How to Share Data Online (fast) – A Taxonomy of Data Sharing Business Models

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Abstract

Data is an integral part of almost every business. Sharing data enables new opportunities to generate value or enrich the existing data repository, opening up new potentials for optimization and business models. However, these opportunities are still untapped, as sharing data comes with many challenges. First and foremost, aspects such as trust in partners, transparency, and the desire for security are issues that need to be addressed. Only then can data sharing be used efficiently in business models. The paper addresses this issue and generates guidance for the data-sharing business model (DSBM) design in the form of a taxonomy. The taxonomy is built on the empirical analysis of 80 DSBMs. With this, the primary contributions are structuring the field of an emerging phenomenon and outlining design options for these types of business models.

Keywords: Data Sharing Business Models, Data Sharing Economy, Taxonomy, Design Options, Empirical Analysis

1. Introduction

"Our goal with the DGA is to set the foundation for a data economy in which people and businesses can trust. Data sharing can only flourish if trust and fairness are guaranteed, stimulating new business models and social innovation," (Hurst & Huet, 2022)

A study by the European Commission shows that the amount of data generated will increase from 33 zettabytes (2018) to 175 zettabytes (2025). The full potential of the data is still not being used, as 80 percent of industrial data still remains untapped (European Commission, 2022b). However, sharing data opens up entirely new business models (Parmar et al., 2014). Related concepts include the data sharing economy, which focuses on B2B data sharing across industries (Richter & Slowinski, 2019). In theory, the idea of sharing data sounds logical and intuitive. In practice, there are clear challenges that must first be overcome. These include creating a basis of trust and transparent ways of sharing data but also uncovering its potential transparently (Gelhaar & Otto, 2020; Opriel et al., 2021). Though, the process is riddled with challenges to overcome. Companies need to understand how they can profit from using data and which data they need and which data they already have.

Various initiatives tackle precisely these challenges. For example, the European Gaia-X initiative aims to create a secure and trustworthy framework for data sharing (GAIA-X, 2021). Another example is the formulation of new legal frameworks, such as the Data Act or the General Data Protection Regulation (European Commission, 2020, 2022a). A forecast by the European Commission shows that such a legal framework is not only necessary for safety reasons. It is assumed that introducing the European Data Act will generate an additional GDP of EUR 270 billion within the EU by 2028 (European Commission, 2022b). The topic of data sharing is not only being strongly promoted in Europe. It is also becoming increasingly important in the global context, as numerous data sharing companies demonstrate, such as Snowflake[1] and Data for Good[2].

The paper starts exactly at this point and shows how companies can design their business models based on data sharing. It is essential to emphasize that this work primarily highlights the unique

[1] Website of Snowflake: https://www.snowflake.com/ (last accessed: August 23, 2022)

[2] Website of Data for Good: https://dataforgood.ca/ (last accessed: August 23, 2022)

URI: https://hdl.handle.net/10125/102706
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characteristics of a data sharing business model and complements existing research on data-driven business models. Because of the above, we investigate the following research question:

Research Question: *What are the design options for data sharing business models?*

We answer this research question by constructing a taxonomy, an highly suitable artifact for structuring a domain of interest (Glass & Vessey, 1995). Taxonomies have a rich history in business model research investigating empirically how business models differ, what types there are, and how they can be designed (e.g., Kamprath and Halecker (2012); Lambert (2015); Möller et al. (2021)). Subsequently, endeavoring to design a business model taxonomy that is explicit to data sharing would complement the field of existing business model taxonomies and enrich it through a new facet (Möller et al., 2021). In this light, we tackle the research question by empirically constructing a taxonomy based on a sample of 80 DSBMs collected from *Crunchbase* and *AngelList*.

This paper is structured as follows. First, the theoretical background is presented in the upcoming section. This includes the basics of the business model concept as well as data sharing. The third section discusses the research approach on which this paper is based. The fourth section presents the developed taxonomy. Likewise, the section discusses the individual dimensions in detail. Subsequently, Section 5 discusses the results. Finally, Section 6 gives an overview of the contributions, limitations, and an outlook on possible future implementations.

