	Enabler	Manager Digital SC & Industrie 4.0	43:54
14	Large	Enabler	Head of Logistics	70:10
15	Large	Industry	Innovation Culture & Open Innovation	52:55
16	Large	Industry	Digital Transformation Manager	100:19
17	SME	Industry	Managing Director	37:12
18	Large	Industry	Senior Digital Innovation Manager	62:33
19	Large	Industry	Head of Digital Lab	52:37
20	Large	Industry	Vice President Corporate Industry 4.0	68:23
21	SME	Enabler	Head of Product Management	55:58
22	Large	Industry	Digital Project Manager	53:02
23	SME	Misc.	Managing Director	36:08
24	SME	Enabler	Head of Digital Business Models	33:29
25	N/A	Public Org.	Head of Department Digitization	28:50
26	N/A	Public Org.	Executive Director of the institute	45:20
27	N/A	Public Org.	Software Developer	41:00

Abbreviations: Misc., miscellaneous companies; N/A, not applicable; Public Org., public organizations and associations.

The data analysis followed an abductive approach to capture the perspectives of the informants. In a first step of analysis, we started with our broad theoretical understanding of data sovereignty to guide our analysis, but we maintained flexibility to identify novel, data-driven insights. As we iteratively analyzed the data, we refined our coding structure to incorporate unexpected themes and patterns that emerged. This resulted in a coding scheme that reflected both theoretical underpinnings and surprising, data-driven findings. These codes were then consolidated into categories, which are presented in Table 2. We critically reviewed the results of this analysis, first individually and then collectively. In a second step of the analysis and coding, we applied S-as-P as an appropriate metatheoretical perspective for further interpretation of the findings. This helped to categorize our findings into an established framework and allowed us to consider interrelationships between different findings (Sætre and Van de Ven 2021; Jarzabkowski, Seidl, and Balogun 2022). Therefore, the three elements of the S-as-P literature (practices, practitioners, praxis) as well as their interactions were used to explain our findings. During the elaboration of our data analysis, we decided to focus on data sovereignty practices. Table 2 provides an overview of the coding scheme and includes sample quotes.

Subsequently, data collection was further enhanced by conducting a post hoc study via three industry roundtables with high-level experts from industrial companies. These discussions helped to reflect on and validate the preliminary findings. The participants were purposefully selected with an international background, and held leadership positions in their respective organizations. During the recorded roundtables, we presented findings from an earlier version of this article for triangulation and to gather additional feedback. We also used open-ended questions from the interview guide to stimulate discussion among the participants and to ensure consistency in responses and empirical data. Table 3 lists the practitioner roundtables and their participants.

For the expert interviews, we focused on interviewees from industrial incumbents; for the roundtable discussions, we also recruited some start-up or scale-up companies to obtain a more diverse view. The roundtable workshops lasted between 75 and 90 min and were conducted online. Prior to the discussion, the facilitator explained the focus of the study on data sovereignty, using the same material as in the introduction of the first study. Following introductions of all participants, the workshops covered the topics outlined in Table 4. All workshops were recorded and transcribed for the purpose of evaluation.

We then discussed the workshop results in our author team, contrasting the findings with the interview results. In all three workshops, participants largely confirmed the qualitative findings regarding the definition and elements of the S-as-P framework, the importance of practices for organizational data sovereignty, and enriched our perspective with numerous examples and illustrations, so that data saturation can be assumed (Aldiabat and Le Navenec 2018).

Various measures were considered to promote validity and reliability (Goffin et al. 2019). Respondents were assured of confidentiality and anonymity regarding the collection, analysis, and

use of data. This allowed them to speak openly, and we sought their validation by providing them with insight into the results of the analysis. This ensured the credibility and rigor of our findings (Gioia, Corley, and Hamilton 2013). Finally, all authors thoroughly discussed the empirical findings through multiple rounds of abstraction to connect them to existing theoretical perspectives. The results of the post hoc data collection provided robust insights into the implications of our initial findings and guided the development of recommendations for managerial practice. Our abductive approach allowed us to integrate the triangulated findings from the initial and post hoc study into a unified conceptual framework of organizational data sovereignty.

