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Is Your Organization Ready to Share? A Framework of Beneficial Conditions for Data Sharing

Completed Research Paper

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Abstract

In a constantly evolving digital sphere, surmounting organizational boundaries and sharing data offers the opportunity to realize a multitude of mutual benefits, such as advanced analytics and innovative services. Organizations aspire to share data. However, they struggle to identify and establish beneficial conditions for data sharing, and research still offers little support to exploit the potential of data sharing. We apply an exploratory research approach to develop a framework of beneficial conditions for data sharing. By combining ten expert interviews and a systematic literature review, we aggregate 23 characteristics that constitute beneficial conditions into eight categories and apply and validate the framework in a real-world case. Thus, we contribute to research by providing a fundamental understanding of beneficial conditions for data sharing and a compact target picture. Additionally, we enable practitioners to systematically assess an organization's current condition to set the course toward exploiting the full potential of data sharing.

Keywords: Data Sharing, Beneficial Conditions, Framework, Qualitative Research

Introduction

Along with the megatrend of digitalization, the gathering of data by organizations constantly increases across industries (Azkan et al., 2020). Nowadays, it is undisputed that companies perceive data as a strategically important asset (Cichy et al., 2021). They pursue using data as a shareable and tradable asset to develop novel and competitive product and service offerings and even to disrupt existing value-creation structures (Cichy et al., 2021; Parvinen et al., 2020). While data traditionally has been stored in data silos and kept internally, organizations are opening and allowing data to flow as organizational boundaries become permeable (Enders, Benz et al., 2020). This trend is reflected in almost every industry by the initiation of various data sharing initiatives such as the data ecosystems *Catena-X* (Catena-X, 2022), the *Aviation DataHub* (Aviation DataHub, 2022), or the *Agricultural Data Space* (Fraunhofer Institute for Experimental Software Engineering, 2020).

Despite rising initiatives and the recognition of its potential for innovation and disruption, organizations are confronted with a multitude of barriers that hamper the sharing of data across organizational

boundaries (Gelhaar & Otto, 2020; Heinz et al., 2022). Thereby, organizations face challenges regarding the data itself as the sharable items such as, e.g., data quality or structuring data (Altendeitering et al., 2022), technology- and organization-related challenges (Ermakova et al., 2013; Lis & Otto, 2021), and challenges related to the environment such as legal frameworks (Bastiaansen et al., 2020).

To counteract these barriers, existing literature focuses on developing incentive mechanisms (Gelhaar, Gürpinar et al., 2021), governance structures (Jagals & Karger, 2021), and business models (Schweihoff et al., 2023). However, research still neglects if organizations even have a clear understanding of the characteristics of data sharing and a concise target picture of beneficial conditions in organizations to strategically prepare for successfully exploiting the potential of data sharing (Dreller, 2018). Particularly beneficial conditions from a strategic, organizational, and governance perspective that need to be pursued to maximize value creation through data sharing are a black box for most organizations (Dreller, 2018; Orenga-Roglá & Chalmeta, 2019; Zeleti & Ojo, 2019). For example, many organizations struggle to implement standardized data sharing processes and governance mechanisms due to an unclear picture of the multiple characteristics affecting data sharing practices, resulting in time-consuming, individually designed data sharing solutions (Gelhaar, Groß et al., 2021).

While existing research focuses on advancing and enhancing data sharing, commonly accepted definitions of the phenomenon, a shared understanding of its characteristics, and successful data sharing strategies (Jussen et al., 2023) are still nonexistent despite being essential. Traditionally, research tackles novel concepts such as data sharing with spotting and closing gaps, such as the lack of incentive mechanisms or business models for data sharing (Sandberg & Alvesson, 2011; Gelhaar, Gürpinar et al., 2021). Our research follows a problematization approach, according to Monteiro et al. (2022) and Sandberg and Alvesson (2011), by elaborating on the fundamentals of data sharing. Consequently, we develop a framework of beneficial conditions as an essential pillar to understand data sharing in its totality and to develop strategic pathways toward achieving beneficial conditions. In our context, a condition is defined as an organization's state regarding a specific characteristic related to the organization's structure, culture, practices, mechanisms, or processes (Markus & Robey, 1988). To develop such a framework of beneficial conditions for data sharing that functions as a precise target picture and to contribute to the emerging field of research, we aim to answer the following research question (RQ) in this work:

RQ: What characteristics constitute beneficial conditions for data sharing?

Given the novelty and relevance of the phenomenon, we develop a fundamental framework of beneficial conditions for data sharing by organizations. The conditions thereby constitute the essential prerequisites for an organization to be pursued to maximize value creation through data sharing. Due to the explorative nature of the topic, we apply qualitative research methods by conducting semi-structured expert interviews and complementing the results with a systematic literature review (vom Brocke et al., 2009; Webster & Watson, 2002). The final framework includes 23 conditions (e.g., data availability, data stewardship, or interoperability) grouped into eight distinct categories, which we further assigned to the three dimensions of the *technology-organization-environment* (TOE) framework (Lis & Otto, 2020; Tornatzky et al., 1990). As we focus on the technological, organizational, and environmental perspectives, we acknowledge that role-based and individual aspects such as competencies, expertise, and behavior are underrepresented in the framework. Consequently, the framework represents a fundamental target picture of beneficial conditions from an organizational perspective. Further, we conduct a focus group of four experts from a company in the chemical industry to apply and validate our framework.

By presenting this framework, we emphasize the multidimensionality of data sharing and stress the need to conceptualize practical strategic initiatives and future research avenues integrally. Our aspiration to develop a generalized framework allows its applicability beyond companies to academic and governmental contexts, too. The framework thus enables future research to theorize and build upon a target picture of beneficial conditions for data sharing and cast back pathways toward these target pictures. For practitioners, we sharpen the understanding of requirements for data sharing to aspire. With the framework, we enable them to assess an organization's state, detect weaknesses, and derive pathways toward establishing beneficial conditions for data sharing.

We structure the remainder of this article as follows: First, we elaborate on the fundamentals of data sharing and related work. Afterward, we introduce the research design. Next, we present the developed framework

and apply and validate the framework in a real-world case. We conclude our work by discussing implications for practice and research, outlining the limitations, and pointing out future research potentials.