2. Theoretical Background

2.1. Data Sharing

Data sharing holds enormous potential for companies. For example, D'Hauwers and Walravens (2021)'s research has shown that data sharing offers new opportunities to drive innovation and align business models. Data sharing means that others are granted access to one's own data (Arnaut et al., 2018; Pasquetto et al., 2017; Vesselkov et al., 2019) in order to be able to develop new applications and services (Vesselkov et al., 2019). This access can be granted to others free of charge or in exchange for compensation (e.g., monetary or reciprocal data) (Arnaut et al., 2018). Because of that, sharing data has broader implications than just the technical process of transferring data from one system to another; it has a business model dimension.

However, companies often take a critical stance toward sharing data, given that the added value is not apparent (Lindner et al., 2021). In addition, companies are faced with the challenge that there is often still no infrastructure for exchanging data, and the corresponding know-how is not available (Lindner et al., 2021). Adding to the technical challenges of implementing data sharing, there are also social challenges. A significant obstacle to establishing data sharing in companies is the concern about exposing sensitive data (Gelhaar & Otto, 2020) and thus losing control over this data or that the data will be misused for the wrong purposes (Bastiaansen et al., 2019; van den Broek & van Veenstra, 2015). Lack of trust (Dahlberg & Nokkala, 2019; Gelhaar & Otto, 2020; Knol et al., 2014) and concern about giving competitors a competitive advantage by sharing data (Gelhaar & Otto, 2020; Lindner et al., 2021).

Nevertheless, data sharing offers enormous potential for companies. Sharing data enables business problems to be tackled collaboratively (Thuermer et al., 2019; van den Broek & van Veenstra, 2015). This provides space for developing new products or enhancing existing ones and improving internal processes by enriching them with data (Richter & Slowinski, 2019; Thuermer et al., 2019). This new way of integrating data into companies as a resource opens up opportunities for the development of new business models, new partnerships, and the opening up of new markets (Lindner et al., 2021; Richter & Slowinski, 2019; van den Broek & van Veenstra, 2015). Data takes on a new value that equates it with assets, creating new revenue opportunities (Lindner et al., 2021). On the one hand, sharing data carries the risk of creating a competitive advantage, data sharing can, in turn, create a competitive advantage for one's own company (Lindner et al., 2021; Thuermer et al., 2019). In general, however, it is necessary to create a secure basis for data sharing. Above all, this requires trust (Dahlberg & Nokkala, 2019; van den Broek & van Veenstra, 2015), which can be achieved by establishing standards and compliance with regulations (Sakpal, 2021; Shin, 2020).

2.2. (Data Sharing) Business Models

A typical metaphor for a business model is a blueprint. A blueprint of what individual components make up a business model, what relationships exist between them, and how they interact to generate revenue for a company (Osterwalder et al., 2005). It supports companies in defining the value proposition, i.e., the product or service they want to offer to a customer segment (Osterwalder, 2004; Teece, 2010). In this context, a business model is not a one-time

fixed construct. For companies, the challenge in defining their business model is to respond to market dynamics in order to create innovation constantly and iteratively adjust to changing environments (e.g., digital technology) (Al-Debei & Avison, 2010; Linder & Cantrell, 2000; Teece, 2010). New technologies resulting from digitalization represent a particularly great challenge for existing business models (Barenfanger & Otto, 2015). Along with this change, the previously existing balance of the business world is also affected (Teece, 2010). Various streams of business model literature thematize the distinctively digital components of a business model (Guggenberger et al., 2020).

These new streams also include business models that focus on data. Data has already transformed existing business models and fundamentally changed the business world (Teece, 2010), resulting in a growing body of research on data-driven business models (DDBMs). Data is at the core of the business model, and companies thus create value for themselves and their customers (Hartmann et al., 2014; Kühne & Böhmann, 2018; Schüritz et al., 2017). Hartmann et al. (2014) define the main components of a data-driven business model. These include the data source, key activities, offering, target customers, revenue model, and specific cost advantage (Hartmann et al., 2014). The sharing of data often includes the sharing of information that can be derived from the data (Fruhwirth et al., 2019). The resulting knowledge risk can provide a crucial competitive advantage to rivals. In a world where data is a resource, companies' business models need to be aligned with the potential risks (Fruhwirth et al., 2019).