4 | Results

Our findings include not only aspects of all three elements of the S-as-P framework, but also interdependencies among them, as shown in Figure 1. Based on our findings, we adapted the S-as-P framework to focus on the impact of organizational data sovereignty on OVC. In particular, the post hoc study reinforced that OVC requires multiple organizations to implement and align their respective data sovereignty practices to jointly create value.

Generally, the interviewees and roundtable participants confirmed the importance of big data in industrial OVC, but also reported challenges, complications, and obstacles in this context. The following quote is a representative opinion we heard from many interviewees. “The whole factory floor is full of gold, because data is everywhere and is basically gold. So the new currency or the new commodity. But people don’t know that. They don’t realize that these data represent a value. But the value is only presented here when you analyze it and turn it into added value and then sell it” (expert #9). In addition, internal data needs to be integrated with external data to achieve higher degrees of OVC: “I believe that there is also an advantage to using external data [...], there is also a necessity to do so, because many of the innovative scenarios, whether in Industry 4.0 or in mobility or in healthcare, are actually based on the fact that I have my own data under control, that I combine it with data from [...] business partners that I somehow know. But then I also enrich it with contextual information. And from this combination, actually something new emerges” (expert #26).

Respondents also mentioned the importance of developing dedicated skills and competencies of data processing and analysis, confirming earlier research (Cappa et al. 2021). In this light, established project management methods did not always seem to be promising, as “digitization, simply because it is so interlinked, often involves more different people or more stakeholders [...] to fully exploit a process that has now been digitized, for example, I have to involve all of a whole chain of people” (expert #6). Instead, agile development methods were suggested, which demand different skills: “The ‘agile’ in the methodology is always a tough one for people and I think it’s important that people understand that that is the best way to develop right now and what that truly means” (expert #10).

The implementation of organizational data sovereignty for OVC was often hindered by ambiguity about how to securely handle data to (co-)create and develop innovations. For expert #3 “it is

TABLE 2 | Coding schemes for the first and second step of interview data analysis.

Code	Description	Exemplary quote
<i>First step of analysis</i>		
Problem	Problems and challenges with regard to data and their use, showing necessity for data sovereignty	<i>I would first drop the data protection issue. That is a hurdle in many many areas. So maybe not completely abolish it, but significantly relax it so that we can also use Zoom now, for example. We're not allowed to use Zoom internally, not even with customers. But that's the tool that all customers can use, because it's just so easy. So I'm now on an tablet, I also have from work, but it's not in the company (#11)</i>
Definition	Contribution to a definition of or understanding of data sovereignty	<i>So actually, it's very much about skills in cross-company collaboration. There is actually even an ISO standard. 44,001 on how to collaborate across companies [...], these are the technical topics for data sharing [...]. We now assume that we have data in digital twins, then it often becomes exciting. And if there is data, then of course there are a lot of new technologies that facilitate that, e.g. cloud technologies (#13)</i>
Advantages	Possible advantages of higher sovereignty with regard to data	<i>Through data collection and data exchange, of course, new business models are created or existing business processes can be accelerated (#5)</i>
Problem solving	Problem solution through better data sovereignty	<i>Let's say, I would imagine, if Big Data approach to production, there would probably be some potential to tease out. But that's not being done at the moment, because we're not sure about our data (#6)</i>
Implementation	Measure to achieve higher sovereignty with regard to data	<i>Just let us do it. It's really a culture clash that we have to some extent. These extreme concerns with all the changes. Yes, we have systems that work. They're running. Why would we change anything? We're safe. And [...] I say "come on, we should just test it and see, does it work?" And then if it works, then think how do we fit that into our security concepts and all the IP protection and everything that we need (#12)</i>
Digital innovation	Interrelationship between data sovereignty and digital innovation	<i>Trusting and honest cooperation across departments. I believe it is imperative for digital innovation projects that several people are always involved, and that they do not work in a classic, single-discipline way, but rather in a way that brings together several areas (#2)</i>
<i>Second step of analysis</i>		
(1) Practitioners	Reference to practitioners in the sense of S-as-P	<i>I would hire more people on this topic than we can. That's because of the market. There are simply not as many as we can hire (#9)</i>
(2) Practices	Reference to practices in the sense of S-as-P	<i>Many companies want to use this agile method, but somehow this loop of one week and again and again doesn't quite fit with some industries (#2)</i>
(3) Praxis	Reference to praxis in the sense of S-as-P	<i>Especially for our company [...], which is somewhat more risk-averse due to its portfolio and history as [...] a typical industrial company perhaps compared to a digital company (#1)</i>