Theoretical Background and Related Work

Despite data sharing being a phenomenon known for decades in research and practice, both still lack a commonly agreed definition of the term (Dreller, 2018; Jussen et al., 2023). For this work, we stick with the definition of the Support Center for Data Sharing, which defines data sharing as "the collection of practices, technologies, cultural elements and legal frameworks that are relevant to transactions in any kind of information digitally, between different kinds of organizations." (Support Centre for Data Sharing, 2022). Based on this definition, the understanding of data sharing comprises the entirety of related activities, including data governance, related support processes, practices, and prerequisites of all involved players, individuals, and organizations. This extends the pure technical exchange of data by additionally including practices and processes related to the activity of data sharing (e.g., use case identification or decision processes), the cultural and legal elements, as well as an organization's culture and mindset (Arenas et al., 2019; Choi & Kröschel, 2015; Dahlberg & Nokkala, 2019). These different aspects are grouped under the term data governance, and their relevance is described independently of organizational context, industry, or company size (Lis & Otto, 2020). However, concrete specifications of these aspects necessary to enable and govern the co-creation of value based on data sharing across organizational boundaries have yet to be defined (Jagals & Karger, 2021; Lis & Otto, 2021).

Examining existing literature on data sharing reveals a highly fragmented research landscape. Extant literature primarily focuses on single conditions for enhancing data sharing, such as data governance (Jagals & Karger, 2021), data quality (Nicolaou et al., 2013), pricing of data products (Fricker & Maksimov, 2017), policy frameworks (Chowdhury et al., 2018), data ownership (Cheng & Du, 2015) or the willingness to share data (Dahlberg & Nokkala, 2019; Holler et al., 2019). Thus, research lacks a precise understanding of the conditions and a clear target picture for organizational pathways to successfully establish data sharing practices, despite being addressed as a necessary topic of research (Enders, Benz et al., 2020; Gelhaar, Groß et al., 2021; Gelhaar, Gürpinar et al., 2021). Adjacent concepts and phenomena of data sharing, such as data ecosystems, data marketplaces, and open data, include data sharing as its constituent activity and exhibit a similarly fragmented research landscape (Heinz et al., 2022). For example, Oliveira and Lóscio (2018) define data ecosystems as "[...] a set of networks composed of autonomous actors that directly or indirectly consume, produce, or provide data and other related resources" (Oliveira & Lóscio, 2018, p. 4). Data marketplaces are referred to as "[...] third-party platforms acting as neutral intermediaries and allowing others to sell standardized data products" (Sterk et al., 2022, p.3), and open data can be defined as "[...] a form of content that can be freely used, modified, and shared by anyone and for any purpose" (Enders, Benz et al., 2020). Similar to data sharing, these concepts lack commonly accepted definitions.

This strengthens the need for a shared understanding and a clear picture of beneficial conditions facilitating value creation by data sharing. However, research lacks such a view of conditions that organizations should aspire to derive pathways for achieving these beneficial conditions. The limited amount of existing research on data sharing aspects focuses on an academic and health context. Johnston and Coburn (2020) analyze 114 academic institutions regarding their support of researchers to share data and derive recommendations for improvement. Further, Korst et al. (2011) develop readiness metrics for health information exchange based on a survey, resulting in aspects around leadership, hospital policies, hospital operations, and incentives. Yet, existing research still lacks a multidimensional view of which conditions are beneficial for data sharing. This gap and the highly fragmented research landscape manifest the relevance of examining data sharing fundamentals across industry sectors. By providing a framework of beneficial conditions independent from specific industries or collaboration structures, we contribute to a fundamental understanding of the data sharing phenomenon.

Research Approach

To develop a framework of beneficial conditions for data sharing, we follow a qualitative research approach based on two distinct data sources. First, we conduct a series of semi-structured expert interviews to account for the exploratory nature of the phenomenon. This allows us to gain first-hand practical insights into the current state of data sharing from different industries and company sizes. We derive an initial set

of codes in two coding cycles by analyzing the obtained data to provide a grounded starting point. Second, we conduct a systematic literature review to enrich the gained insights with theoretical knowledge. We further apply two coding cycles to derive the respective beneficial conditions. By combining different data sources from practice and academia, we take existing practical and scientific knowledge into account for developing the framework. To apply our framework in a real-world setting, we conduct a focus group of four industry experts from an organization in the chemical industry.

Framework Development: Expert Interviews

To build the foundation for our research, we conduct ten expert interviews across nine different organizations. Interviewing experts engaging in data sharing allows us to gain first-hand insights into current topics relevant to the practical establishment of data sharing. For the interviews, we apply a semi-structured interview approach. This ensures a certain degree of standardization while at the same time making room for individual in-depth investigations. We develop a representative interview sample following two distinct criteria (Palinkas et al., 2015). First, experts with extensive competencies and experience in data sharing are selected. Second, we include both business and technological perspectives in the sample. The interviews have a duration between 49 and 62 minutes, with an average of 56 minutes. Table 1 depicts the expert sample, interviewees' roles in the respective company, and additional information on each company in the sample.

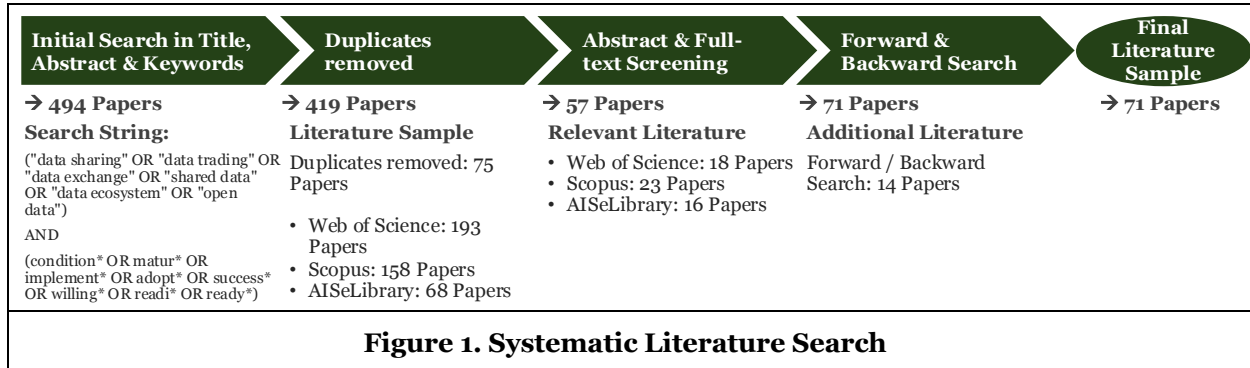| #	Role	Company	Industry	Annual Revenue (USD in 2021)	Employees (in 2021)
I1	Director IT Innovation	Alpha	Consumer Goods	10 - 50 bn	50.000 - 100.000
I2	Head of Data Assets	Beta	Insurance	50 - 100 bn	25.000 - 50.000
I3	Vice President Global Sales & Marketing	Gamma	Industrial Goods	50 - 100 bn	> 100.000
I4	Senior Project Manager	Delta	Consulting	N/A	< 1.000
I5	Head of Sales & Marketing	Epsilon	Conglomerate	> 100 bn	> 100.000
I6	Product Lead	Zeta	E-Commerce	10 - 50 bn	10.000 - 25.000
I7	Solution Engineer	Eta	Software	10 - 50 bn	50.000 - 100.000
I8	Global Data Steward	Theta	Chemicals	10 - 50 bn	> 100.000
I9	Principal Data Scientist	Theta	Chemicals	10 - 50 bn	> 100.000
I10	Head of Data Governance & Data Science	Jota	Oil & Gas	1 - 10 bn	1.000 - 10.000