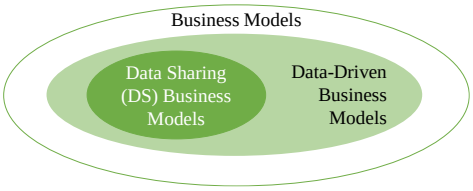

Figure 1. Classification of Business Models

If we now take a closer look at business models relying on sharing data, we can position them as a subset of DDBM. Contrary to existing research on DDBM (e.g., Exner et al. (2017); Möller et al. (2020)), these business models require a distinct focus on the peculiarities of data sharing (see Section 2.1), i.e., issues of trust, incentive mechanisms, or the lack of established solutions for data sharing (e.g., Gelhaar, Gürpinar, et al. (2021); Gelhaar and Otto (2020); Opriel et al. (2021)). Subsequently, we conceptualize 'borders' of DSBM and position them as a part of DDBM (see **Figure 1**). The figure represents a continuation of the illustration of the incorporation of DDBMs into traditional business models developed by Hahn et al. (2020). This can be justified by the fact that data is the core resource of both. The difference is that DSBMs focus on the process of data transfer, while DDBMs only require data as a key resource, which can strictly speaking, be entirely internal. Consequently, DSBMs have specific characteristics that merit deeper analysis. Other characteristics of DDBMs found in the existing literature, such as Hartmann et al. (2014) or Dehnert et al. (2021), also apply to DSBMs. Azkan et al. (2020) or Möller et al. (2020) investigate data-driven business models, such as API-based business models in logistics. Yet, sharing data is not their focus but the general business model. For a discussion and categorization of selected taxonomies, see **Figure 2**.

3. Research Design

Taxonomies are artifacts that organize and structure knowledge about a domain of interest (Glass & Vessey, 1995; Nickerson et al., 2013; Szopinski et al., 2019). Regarding our research question, generating a taxonomy for data sharing business models is goal-oriented. In the field of business model research, taxonomies are a common artifact to summarize knowledge about how to deconstruct and design business models (Möller et al., 2021).

3.1. Data Collection and Data Selection

We position the data sharing business model taxonomy based on the guidance by Möller et al. (2021). Since our approach is empirical, we collect empirical objects, i.e., DSBMs, and construct a *comprehensive* sample. Subsequently, we built a selection of actively operating companies dealing with data sharing from *Crunchbase* and *AngelList*. We chose these two databases because of our prior experience working with them and the ability to search for companies based on keywords. In each database, we searched for "data sharing," yielding an initial sample of 235 companies on *Crunchbase* and 1.781 companies on *AngelList*.

Our approach is mainly *empirical-to-conceptual* because we analyze empirical data from companies based on publicly available data. We divided the sample into three iterations, analyzing 25 (1st iteration), 25 (2nd iteration), and, lastly, 30 (3rd iteration) companies, resulting in a sample of 80 companies. To minimize potential database biases, we distributed them as follows: In the first and second iterations, we used *Crunchbase* and *AngelList* separately. In the 3rd iteration, we then brought the

databases back together to achieve the most robust level of cross-database analysis possible.

The selection of the companies was based on several filtering criteria we defined in advance. These included an available website in German or English language. We also based our choice of companies on the findings regarding the services of DDBMs in data ecosystems from Schweihoff et al. (2022). Accordingly, we determined that the reference to data sharing must be ensured by offering a database, security frameworks for data sharing, an infrastructure for data sharing, or further services around data sharing. The data set is concentrated in the North American region with 54 companies identified, followed by Europe with 16 companies. Smaller focal points are formed in the Asian region, with five companies in Singapore, Indonesia, and Japan and three companies in India. In addition, one each in Australia and Israel was selected. Four companies did not provide any information on their location. The companies focus on the B2B, B2C, and B2G customer segments. The sizes of the analyzed companies range from very small companies with an employee count of 1-10 employees over SMEs with up to 249 employees to big companies with a range of employees from over 200 to over 5000. On average, the company size was 11-50 employees. It is also clear that data sharing is a cross-industry issue and is already being addressed in various industries. These include Health Care & BioTech, Logistics, Finance, Automotive & Mobility, Travel & Hospitality, Insurance, Manufacturing, IT, Civic leaders, Energy, Agriculture, Marketing, Food, E-Commerce, Education, and General.