(Continues)

TABLE 2 | (Continued)

Code	Description	Exemplary quote
Interrelation (1–2)	Reference to an interrelationship btw. practitioners and practices	<i>And that's just by introducing these systems, it's not done, but then you also have to train people more and more and also accompany them through this introduction. And unfortunately, that is not happening either. [...] You just introduce a new system and are happy that the new system is finally up and running. Unfortunately, the employees are left by the wayside and are confronted with a lot of extra work, because they have to understand and learn it, and the training is usually inadequate (#7)</i>
Interrelation (1–3)	Reference to an interrelationship btw. practitioners and praxis	<i>Because they [digital innovation projects] are even more strongly determined by uncertainty and perhaps also change more strongly in the course of the project. In this respect, I would say we need an open mindset. In addition to these technological or technical skills (#1)</i>
Interrelation (2–3)	Reference to an interrelationship btw. practices and praxis	<i>And that's also the big difference in digital projects than in quotes classic projects as we know them. You just have to get into the spirit of this agile method (#3)</i>

TABLE 3 | Participants in the post hoc roundtable workshops.

Group	Expert #	Size	Category	Position
1	1.1	SME	Enabler	Founder & Managing Director
1	1.2	Large	Industry	Chief Operating Officer
1	1.3	Large	Industry	Project Leader
1	1.4	Large	Industry	Principal Key Expert
2	2.1	Large	Industry	Vice President Process Engineering
2	2.2	Large	Industry	Head of Data Strategy & Science
2	2.3	Large	Industry	Program Director “Factory of the Future”
2	2.4	SME	Enabler	Vice President R&D
2	2.5	Large	Industry	Technology Executive
2	2.6	Large	Enabler	Global Product Owner OT Security Services
2	2.7	Large	Industry	Authorized Representative Production
3	3.1	SME	Enabler	General Manager
3	3.2	N/A	Public Org.	Professor for digital business
3	3.3	SME	Enabler	Research Manager
3	3.4	Large	Industry	Director Strategy Development
3	3.5	Large	Industry	Technical Director Tech Fund
3	3.6	Large	Industry	IT Manager
3	3.7	Large	Enabler	Chief Technology Officer
3	3.8	Large	Industry	Technology Scouting Innovation & Ventures Advisor

Abbreviations: N/A, not applicable; Public Org., public organizations and associations.

simply uncertainty in the company in most cases. What I mean by that: If data is going to the cloud, it's said ‘Woah, cloud, quite dangerous’. The fact that we as a chemical company

cannot manage certain data centers as well as Microsoft or Amazon because their data center is outside our plant fences is still beyond the imagination of many people today. So a data

TABLE 4 | Setup of post hoc roundtable workshops.