Table 1. Expert Sample of the Interview Study

We conduct and record all interviews virtually and transcribe them for further analysis. For the transcription, we iterate through two coding cycles (Saldaña, 2015) using the coding software MaxQDA. Two independent researchers conduct this process to ensure consistency of the results. First, we apply an open coding approach in which we assign 597 codes to 21 characteristics, constituting a condition for data sharing (such as e.g., data ownership, motivation & prospects, strategies, or continuous monitoring & establishment of novel trends). The codes derived from the first coding cycle represent the first-order concepts according to the Gioia method (Gioia et al., 2013). Afterward, we perform a second iteration of coding, applying an axial coding approach (Saldaña, 2015) to structure the initial codes into seven consistent categories (data, information technology (IT), data governance, human resources, management, external factors, and collaboration). The aggregated and revised codes represent the second-order themes (Gioia et al., 2013). This code set serves as the basis for the subsequent literature review.

Framework Development: Systematic Literature Review

We conduct a systematic literature review to support our empirical findings and complement them with the current state of scientific literature (vom Brocke et al., 2009; Webster & Watson, 2002). We develop a search term, depicted in Figure 1, that comprises data sharing, open data, and data ecosystem concepts, as well as various terms describing an organization's current state and maturity regarding data sharing to ensure the coverage of relevant and adjacent topics. To adhere to scientific standards, we limit our search

to peer-reviewed articles from the Senior Scholars' Basket of Eight, the VHB JourQual-3 IS outlets, and six leading information systems (IS) conferences (e.g., International Conference on Information Systems). We apply our search term to the databases Web of Science, Scopus, and AISeLibrary. The subsequent literature review process is illustrated in Figure 1.

Initial Search in Title, Abstract & Keywords	Duplicates removed	Abstract & Full-text Screening	Forward & Backward Search	Final Literature Sample
→ 494 Papers	→ 419 Papers	→ 57 Papers	→ 71 Papers	→ 71 Papers
Search String:	**Literature Sample**	**Relevant Literature**	**Additional Literature**	
("data sharing" OR "data trading" OR "data exchange" OR "shared data" OR "data ecosystem" OR "open data")	Duplicates removed: 75 Papers	• Web of Science: 18 Papers • Scopus: 23 Papers • AISeLibrary: 16 Papers	Forward / Backward Search: 14 Papers	
AND	• Web of Science: 193 Papers			
(condition* OR matur* OR implement* OR adopt* OR success* OR willing* OR readi* OR ready*)	• Scopus: 158 Papers • AISeLibrary: 68 Papers			

Figure 1. Systematic Literature Search

Our initial literature search yields 419 results after removing 75 duplicates. An abstract and full-text screening leads to 57 relevant papers, which we complement with 14 additional papers from a forward and backward search. This results in a final literature sample of 71 relevant papers (indicated by a "*" in the references). To analyze the literature, we continue with a provisional coding cycle (Saldaña, 2015) and again use the coding software MaxQDA. The previously defined codes from the interview analysis serve as the baseline code set and are complemented by additional codes derived from the literature. In total, we derive 467 codes from the literature, which we assign to 23 respective characteristics of data sharing that indicate beneficial conditions. Thereby, we adjusted characteristics (e.g., motivation & prospects to motivation & incentives or competencies to data literacy) and added two new characteristics (funding and evaluation). In a second coding cycle, using an axial coding approach (Saldaña, 2015), we again categorize the derived codes similarly to the second coding approach of the expert interviews, resulting in eight distinct categories. Thereby, we recognized the distinction in the literature between management- and operations-related conditions for data sharing, which consequently results in breaking up the codes into two distinct categories. Leaned on the Gioia method, the revised second-order themes were further aggregated into third-order dimensions. Thereby, we draw on the TOE framework introduced by Tornatzky et al. (1990) as the basis for aggregation, similar to existing research in IS literature (e.g., Lis and Otto 2020, Jöhnk et al. 2021). The TOE framework generically describes technological, organizational, and environmental dimensions without further specifying them (Tornatzky et al., 1990). Thus, the TOE framework is broadly applicable to different disciplines and contexts and can be adapted to a study's context.

Framework Application and Validation: Focus Group

We apply our findings by conducting a focus group to apply and validate the framework in a real-world organization to illustrate and verify its relevance, applicability, and completeness. The focus group comprises four industry experts (Head of Global Data Governance and Data Sharing, two Global Data Stewards, Regional Data Steward (Europe), and Digital Solution Services Manager). After introducing the framework by the researcher, the experts discuss each condition of the framework individually for 90 minutes in a virtual setup. Thereby, the experts evaluate the organization's current state for each respective condition of the framework. Thereby, the conditions are rated on a five-point rating scale from least ready (1) to most ready (5), which is proposed by the experts to assess the current state of beneficial conditions. Further, each characteristic and category are discussed among the experts regarding its relevance and validity, as well as if any characteristics are missing, miscategorized, or redundant. Hence, we collect valuable feedback on the applicability and relevance of the framework in practice. Simultaneously, we verify the framework's validity and reliability and gain thoughtful insights for further evolving our framework.