3.2. Taxonomy Development

The approach chosen here is based on the taxonomy development approach proposed by Kundisch et al. (2021). This approach updates the taxonomy development method of Nickerson et al. (2013), the *de facto* standard in business model taxonomy design (Möller et al., 2021). The first step (1) is to *identify and motivate the problem* (Kundisch et al., 2021). Data sharing offers a lot of potential, but companies remain critical of data sharing. Highlighting the typical characteristics of existing data sharing companies aims to show other companies how data sharing can be integrated into their business model. The second step (2) defines the *objectives of the solution* (Kundisch et al., 2021). Following the research question, the meta-characteristic is: "*Provide design options for data sharing business models*." In this step, one also sets the ending conditions and evaluation objectives necessary to complete the taxonomy. The third step (3) deals with the *design and development* of the taxonomy (Kundisch et al., 2021). As was already the case with (Nickerson et al., 2013), this step determines whether an empirical-to-conceptual or conceptual-to-empirical approach is selected. In the context of this research, an empirical-to-conceptual approach was selected. The previously identified companies were finally examined and analyzed for typical characteristics. The findings were collected and presented in a morphological box (see **Table 3**). The fourth step (4) focuses on the *demonstration* of the taxonomy (Kundisch et al., 2021). For this purpose, the objective end conditions defined in step 2 were checked. As long as these end conditions are not fulfilled, steps 7e-9e, according to (Kundisch et al., 2021), continue to be performed iteratively until all conditions can be considered fulfilled. The fifth step (5) is *taxonomy evaluation* (Kundisch et al., 2021). First, the subjective end conditions are checked. Next, we complement the fulfillment of ending conditions by using the framework of Szopinski et al. (2019) to evaluate our taxonomy in-depth. Last, in the sixth step (6), the taxonomy is communicated to a broader audience, which is done here in the paper.

4. Taxonomy of DSBMs

This section presents the final taxonomy of DSBMs consisting of four meta-dimensions, eleven dimensions, and their associated characteristics (see **Table 3**). The focus of the development of this taxonomy was primarily on differentiating data sharing business models from data-driven business Models.

4.1. Meta-Dimensions and Dimensions

The taxonomy draws from the concept of meta-dimensions, i.e., a theoretical lens to organize the inductively generated dimensions and characteristics (Möller et al., 2021). For this purpose, we initially looked for the typical characteristics of a DDBM, drawing ontological elements from the VISOR framework (El Sawy & Pereira, 2013): *Value Proposition*, *Interface*, *Service Platform*, *Organizing Model*, and *Revenue/Cost*. The VISOR framework was selected because it was the best conceptual fit at our project's beginning, which we adapted (see **Table 1**). During the design iterations, we found that these initial meta-dimensions were not specific enough to differentiate DDBMs and DSBMs. Subsequently, we complemented some of the VISOR-Framework's meta-dimensions (value proposition, service platform) and completed them with two inductively generated meta-dimensions: *Security* and *Incentives*. Given the

nature of data sharing, i.e., granting access to one's data (see Section 2.2), it became apparent that security is a significant component of a DSBM. Since data sharing is also subject to various hurdles hindering the willingness to share data, we analyzed incentive mechanisms more in-depth (e.g., Gelhaar, Gürpinar, et al., 2021).

Table 1. Four meta-dimensions to structure the taxonomy

Meta-Dimension	Origin	Key Questions
Service Platform	VISOR-Framework	What technical framework is needed for data sharing?
Security	Inductive	How is secure data sharing ensured?
Value Proposition	VISOR-Framework	What value is created for customers and companies?
Incentives	Inductive	How is data sharing motivated?

These meta-dimensions provide the framework for the individual ***dimensions*** and act as a theoretical lens to structure the empirically developed characteristics. The individual ***characteristics*** are non-exclusive characteristics represented in morphological form. We decided to deviate from strict exclusiveness of dimensions (e.g., as recommended in Nickerson et al. 2013) since our taxonomy requires more degrees of freedom to represent design options sensibly (Möller et al. 2022). We use morphological visualization since it is typical for business model taxonomies if their purpose is to design new business models (Möller et al., 2021; Szopinski et al., 2020). **Table 2** below describes each dimension briefly.

Table 2. Overview of the dimensions

Dimension	Description
Sharing Purpose	What is the purpose of data sharing?
Technology	What technology is used for data sharing?
Data Sharing (DS) Channel	Through which channel will the data be shared?
Data Types	What kind of data is involved?
Usage Restrictions	What restrictions are placed on its use?
Security Architecture	How is security structured to ensure secure data sharing?
Service Offer	What does the company offer to create value?
Added Value	What additional value does the company create through its offering?
Social	What social incentives can be used to motivate data sharing?
Technical	What technical incentives can be used to motivate data sharing?
Financial	What financial incentives can be used to motivate data sharing?