Agenda item	Content
Part 1: Introduction and general opening discussion	Open discussion about the participants' experiences with sharing of industrial data within and across organizations in a manufacturing setting
Part 2: Presentation and results of initial findings	<ul style="list-style-type: none">• Presentation of our first study setup and the results• Introduction to the Practice-Praxis-Practitioners (S-as-P) framework• Presentation of our initial definition of organizational data sovereignty
Part 3: Feedback on and discussion of results of the initial findings	<ul style="list-style-type: none">• Gathering of initial feedback of participants on our results (individual, using comment function)• Open discussion of the results and whether they seem plausible and adequate for the participants<ul style="list-style-type: none">• Implications for manufacturing organizations from various perspectives• Informal discussion of industrial data sharing and open innovation in a manufacturing context in general

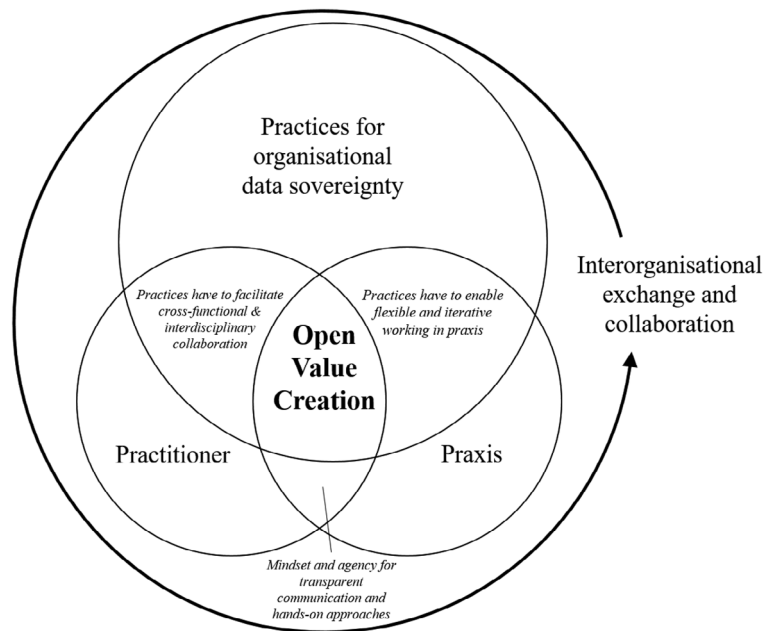


FIGURE 1 | S-as-P elements to enable open value creation.

center inside the factory fence [is seen as] great, the data is secure. But data going into the cloud, ‘Oh my God, there are Google and Microsoft’. There are so much [...] half-truths coming together that people are just insecure there.”

Innovation managers also faced administrative and regulatory hurdles that prevented internal and external data exchange. “Even across departments, it is sometimes not easy to access the same data in terms of authorization. And if you then go external, it is even more difficult in terms of the process, because of internal guidelines, external systems, firewalls, all these things make it difficult at the moment, because the infrastructure in our company has not been set up in such a way that you can work with changing partners” (expert #2). In this context, expert #1 outlined considerable difficulties in the use of external data: “That starts with the description of the property rights on the data and then the application and the clarification of the rights of the result exploitation. [...]”

After these initial observations, we refer to the three elements of the S-as-P framework below to further elaborate our analysis. In particular, we focus on the practices that practitioners engage in when implementing data sovereignty within their organizations. of how data sovereignty is established and enacted in practice.

4.1 | Enabling Practices for Data Sovereignty to Enable OVC

In the S-as-P literature, practices are understood as routines or processes that provide practitioners with a framework for action. However, a major challenge for companies was the lack of consistent practices for handling data, limiting sovereignty. Instead of standardized procedures, many companies still relied on case-by-case or on-premises solutions and individual agreements.

Before considering the technical implementation of data exchanges, organizations engaged in *developing regulatory oversight* for data sharing, especially for meeting the legal prerequisites. As OVC often implies sharing data between different organizations, their legal departments first had to establish contracts for all framework conditions and contingencies. “We have a big legal department. There are 100 million clauses there. So I think that’s the cudgel. It’s not always the best, but I think that’s the remedy” (expert #2). However, the exact details and contractually regulated aspects were always individual and depended on past mistakes. “We need between our companies to have agreements to share that data. Part of those agreements to include cybersecurity, liabilities and risks of loss or breaches come into play. Strong contract language, but it’s needed and it’s there for a reason, because there’s been issues where that has happened” (expert #10). Also, companies feared a loss of their intellectual properties through the handover of data and were therefore particularly concerned about precautionary measures (all workshop groups).