A Framework of Beneficial Conditions for Data Sharing

In the following section, we present the results of our work, the developed framework, which is the essence of interviews with industry experts in data sharing and scientific knowledge from existing literature. The framework comprises 23 characteristics, reflecting the conditions, grouped into eight distinct categories

along the three dimensions of the TOE framework, as depicted in Figure 2. The framework enables organizations to identify, evaluate, and assess their current state regarding the conditions, detect weaknesses and potentials for improvement, and derive actions and initiatives accordingly.
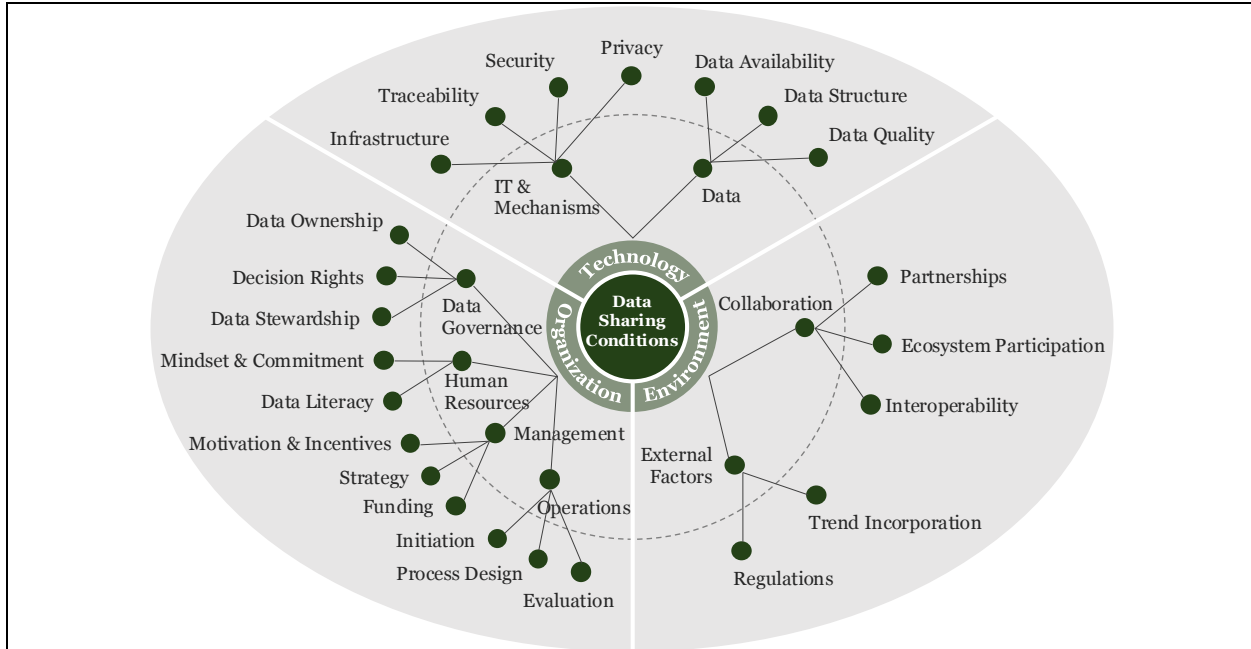

Figure 2. A Framework of Beneficial Conditions for Data Sharing

To demonstrate the range of a condition for each characteristic, we define the two respective extrema for each characteristic: the ideal (most beneficial) condition and the baseline (least beneficial) condition. Table 2 provides an explanation of this extrema for each condition. By describing the two extremes, we frame the range of an organization's potential current condition and provide a frame for possible intermediate steps on the pathway toward the described target condition. We acknowledge that establishing successful data sharing initiatives does not necessarily require achieving every target condition and does not imply that meeting more conditions automatically leads to maximizing value generated by sharing data. Instead, the conditions reflect beneficial prerequisites for advancing the opportunity for organizations to exploit the full potential and benefits of data sharing. The model thus supports identifying focus areas and developing pathways to advance data sharing by comparing the current state with the target picture.

Cate-gory	Characte-ristic	Least beneficial Condition	Most beneficial condition
Dimension: Technology			
Data	Data Availability	Data landscape is unknown, and data is only accessible for single individuals and on ad-hoc requests	Full transparency about the data landscape and clearly defined access mechanisms
	Data Structure	Unstructured data lacking related metadata as well as interoperable data formats and links	Data stored in standardized, interoperable formats, well-described by metadata, and linked accordingly
	Data Quality	Imbalanced, drifted, or unlabeled data with lack of data quality tools and manual data engineering	Automated and seamless integration of data quality standards and associated tools (e.g., data repositories)
IT & Mechanisms	Infrastructure	Siloed, heterogenous landscape of IT systems with no interoperability	Interoperable and homogenous system landscape (e.g., multi-cloud or platform solutions) without data silos
	Traceability	No traceability of usage, reusage and access history of shared data	Established mechanisms for tracing data usage, reusage and access history (e.g., using distributed ledger technologies)

	Security	No security mechanisms for authentication and certification of users, validated data transmission, and data usage	Automated security mechanism (e.g., cryptography) to ensure authenticity, safe data transmission, and purposeful data usage
	Privacy	No privacy-preserving measures apart from categorically not sharing potentially sensitive and confidential data	Privacy mechanisms (e.g., anonymization and de-identification) and privacy-enhancing technologies to ensure appropriate sharing of critical data
Dimension: Organization			
Management	Motivation & Incentives	Unclear potentials of data sharing, both monetary and non-monetary	Systematic exploration of data sharing potentials and establishment of incentive mechanisms regarding all involved stakeholders
	Strategy	No representation of data sharing in the corporate, business and data strategy, no managerial attention	Data Sharing as an essential pillar of the corporate, business and data strategy to be pursued and implemented
	Funding	No investments in data sharing projects and initiatives, no available financial resources	Available and secured provision of financial resources for investments in data sharing projects and initiatives
Data Governance	Data Ownership	Unclear ownership and responsibilities of data within the organization (e.g., ensuring quality and maintenance)	Clearly structured data ownership and responsibilities to maintain and ensure data quality
	Decision Rights	Unclear decision rights and power for data sharing activities	Clearly defined decision rights for data sharing practices from management, business, and legal perspective
	Data Stewardship	No established data stewards and no defined responsibilities	Well-defined data steward responsibilities ensuring compliance, data quality and data usage standards. Established data management methods for acquiring, maintaining, and abandoning data
Operations	Initiation	No (or ad-hoc) identification of data sharing practices based on individual internal or external requests	Systematic and proactive initiation of data sharing and identification of internal and cross-industry data sharing practices
	Process Design	Individual process design from scratch for each data sharing practice	Standardized and adaptable processes for designing data sharing activities, as well as mechanisms for continuous dynamic improvement, use of reference cases and best practices
	Evaluation	Subjective risk assessments as well as unclear pricing models and valuation of data sharing practices	Structured and unbiased valuation, risk assessment and pricing mechanisms for data sharing practices
Human Resources	Mindset & Commitment	Closed company culture and low commitment of management and employees	Open culture and strong commitment across management hierarchies and ensured commitment to engage in share data activities
	Data Literacy	Lack of skilled human resources regarding experience and data literacy capabilities for data sharing	Human resources across the organization are available, skilled, experienced, and equipped with data literacy capabilities for data sharing
Dimension: Environment			
Collaboration	Partnerships	No existing strategic and operational partnerships, no proactive identification and pursuit	New types of cooperation and strategic and operational partnerships are established and partners across industries are proactively identified to enable and engage in data sharing
	Ecosystem Participation	No data ecosystem and data marketplace endeavors and participation	Proactive participation in the design and establishment of data ecosystems and marketplaces
	Inter-operability	No interoperability regarding data semantics, systems, processes, and legal consent within the organization	Standardized, interoperable data semantics, systems, infrastructure, processes, and legal consent within and across organizations
External Factors	Trend Incorporation	Disregard or no observation, evaluation, and incorporation of trends affecting data sharing	Continuous monitoring, evaluation, and incorporation of trends affecting data sharing in the form of systematically derived actions
	Regulatory Compliance	Unknown, ignored or not understood regulations, no application in the company's context	Continuously monitored, well-known and complied local, regional, and national regulations
Table 2. Description of Beneficial Conditions for Data Sharing			