Table 3 shows the taxonomy as well as three illustrative examples: *Privacera*, *Dataminr*, and *Datadog*[3]. *Privacera* (blue) offers governance management solutions for companies at the B2B level. *Dataminr* (red) provides a data platform to help identify potential crises at an early stage. *Datadog* (orange) offers a monitoring solution for intra-organizational data management. The characteristics of the exemplary companies are visually highlighted in the taxonomy (**Table 3**).

4.2. Meta-Dimension: Service Platform

The first meta-dimension, ***Service Platform***, deals with the technical framework required for data sharing and consists of four dimensions. The first step is defining the **sharing purpose** in five ways. Data sharing can be used for *collaboration* between companies, *(Inter-/Intra-/Individual) organizational data management*, or to establish *governance*.

The next step is to outline which **technology** forms the basis for the data sharing process. Various technologies such as *blockchain*, *machine learning*, *knowledge graphs*, *clouds*, or *artificial intelligence* come into question for this purpose. In addition to the required technology, **a data sharing channel** for the data is also needed. Data sharing can be done using *APIs*, *Apps*, *Platforms*, or *Plugins*. Rounding out the meta dimension is the core resource of a DSBM: the **data types** used. The data that can be included in the data sharing process can be *individual*, *business*, *sensor*, *government*, *open*, or *real-time data*.

Privacera, for example, offers a governance management solution as software-as-a-service for its customers. They develop cloud governance solutions and provide their customers with the corresponding solutions via a platform. *Dataminr*'s overriding sharing purpose, on the other hand, is collaboration, both within the company and with other companies. Real-time data with critical information is to be transmitted to all addressees to react quickly to critical situations. AI ensures that the necessary data is identified and compiled. *Datadog* focuses on

[3] Company websites: privacera.com; dataminr.com; datadoghq.com (last accessed: August 23, 2022)

infrastructure monitoring through, for example, data visualization. This facilitates intra-organizational data management via a cloud.

4.3. Meta-Dimension: Security

The second meta-dimension, ***security***, deals with the basic **usage regulations** required for secure and trustworthy data sharing. These define the conditions and requirements imposed on users to use and share data. These include *compliance posture monitoring*, *legal frameworks*, *immutability*, and *certifications*. The **security architecture** represents the basic framework in the form of technical aspects. Fundamental to this is, on the one hand, *build-in security*, *build-in privacy*, and *build-in control*. In addition, *cryptography*, *Tokenization*, and *Anti-fraud Detection*. There is a *neutral security provider* to monitor compliance with the rules.

Privacera focuses on monitoring compliance with usage restrictions. For example, they offer data access control, alerts and monitoring, but also data masking and encryption. The customizability of SaaS solutions also enables integrated data protection. *Dataminr* offers a privacy policy, which is supposed to protect the data of its users. To ensure the necessary security of the data, *Datadog* offers various tools like real-time detection, intended to detect attacks on the system at any time, and access control.

4.4. Meta-Dimension: Value Proposition

The ***value proposition*** defines the company's value through its daily activities. This meta-dimension also represents a classic and central meta-dimension of non-data-sharing business models. For this reason, it is also indispensable for the development of a DSBM. In concrete terms, two dimensions make up the value proposition. On the one hand, this is reflected in the company's **service offer**. The service offer describes the direct offer that the company provides to its customers. This includes various *management solutions*, the development, and provision of a *data catalog*, *data-centric applications*, *various customized security solutions*, or *software development*. In addition, the *analysis and prediction* of data can be part of the service offer. Additionally, there is the possibility of having *supporting services* for each service offering. In addition to the classic service offer of DSBMs, they often offer **added value** to their customers. This can be done, for example, by adhering to various principles, such as the *F.A.I.R. principle* (Findable, Accessible, Interoperable, Reusable) or the *ACID properties* (Atomicity, consistency, isolation, durability). Furthermore, an additional value can

Table 3. Taxonomy of Data Sharing Business Models
Privacera (blue/circle); Dataminr (red/star); Datadog (orange/square)