Hence, a first step could be for companies to develop a consistent understanding of digital data and its confidentiality and value. Without knowing what the data means to the company, what information can be derived from it, and to what extent it is already publicly known, it is impossible for the practitioners involved to assess whether and under what conditions data exchange is possible. For this *constituting of the particular value of data*, the categorization of a company’s data, as described by expert #2, was a possible step. “There are very clear guidelines. We have a data [...] rating system in four levels, which are confidential, public, internal and I forgot one. So four levels [...] and then it is defined exactly what can be transferred where and how” (expert #2). To achieve this value constitution, companies relied on *establishing consistent assessment mechanisms for data* so that employees and partners were fully aware of the economic value of data. Expert #26 believed “that if you know how data behave differently, then it is also possible to treat data like an asset and then you can apply valuation methods.” He mentioned three approaches, (1) the production cost approach (“so I can consider what did I have to spend to get the availability of this data and the usability of this data”), (2) the utility value approach (“what added value does the availability of this data offer me then? Ideally at a certain quality in a process or for a certain service? That’s actually what everyone wants [...] It’s very case-specific”), and (3) the market price (“I’ll just see if there’s someone who offers me a market price for my data”). Regardless of which approach to valuation organizations chose, it was important to have an appropriate and consistent understanding of their data value. Even if companies did not monetize their data directly, but shared it on platforms or in ecosystems for OVC, they should have an assessment of what it was worth. “When I share data in an ecosystem, what we see there at the moment is that there is probably less [...] a compensation in euros, but [...] we are actually back in the barter economy and that’s what I’m seeing more of now [...] you get my data, but I want some from you” (expert #26).

Several experts also highlighted the necessity of *developing standards and technical solutions* that enable data sovereignty. “We are working on technological solutions how [...] to collaborate and share data even without trust” (expert #1). And expert

#13 added that companies “need mechanisms with which I can guarantee, and with that I think first of all of any models of collaboration, that no nonsense is done with my data [...] Basically, I first have to create the conditions to be able to manage data exchange at all. And my hypothesis is that this is only the starting point for the crystallization of digital twins and the sharing of digital twins. In other words, I don’t say I share any databases, but I share the digital twins” (expert #13). Nevertheless, none of the experts interviewed was able to report that such practices had already been implemented in concrete terms or what specific technical solutions might look like.

Despite careful legal preparation, firms had large uncertainties as to influence how data that had been released was actually handled. “I can’t ensure that he won’t do other things with it later, once the data is released, it’s out” (expert #4). In some cases, companies resorted to *protecting data through anonymizing* it and using dummy data from which no conclusions could be drawn about IP and company trade secrets (e.g., experts #4 and #12).

In even more interviews, it was pointed out that *building trust in data exchange*, for example, through personal relationships, could form a basis for data-based OVC (e.g., experts #1, #6, #9, and #13). “But if the trust is not there, then the contract, the paper on which it is written, is worth nothing. If there’s no trust, you can leave it” (expert #9).

In summary, our respondents noted that to date, companies have often relied on individual measures before exchanging data, and hence one-off solutions that were not scalable, which made continuous data exchange difficult. Some respondents therefore called for industry-wide standards: “We are also active in certain standardization bodies, even if we are now talking about Open Data, or Data Spaces or simply the will to exchange and collect data more intensively. Then the topic of standardization of data also plays a big role. For now, there is no such thing as a globally uniform standard, [...] this is something where we also have a great interest” (expert #1). During the roundtable discussions, participants mentioned a number of specific initiatives, such as Catena-X, an automotive data-sharing ecosystem, or the recently launched international Manufacturing-X initiative. To represent the suitability for data sharing with external organizations, the layer of inter-organizational exchange and collaboration was added to the basic framework in Figure 1.