Technological Conditions

Technological conditions on data and information technology are essential to establish data sharing successfully. Hence, this category focuses on conditions to prepare the data for sharing, ensure infrastructural, security, and privacy prerequisites, and enable traceability of shared data. One could argue that data as an organizational resource should be assigned to the dimension "organization". However, in our work, we focus on aspects of technological mechanisms to structure data, make data available and accessible, ensure and increase data quality, and therefore assign the category "data" to the dimension "technology". While data- and IT-related prerequisites for data sharing are manifold, our analysis reveals three data-related and four IT- and mechanism-related conditions that are particularly relevant to an organization's ability to share data.

Data

First, **data availability** is a significant condition for data sharing. Traditionally, data is widely spread across an organization's historically grown landscape of IT systems, leading to a lack of transparency and data only being accessible for single users or on ad-hoc requests (Abramowicz & Węcel, 2013; I7). Thus, it requires transparency in the data landscape, e.g., by data catalogs to enable findable and transparent data (Kaiser et al., 2021; Nokkala et al., 2019; I1; I2; I8). Further, establishing clear access policies to the data using automated authorization mechanisms is essential to ensure authorized users read, write, and use different sets of data (Ermakova et al., 2013; Fabian et al., 2015; Knol et al., 2014; Zhong et al., 2011; I4).

Second, the **data structure** requires standardized and interoperable data formats across systems that enable the combination of various data sets, metadata models to describe the data (e.g., data privacy classifications, usage rights), and linking data across IT systems (Abramowicz & Węcel, 2013; Lindman et al., 2014; Ure et al., 2009; I1; I4). However, data often is captured in various systems in local data formats, lacking a certain metadata model, and are not linked across systems (Hüner et al., 2011; Rudmark, 2020; Schwede & Cirullies, 2021; I5; I8; I10).

Third, **data quality** is a critical factor for combining shared data sets. However, data quality in many organizations exhibits imbalanced, drifted, and unlabeled data, leading to considerable data engineering efforts (Altendeitering et al., 2022; Dahlberg & Nokkala, 2019; Nicolaou, 2011; I5; I6; I10). Seamless and automated data quality standards and tools, such as data repositories, noise reduction, removing data anomalies, data auditing, and metadata models, are thus necessary prerequisites to ensure, e.g., the usability, compatibility, linkability, accuracy, or validity of data (Link et al., 2017; Nokkala et al., 2019; Orenga-Roglá & Chalmeta, 2019; Rehman et al., 2016; I1; I3; I6).

IT & Mechanisms

The technological **infrastructure** in organizations has mainly grown historically, leading to a fragmented landscape of data and systems primarily siloed in databases or even on local computers (Enders, Wolff et al., 2020; Menon and Sarkar, 2016). Mostly, this infrastructure lacks interoperable structures, processes, and interfaces (Dalmolen et al., 2019; Gelhaar, Groß et al., 2021; I5). Consequently, a specific technological infrastructure is vital to storing, managing, and delivering data (Azkan et al., 2020). Organizations must break up data silos and ensure multilateral interoperability of systems within and across organizations (Altendeitering et al., 2022; Bastiaansen et al., 2020; I1, I7).

Second, to ensure control and legal compliance, **traceability** is a significant prerequisite. The current lack of mechanisms to control, monitor, and audit the scope, location, and entity of data usage leads to organizations refraining from sharing data (Azkan et al., 2020; Bastiaansen et al., 2020; Priego & Wareham, 2020; I1; I6; I8). Establishing traceability mechanisms like digital signatures, authorization mechanisms, or multi-party computation can reduce this lack of control and eliminate the need for a trusted third party as an intermediary (Agahari et al., 2022; Bruckner & Howar, 2021; I9).

Third, automated and established **security** mechanisms like, e.g., data encryption and anonymization, certification of users, or setting firewalls counteract the risks to prevent unintentional access or tapping of data and further security attacks and violations (Azkan et al., 2020; Heinz et al., 2022; Knol et al., 2014; Nicolaou et al., 2013; I3; I6; I7; I10).

Fourth, for **privacy** reasons, many companies categorically classify them as sensitive or confidential and preserve them within organizational boundaries (Bergman et al., 2022; Bruckner & Howar, 2021; Gutierrez

et al., 2019; I3; I6; I8; I9). However, privacy-enhancing mechanisms, such as data masking, anonymization, or de-identification, can mitigate the risks of privacy and confidentiality breaches and enable organizations to responsibly balance the interests of stakeholders and protection of data privacy rights (Aloitabi et al., 2021; Chowdhury et al., 2018; Li & Sarkar, 2010; Zhong et al., 2011; I3; I7; I8).

Organizational Conditions

Besides technological conditions, an organization's structures, processes, and culture are relevant to establishing data sharing activities successfully. Thus, organizational change and the realization of prerequisites are indispensable due to the novelty of data sharing for many companies. Consequently, we carve out the elementary conditions for data sharing from an organizational perspective along the categories of management (3), data governance (3), operations (3), and human resources (2).

Management

First, the ***motivation and incentives*** are decisive for initiating and establishing data sharing initiatives and activities (Azkan et al., 2020; Bergman et al., 2022; I1; I4; I6). Today, the benefits and potentials of data sharing practices and initiatives remain unclear to the management, hampering the motivation to share data (Jagals et al., 2021; I3; I4; I7; I8). Hence, it is essential to clearly identify frameworks and processes to unravel the potential benefits for involved stakeholders (Gelhaar, Gürpinar et al., 2021; Holler et al., 2019; Müller et al., 2020; Schweihoff et al., 2022; I4; I5). Furthermore, (non-) monetary incentives like value-based reward models or increasing the reputation of participating stakeholders through public communication of novel data sharing collaborations and partnerships can be established to increase the motivation towards data sharing (Agahari et al., 2022; Enders, Benz et al., 2020; I1; I5; I6; I8; I9, I10).