Our analysis demonstrated the need for consistent practices in the handling and use of data, but also revealed a number of challenges to data sovereignty practices in OVC. Although respondents agreed with the need for agility and flexibility, in many cases the implementation of agile practices was not yet successful. “Many companies want to use this agile method, but somehow this loop of one week and again and again doesn’t quite fit with some industries” (expert #2). They either did not understand agile development methods or had difficulties in switching from conventional project management methods. “And when it comes to agile methodology, you do sprints and hope for the same results. But it may not always come that way because of the trouble you may endure during the sprint and software is not like doing a service or components” (expert #10). Agile methods clashed with their established practices and

collided with existing rules and structures, especially when external partners were involved. “It’s often the case that our partners also want to work in the same [agile] way, especially those we want to make especially for digitization. And that completely clashes with our internal processes that we have defined. We often have processes where certain decisions have to go through certain committees. The committees then meet once a quarter. And at the same time, we want to use Scrum to complete a project within one month” (expert #12).

Such internal policies and practices, as well as legal requirements (e.g., privacy), are barriers to OVC and prevent companies from developing better practices for data sovereignty. At the same time, trusted partnerships served as a foundation for data sharing.

4.2 | Role of Practitioners for Organizational Data Sovereignty

Interviewees repeatedly emphasized the importance of the individuals involved, referred to as practitioners in the S-as-P literature. Practitioners include the internal teams responsible for digitization as well as external experts and partners (e.g., in the case of experts #8 and #19). The IT department was rarely responsible for implementing data-driven OVC, but supported the functionality of the technological infrastructure for data storage, security and transmission. In many cases, IT staff were hired as specialists to provide in-depth knowledge and skills in dealing with (the volume of) big data. Other frequently mentioned practitioners included the top management team and the legal department. Overall, industrial incumbents only achieved significant added value from big data when the practitioners involved worked together in cross-functional teams. Similarly, partnerships with external stakeholders for OVC were particularly successful when they provided access to complementary skills, especially in the areas of IS and data analytics. These more technical skills were complemented by legal practitioners dealing with regulatory risks (as confirmed by the roundtable discussions).

4.3 | OVC Praxis With Regard to Data Sovereignty

In S-as-P research, the term praxis refers to the reality in which practitioners find themselves and act, which may well differ from existing or desired practices. Based on our interviews, we were able to derive barriers in the context of OVC, as well as recommendations for improvement. The interviewees and roundtable participants described a conservative and risk-averse mindset in industrial companies, and cited different regulatory regimes as reasons for not implementing open data-based forms of value creation. They also mentioned the challenge of dealing with high uncertainty about the quality and usefulness of insights from big data, the amount of investments required, and the integration of data from different stakeholders. These concerns have led to a protectionist, security-oriented approach to data. Uncertainty about the long-term use and value of data prevented organizations from using data in a sovereign manner. In addition, a lack of clarity about the company’s digitization strategy and overarching goals for using data exacerbated these

effects. Companies could overcome this by enabling hands-on approaches in the form of small use cases and communicating the results transparently and interactively across hierarchical levels, highlighting the value of the data-driven applications.

As shown in Figure 1, in addition to the three S-as-P elements, organizations always have to consider their external stakeholders in data sharing for OVC. Awareness of their partners’ capabilities for data processing contributes to a culture of recognizing that external data is someone’s “property and has to be treated with respect” (expert #1.4). Expert #1.2 also emphasized the awareness for data-related practices and competencies of external stakeholders as precondition for the successful integration of external data in own systems and a quid pro quo approach in getting and sharing data. Therefore, data sovereignty helps to comprise conscious decisions on how to use and control data or why to share it (expert #1.4).