Second, data sharing is mostly neither anchored in a corporate business ***strategy*** nor a separate strategy for data sharing and management (Reimsbach-Kounatze, 2021; Spanaki et al., 2021; I1; I3; I6). Hence, data sharing activities are fragmented and lack a long-term strategic direction (Arenas et al., 2019; Enders, Benz et al., 2020; I2, I10). Developing a data sharing strategy and incorporating data sharing in a corporate strategy paves the way to systematically fostering an organization's activities to engage with data sharing, e.g., by defining clear objectives and measurements and defining required roles or aligning data sharing with business activities (Janssen et al., 2012; Orenga-Roglá & Chalmeta, 2019; Paletti, 2018; I1; I9; I10).

Third, data sharing initiatives require intensive ***funding*** from an organization's management (Abbas et al., 2021; Parvinen et al., 2020; I8). Due to the uncertainty about the potential monetary benefits, the conventional approach of balancing benefits versus costs as a decision-making basis is not applicable (Bastiaansen et al., 2020; I3; I4; I10). Thus, planning investments and funding is an indispensable prerequisite (Abbas et al., 2021; I6; I8).

Data Governance

First, unlike physical products, ***data ownership*** often remains unclear and becomes even more complex through an organization's distributed data gathering and processing. In particular, the responsibility for maintaining data, ensuring its quality, and defining privileges to control data access and usage impedes data sharing (Dalmolen et al., 2019; Nokkala et al., 2019; I1; I3; I6; I10). Thus, organizations must clearly define data owners at three levels: the data itself, the data product, and the data platform (Fadler & Legner, 2020). This generates clear responsibilities and accountability for seizing data access and usage, ensuring the business value of a data product throughout the data lifecycle, maintaining data sources and products, and ensuring data quality (Lis & Otto, 2021; Reimsbach-Kounatze, 2021; I1; I5).

Second, ***data stewardship*** is essential to establishing decisions and actions that secure data quality regarding data availability, integrity, and security (Nokkala et al., 2019; I8; I10). Thus, data stewards should be employed to develop and establish master data frameworks, perform data lifecycle and data provenance tasks, develop and incorporate data quality standards, and ensure legal consent to data sharing activities (Choi & Kröschel, 2015; Jagals & Karger, 2021; Liang et al., 2018; Lis & Otto, 2021; I1; I3; I10).

Third, organizations often lack clear ***decision rights*** and power for data-related tasks like determining data usage and the approval of sharing data (Cheng & Du, 2015; Witte et al., 2020; I1; I8). However, data sharing practices are bound to fail without clearly established decision rights (Enders, Benz et al., 2020). Consequently, organizations should install either monocentric decision rights centered on focal actors with

the capability to enforce decisions or a polycentric approach of balancing the decision rights of various stakeholders like legal experts, managers, and data stewards (Lis & Otto, 2020; I2; I3; I4).

Operations

First, the proactive ***initiation*** of data sharing activities is either not incorporated or based on individual internal and external requests rather than proactively approached (Janssen et al., 2012; I3, I6). Developing frameworks and processes to identify data gaps systematically, define internal and external reference cases, and design practices by investigating the potentials of data linkages from different sources across organizations and industries is a decisive prerequisite and supports the initiation process of respective data sharing practices (Abramowicz & Węcel, 2013; I2; I5; I7; I8).

Second, the ***process design*** of data sharing activities is often individually designed for each data sharing practice, e.g., preparing and engineering data, establishing data exchange infrastructures and APIs, and contracting (Zeleti & Ojo, 2019; I1; I6, I10). To ease data sharing, an organization requires standardized processes to communicate and process data sharing activities, such as establishing reference cases, identifying processes for data gaps, and standardizing legal contracting (Enders, Wolf et al., 2020; I3, I10). These processes must be complemented with mechanisms for continuous dynamic evaluation, adaptation, and improvement (Altendeitering et al., 2022; I6).

Third, evaluating data sharing activities and initiatives is a crucial prerequisite for fact-based decision-making. As data is an intangible asset, existing valuation approaches are barely applicable, leading to subjective decision-making based on personal perceptions of risks and benefits (Fricker & Maksimov, 2017; I3, I4, I6). Consequently, organizations must develop a profound understanding of data-related value structures (Abbas et al., 2021; I1; I9). Therefore, the design and development of valuation criteria, mechanisms, and pricing models from both monetary and non-monetary perspectives are crucial (Fricker & Maksimov, 2017; Gelhaar, Gürpinar et al., 2021; I3; I7).

Human Resources

First, companies traditionally established a closed and limited ***mindset and commitment*** to data sharing of an entire organization, its management, and employees for competitive reasons. Opening organizational boundaries and sharing data is counter-intuitive and often closely related to the perception of loss of control and power (Cheng & Du, 2015; I4; I6; I7). However, a shift in mindset by outlining and determining the potentials and benefits, perceiving data sharing as an opportunity rather than a risk and intensifying clear communication throughout the entire organization on all levels is vital (Habib et al., 2022; Roeber et al., 2015; I6; I10). The top-level management needs to exemplify this mindset shift and commitment, followed by actions to support data sharing initiatives (Enders, Wolf et al., 2020; I1).

Second, employees at all levels face novel challenges and thus require the acquisition of competencies, often called ***data literacy*** (Zeleti & Ojo, 2019; I4; I10). Hence, employees must be empowered to handle, maintain, and govern data, evaluate the risks and benefits of data sharing, and develop guidelines and standards (Dahlberg & Nokkala, 2019; I1; I7). Consequently, the top management should incorporate measures to provide employees with the necessary skills and capabilities by means of training and workshops or data literacy academies (Enders, Wolf et al., 2020; Priego & Wareham, 2020; I6; I9).

Environmental Conditions

In addition to technological and organizational conditions, the organization's environment further impacts successful data sharing. Designing and establishing collaborations can boost data sharing across organizations, resulting in three conditions in the framework. Moreover, external factors such as regulations and trends tremendously impact data sharing and thus require consideration when thinking of pathways to establish data sharing practices successfully.

Collaboration

First, many organizations seek to establish strong ***partnerships*** to facilitate data sharing and co-create value. Despite its potential, identifying appropriate partners is complex, and organizations' varying requirements, individual objectives, and trust-related issues hamper the process (Ham et al., 2015; Müller et al., 2020; Zhang et al., 2022; I2; I7). Therefore, organizations must develop pathways to proactively identify partners through open communication, strengthen and extend existing partnerships toward

sharing data, and increase trust between partners, e.g., by cross-licensing agreements or security and privacy mechanisms (Gelhaar & Otto, 2020; Müller et al., 2020; I2; I3, I6, I8). Furthermore, pursuing long-term strategic partnerships leads to increased data sharing practices regarding the frequency and amount of data (Agahari et al., 2022; Du et al., 2012; Parvinen et al., 2020; I5, I8).

Second, many organizations are cautious about **ecosystem participation**, resulting in low or no endeavors to design and establish data ecosystems and marketplaces (Abbas et al., 2021; Alotaibi et al., 2021; I4; I5; I10). However, their attributed potential to enable and accelerate data sharing is enormous (Azkan et al., 2020; Gelhaar, Groß et al., 2021; Heinz et al., 2022; Rudmark & Hjalmarsson, 2019; I2). Consequently, organizations should proactively participate with financial and human resources in the design and establishment to assess and evaluate their ability to participate and derive actions for setting the course for future interaction (Gelhaar & Otto, 2020; van de Ven et al., 2021; I1; I3; I5).

Third, **interoperability** between organizations plays a crucial role in data sharing. While organizations lack system standardization within and across organizations, interoperability from a technological (e.g., system interoperability through APIs), a semantic (e.g., standardized data types and labeling), an organizational (e.g., data governance processes), and a legal perspective (e.g., legal compliance) are indispensable prerequisites to data sharing (de Corbière & Rowe, 2013; Frick & Schubert, 2011; Hutterer & Krumay, 2022; Kurrle et al., 2022; Marrella et al., 2019; I1; I5; I8; I9). Hence, they should strive to apply existing standards from all four perspectives and actively contribute their knowledge and experience to setting novel standards (Bastiaansen et al., 2020; Ure et al., 2009; Witte et al., 2020; I3).

External Factors

First, disregarding **trend incorporation** of novel developments (e.g., data ecosystems, data democratization, or data mesh) affects data sharing and can, therefore, rapidly diminish an organization's engagement in sharing data (Enders, Benz et al., 2020; Rantanen & Koskinen, 2019; I3; I5). Consequently, organizations should establish processes such as implementing monitoring mechanisms (e.g., trend radars) to continuously screen the changing landscape of trends, design and develop evaluation mechanisms to examine a trend's impact on data sharing practices, and systematically derive necessary actions for incorporating trends (Heinz et al., 2022; Müller et al., 2020; Orenga-Roglá & Chalmeta, 2019; I1; I4; I9).

Second, to ensure **regulatory compliance**, it is particularly relevant to continuously screen, understand, and incorporate the current legal regulations, as laws significantly vary on a local, regional, and (inter-)national level (Huang et al., 2019; Jussen et al., 2023; I8; I10). Regulations need to be considered and incorporated into data sharing contracts and consent management, e.g., in the form of integrating legal experts and lawyers already in the initiation phase (Smith et al., 2016; Witte et al., 2020; I1; I3; I5; I6; I10).

Framework Application and Validation – A Case in the Chemical Industry

To ensure the framework's applicability in practice and validate our framework, we apply the presented framework to an organization in the chemical industry. In a focus group, four experts directly involved in data sharing endeavors of the organization under consideration used the framework to assess their organization's current state of beneficial conditions for data sharing. For validation purposes, we further discuss each characteristic and category with the experts regarding its relevance and reliability.

The organization in which the framework is applied has more than 100.000 employees and provides products and solutions for various industry sectors. Due to its splitting into independent divisions, we focus on one division: agricultural products. For assessment purposes and to account for the intermediate steps along the pathway to achieve the most beneficial condition, the experts proposed a five-point rating scale. The experts also acknowledge that the intermediate steps are yet undefined and require additional research and examination in practice on each condition. However, a five-point rating scale seems appropriate to the experts to assess the organization's state and depict recent and past endeavors toward achieving beneficial conditions for data sharing while additionally providing a valuable determination of the current standpoint and progress in each condition. According to the experts, the rating scale for each condition is understood as follows: (1) the least beneficial extremum describes the standpoint of the organization; (2) the organization elaborates on first strategies and concepts; (3) first initiatives are derived and in progress; (4) several initiatives are established and mature in their progress; (5) the organization achieved the most beneficial condition. The outcome of assessing the expert's organization by applying our framework is illustrated in Figure 3.
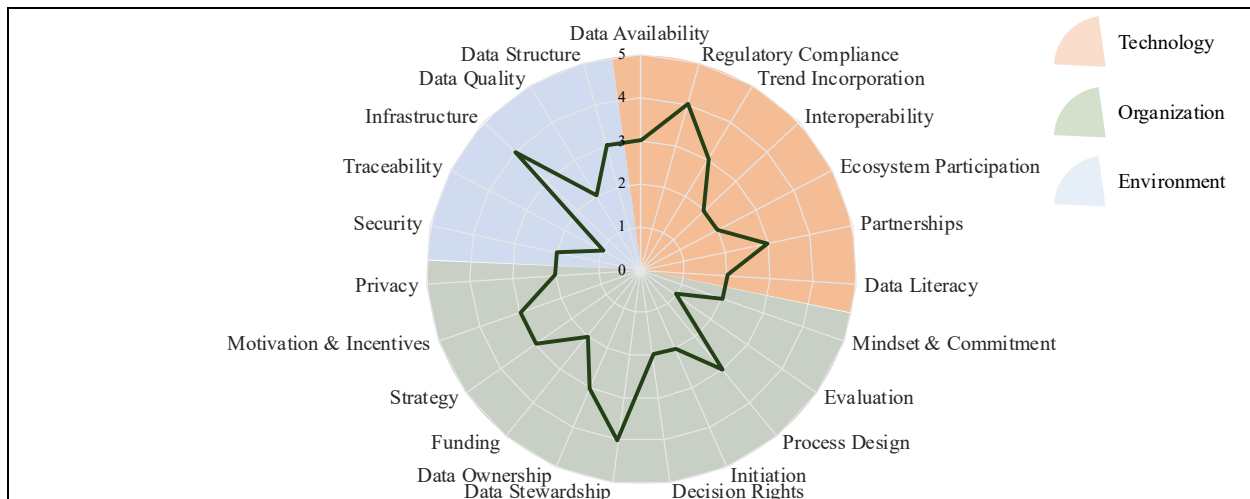
Figure 3. Framework Application to an Organization in the Chemical Industry

 From a technological perspective, the organization is already working on implementing and incorporating various measures. The organization, e.g., develops a data catalog, establishes a data platform to break up existing silos, advances the infrastructure to enable APIs within and across organizations, and structures data through developing data as a product and respective data ontologies. However, regarding tracing back data access and usage and establishing security and privacy mechanisms, the company is still in the early phase of identifying and evaluating appropriate measures. During the assessment, the experts agree with the proposed characteristics as sufficient for determining beneficial conditions for data sharing for an entire organization. However, the experts mention the possibility of breaking down the existing characteristics if applied to single divisions or teams within the organization, such as data availability into, e.g., data accessibility and data findability. Moreover, the experts highlight the characteristics of security, privacy, and data availability as fundamental prerequisites for data sharing and data quality as an essential prerequisite to ensure usability for the data consumer.