5 | Discussion

The objective of our exploratory analysis was to extend the discourse on data sovereignty from the societal or political level (Couture and Toupin 2019; Hummel et al. 2021) to the corporate level and thus to initiate discussions on data sovereignty as an organizational competency in (innovation) management research. Our analysis shows the strategic importance of data-driven OVC in industrial organizations, as well as their struggle to implement it. Therefore, we propose organizational data sovereignty as a construct to address these struggles and promote the use and exploitation of data in OVC. We define *organizational data sovereignty* as the *self-determined and deliberate exercise of control over an organization’s data assets, which includes the recognition of their value, the proactive management of data activities (collection, storage, sharing, analysis, and interpretation), and the ability to assimilate and apply these data to drive value creation through interorganizational collaboration*.

Practices to achieve this self-determined and conscious handling of data should include (1) developing regulatory oversight, (2) constituting the particular value of data, (3) establishing consistent evaluation mechanisms for data, (4) developing standards and technological solutions, (5) protecting data through anonymization, and (6) building trust in data exchange. Technological solutions for data sharing and analysis must contribute to the goals of OVC among different stakeholders. One example is the creation of so-called data spaces based on a standardized open reference architecture for data sharing, such as “Catena-X” in the European automotive industry (Mügge et al. 2023; van Dyck et al. 2023). Moreover, these practices must be designed not only for openness and collaboration, but also for agility and experimentation. This is not an easy task. Synchronizing agile development across different functions and multiple organizations has proven to be challenging but beneficial for data-driven value creation (Moschko and Blazevic 2023) and must be addressed in data sovereignty practices.

The S-as-P framework served as an appropriate lens for our analysis, as it could also show the interdependencies among its three elements (Figure 1 provides a summary overview of the three elements and their interrelationships). For example, to implement

organizational data sovereignty practices, an organization needs the interdisciplinary collaboration of practitioners within and outside the organization. These involved practitioners need to have the right communication skills and a common understanding of the practice to benefit from enhanced collaboration. In addition, they need the right mindset as well as the necessary agency to rapidly develop and subsequently scale data-driven ideas in a prototypical manner.

In terms of our theoretical contribution, we propose that organizational data sovereignty can provide a new lens for different streams of research on big data and OVC. First, the definition of organizational data sovereignty can provide a common ground for analyzing the strategic challenges firms face in using data for open innovation initiatives while navigating the complexities of data governance. After all, the use of digital technologies requires the use of data, and only the sovereign handling of data enables competitive advantages to be derived from digitization, as emphasized in the IS strategy literature (Chen et al. 2010; Mithas, Tafti, and Mitchell 2013). Organizational data sovereignty provides a perspective not only for managers, but also for further research to constitute the value of shared (big) data and its more efficient and strategic use. This enables organizations to achieve their OVC goals faster or to a greater extent. Data sovereignty can support further analysis of the tensions arising from an ill-defined understanding of data that characterizes many digitization initiatives in established firms (Moschko, Blazevic, and Piller 2023; Smania et al. 2024). We propose to use organizational data sovereignty as a novel framework for investigating the specific capabilities and practices required in firms to generate value from shared data.

Second, the concept of organizational data sovereignty could also provide a new perspective to the discussion of digital business strategy, which envisions the convergence of organizational and IS strategies (Bharadwaj et al. 2013; Chen et al. 2010; Mithas, Tafti, and Mitchell 2013). The data sovereignty practices we identified (such as regulatory oversight, value constitution of data assets, and data valuation mechanisms) could form innovative “patterns” (Weiking et al. 2020) of data-driven business models. By exercising self-determined control over data, organizations can explore new revenue streams, personalized offerings, and data-based services in line with their digital business strategy. Highlighting these practices as elements of digital business models extends previous research on business model design (Trabucchi et al. 2023) and provides a new analytical lens.