From an organizational perspective, the motivation varies widely between data sharing enthusiasts and laggards, mainly due to the lack of a clear target picture of incentives to share data. However, the organization already has a data strategy in place, working towards incorporating data sharing as a core pillar with funding from top-level management. From a governance view, the organization established a robust data stewardship community but still lacks clearly defined data ownership structures and struggles with assigning decision rights, which are recently determined individually. The data sharing operations are characterized by isolated single-use cases based on ad-hoc requests and a significant lack of evaluation mechanisms. The process design of data sharing practices is still in progress toward standardizing legal contracting and identifying reference cases. Furthermore, the experts constitute the organization's traditional attitude of protecting data, which slowly develops towards an open mindset on data sharing. In line with this, the organization has already started to build up resources, although the establishment of data literacy is in its infancy, particularly in non-IT-related departments. By discussing each characteristic, the experts recognize the appropriateness of the characteristics and further note that each characteristic is a broad concept that, in detail, can be further unraveled (e.g., data ownership to legal ownership and ownership roles within the organization). On the relevance of each characteristic, particularly data governance (ownership, stewardship, and decision rights), establishing a data sharing-enabling mindset and commitment, a clearly defined strategy, and a robust process are called indispensable by the experts to enable and facilitate data sharing.

From an environmental perspective, it is evident that the organization only has a few partnerships in place. Strategic and novel partnerships are sparse, and the organization takes on an observing role regarding ecosystem participation. This is also reflected in the focus on interoperability within the organization while rarely considering interoperability across organizational boundaries. However, the organization has started continuously monitoring and evaluating recent trends, incorporating data-sharing-related trends, and intensely focusing on strengthening regulatory compliance and collaboration with legal departments. Particularly, compliance with the laws and regulations is considered one of the essential and dominating

prerequisites for organizations to engage in data sharing. In contrast, fostering trend incorporation, establishing data sharing collaborations, and ensuring interoperability are seen as important targets for the future. The experts highlight the necessity of preparing their organization internally before engaging in collaborations and establishing interoperable solutions beyond organizational boundaries. Despite this, they recognize the relevance of these prerequisites as beneficial conditions for data sharing.

Applying the framework raises the experts' awareness that data sharing is increasingly relevant for organizational activities. Additionally, the experts are enabled to understand the multiple facets and characteristics of data sharing. The experts acknowledge that recent endeavors remain at limited initiatives and scarce successful data sharing practices and hold immense potential for value creation. For this, the experts value the framework as an effective and relevant tool to detect weaknesses and improvement potentials and establish beneficial data sharing conditions. Regarding the applicability and usefulness of the framework, all four experts recognize it as a relevant, valuable, and supportive tool to define a more precise target picture of beneficial conditions for data sharing and develop concrete pathways to advance and realize a beneficial state for data sharing. While the experts highlight the potential to extend each characteristic towards more granular sub-characteristics, the framework as a whole is valid to the experts, and the experts confirm the relevance and reliability.

Conclusion, Limitations, and Future Research

With this work, we present a framework of beneficial conditions for data sharing that provides organizations with a concise target picture of beneficial conditions for data sharing on the pathway to exploiting the full potential of data sharing. By combining ten expert interviews with a systematic literature review (vom Brocke et al., 2009; Webster & Watson, 2002), we derive 23 characteristics grouped into eight distinct categories: data, IT & mechanisms, management, governance, operations, human resources, collaboration, and external factors. The TOE framework introduced by Tornatzky et al. (1990) provides the foundation for assigning the categories to the dimensions of technology, organization, and environment. Analyzing two distinct data sources proves that existing research and practical knowledge have lacked a clear picture of beneficial conditions for an organization to pursue toward successful data sharing. By systematically examining these characteristics and their specifications based on scientific and practical knowledge, we provide a compact framework of beneficial conditions for data sharing.

From a theoretical perspective, our work contributes to an in-depth understanding of the emerging data sharing phenomenon and presents a precise target picture from different perspectives. The identified beneficial conditions support researchers in streamlining and channeling future theorizing endeavors and research approaches for developing pathways and measures toward increasing data sharing practices of organizations. Furthermore, the evidence of the multitude of characteristics of data sharing further lays the foundation for developing integral research approaches.

From a practical perspective, the results of this work contribute to the awareness of beneficial conditions for data sharing and their interconnectivity. With the framework, we enable organizations to assess their current state regarding data sharing activities and thus lay the foundation for developing approaches and initiatives to advance and fulfill these prerequisites and unleash the full potential of data sharing. By taking on a multidimensional perspective on data sharing, we expect to encourage practitioners to expand practical efforts to achieve data sharing proficiency and facilitate data sharing.

While striving for generalizable results, our work has certain limitations. Exhaustiveness cannot be guaranteed, as variations in either the expert sample or the literature review may uncover additional results. Thus, considering literature from other disciplines, e.g., computer science, and extending the expert sample could provide additional insights. Additionally, the gathered data has been collected across various industries to ensure a high degree of generalizability and, therefore, neglects industry-specific characteristics. Thus, future research might extend the framework by industry-specific aspects. Moreover, as our framework focuses on an organizational view of beneficial conditions, additional perspectives such as beneficial conditions from a role-based or individual perspective could be researched in future studies. Further, the model has been tested and validated regarding relevance, applicability, and reliability by conducting a focus group in one organization. Consequently, examining a multiple case study and cross-case analysis with various organizations may yield additional insights to evolve the framework. Further, our research outlines the least and most beneficial conditions for each characteristic and neglects to elaborate

on pathways to achieve them. Subsequently, future research could ground on the framework and examine pathways and guidance for organizations toward attaining the most beneficial conditions.

With this work, we lay the foundation for an organizational data sharing target picture. While the framework comprises a multitude of conditions, understanding their interrelations is essential to develop integral approaches for an organization toward achieving beneficial conditions for data sharing. However, data sharing is still a novel phenomenon and results in a lack of clear and precise measures to achieve the proposed target state of data sharing. Thus, our work presents a grounded starting point to develop measures such as process frameworks (e.g., by applying design science research) toward achieving beneficial conditions for data sharing. Overall, we accredit tremendous potential to the emerging field of data sharing for research and practice alike. We hope that our work contributes to the foundational understanding by providing a clear target picture and explicitly call for additional practical and scientific endeavors to approach and advance data sharing initiatives and practices integrally.

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