Third, prior research has highlighted that pre-digital firms in particular need to engage in organizational change initiatives that go beyond technology adoption but require dedicated transformation strategies (Chanias, Myers, and Hess 2019; Ceipek et al. 2021; Dąbrowska et al. 2022; Smith and Beretta 2021). For this stream of research, the concept of organizational data sovereignty emphasizes the required change in data practices that are aligned with practitioners and practice. It provides a foundational framework for aligning an organization's data practices, processes, and mindsets (praxis) to enable OVC through interorganizational collaboration. Further research could use the elements of data sovereignty to identify barriers and drivers

in such a digital transformation process, such as organizational culture, cross-functional collaboration, or the development of new capabilities for agile experimentation and rapid prototyping of data-driven solutions. We propose, as a key theoretical implication, that integrating data sovereignty practices into digital transformation frameworks can provide a more comprehensive understanding of the organizational changes required for firms to effectively leverage data resources and collaborate in data-driven ecosystems.

Finally, organizational data sovereignty adds to the open innovation literature the idea of using big data to enhance collaboration among multiple independent organizations (Enkel, Bogers, and Chesbrough 2020; Hilbolling et al. 2020; Urbinati et al. 2020). Data can indeed become the object of co-creation of value resulting from an open innovation initiative (building on the concept of “innovation as data” by Rindfleisch, O'Hern, and Sachdev 2017). To realize this proposition, further research should extend earlier frameworks of open innovation capabilities (e.g., Pollok, Lüttgens, and Piller 2019) with elements of organizational data sovereignty. For example, organizations could add more data-focused practitioners to innovation teams, with skills and credentials such as computer scientists, data scientists, and programmers. In our interviews, the importance of these practitioners was repeatedly emphasized, and many experts described the need for additional staff and further training of existing staff. Future research on such “data-focused human resources” for open innovation and OVC could be a promising approach.

6 | Limitations, Implications and Conclusion

As with most qualitative empirical studies, the generalizability and transferability of the findings must be mentioned as a limitation. In particular, since we focus on industrial incumbents with their specific characteristics, the question arises to what extent the results can be transferred to other types of firms. By interviewing industrial firms from different sectors, as well as digitalization enablers and public institutions, we have mitigated these limitations as much as possible. Despite our intention to highlight findings and implications that are transferable to other contexts, some of our findings may be specific to industrial firms. In addition, any qualitative study may be subject to researcher bias, particularly in the interpretation of interview data, while participants' responses may have been influenced by social desirability bias. We attempted to mitigate this through intensive discussions between the researchers, a wide range of interviewees, and the post hoc study in the form of the three roundtable workshops. However, as this is an initial and therefore broad investigation of organizational data sovereignty, further research is needed. Future research could either adopt a mixed-methods approach to strengthen the statistical relevance and depth of insights, integrating qualitative findings with quantitative data, or consider a purely quantitative design to examine the prevalence and variation of data sovereignty practices across different sectors.

Nevertheless, our study has some important managerial implications. Although the relevance of big data for OVC can definitely be emphasized, we see that sovereign handling of

data does not require a purely technical approach and cannot be achieved by isolated departments. Rather, it requires an integrated approach. Companies must enable collaboration among all stakeholders while aligning data practices with clear organizational goals to drive OVC. Particularly in industrial companies, it seems important to abandon risk-averse and data-averse attitudes and instead promote an innovation-oriented use of data, for example by starting to convince relevant actors with small-scale sample projects and demonstrators. Building on these findings, future research could investigate how organizational culture or technological advances in secure data sharing facilitate the implementation of data sovereignty practices.

Therefore, we call for further consideration of organizational data sovereignty in future research studies in areas such as (digital) innovation management, IS strategy, digital business strategy, or digital transformation. As our methodological approach did not allow us to cover industry-specific influences, further studies could address the contextual factors and their effects in individual sectors, such as regulatory constraints in the health-care sector or novel data-driven practices in the mobility industry. Furthermore, our research contributes to the S-as-P theory by applying it as a meta-theoretical perspective to the broad topic of data sovereignty and confirms it as an appropriate lens for further research in this area.

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

The data (interview protocols) that support the findings of this study are available from the corresponding author upon reasonable request. The data are not publicly available because of privacy restrictions.

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