MD	Dimension	Characteristics				
Service Platform	Sharing Purpose	Collaboration ★	Inter-organizational Data Management	Intra-organizational Data Management ■	Individual Data Management	Governance Management ●
	Technology	Blockchain	Machine Learning	Knowledge Graphs	● ■ Cloud	★ AI
	DS Channel	API ■	Apps	● Platform ★	Plugins	
	Data Types	Individual Data ● ■	Business Data	★ Sensor Data		
		Government Data	Open Data	★ Real-time Data ■		
Security	Usage Restrictions	Compliance Posture Monitoring ■ ●	★ Legal Framework	Immutability	★ Certification	
	Security Architecture	Cryptography ●	Tokenization	■ Anti-fraud Detection	Neutral Security Provider	
		Build-In Security	● Build-In Privacy	Build-In Control		
Value Proposition	Service Offer	Management Solutions ★ ■	Data Catalog	■ Data-centric Applications	Support	
		Security Solutions ●	★ Analysis & Prediction	Software Development		
	Added Value	F.A.I.R.	ACID	■ Visibility ● ★	Targeted Sharing	● Control over ■ own Data
Incentives	Social	Customer focus & experience ● ■	★ Collaboration opportunities	Sustainability		
	Technical	Scalability ★	Different data sources & formats	Find Systemic Inefficiencies	● Know-How	
		Data Integrity	Quality	● ■ Standardization		
	Financial	Monetarization of data	Build new revenue streams	Cost saving ★ ● ■	Process Optimization	Adaptability to markets

represent *visibility*, *targeted sharing*, or *control over one's own data*. *Privacera* focuses on offering security solutions, which implies visibility and control over one's data as an added value for the user. *Dataminr* offers customers a data catalog that can retrieve relevant data in real time. This data makes it possible, for example, to make forecasts and thus warn of storms or floods. Data can also be transmitted quickly within teams. *Datadog* offers various management solutions, such as infrastructure monitoring, network performing monitoring, or container monitoring. They also focus on various security solutions, allowing control over their data.

4.5. Meta-Dimension: Incentives

For data sharing to be applied in companies, it is necessary to formulate incentives that can be used to motivate data sharing because of its currently still very controversial nature. These ***incentives*** can be differentiated according to their social, technical, and financial origin. **Social** aspects include a *customer focus and the customer experience*, *collaboration opportunities*, and the resulting expansion of the company's own network and the associated positive synergies. *Sustainability* is also a key aspect. On the **technical** side, there are several incentives. To be able to implement data sharing, many companies still lack the necessary knowledge to establish solutions. Data sharing thus offers more accessible access to *additional knowledge*, not only related to the actual data sharing process. A positive effect can be the access to knowledge that the company has not yet been able to obtain through its activities. Other aspects include *scalability*, *data integrity*, *standardization*, and the *use of different data sources and formats*, which makes collaboration much more straightforward. The focus is always on the desired *data quality*. *Systemic inefficiencies* can also be discovered and eliminated. On a **financial** level, various incentives are offered. Data sharing offers companies *new opportunities to generate revenue*. This is possible, for example, through the *monetization of data*. Likewise, required data sets or software products do not have to be developed at great expense since a data-sharing partner may already have the necessary know-how. Consequently, *cost saving*, and *process optimization* are possible incentives. As mentioned in the social incentives, data sharing opens new collaboration opportunities. These are no longer tied to a specific industry, resulting in *new markets* or *market adaptability*.

The *Privacera* example focuses on customer centricity and social incentive experience. By providing technical know-how, governance solutions can be enabled, but also costs can be saved by offering everything in one solution. A significant element of *Dataminr* is the scalability of its offering, which allows it to be adapted to any size of the company. In addition, the platform provides collaboration opportunities that can be used within teams, but also across teams. *Datadog* provides an overview of all critical data in the company, enabling cost savings and process optimization because all data can be found in one place or a standardized tool, which can be used for all applications.

5. Analysis: DDBM vs. DSBM

To precisely define where DSBMs conceptually differ from DDBMs, we have analyzed six exemplary taxonomies of DDBMs and Data Sharing and compared them with the taxonomy developed in this paper. These taxonomies could not be included in the development of the taxonomy, as they only touch on data sharing aspects. For this reason, they are only reflected at this point in order to show how DSBMS differs from previous work. Two taxonomies have been selected that deal with DDBMs in general (cf. Hartmann et al. (2014) and Dehnert et al. (2021)), as well as two industry-specific taxonomies (cf. Azkan et al. (2020) and Möller et al. (2020)). The last two taxonomies address data sharing in data ecosystems (cf. Gelhaar, Groß, and Otto (2021) and Gelhaar, Gürpinar, et al. (2021)). **Figure 2** shows the evaluation of the matching of the different taxonomies. For the comparison, we selected the categories "*Data Sharing*", "*Data-Driven Services*", "*Data-Driven Business Models*", and "*Data Sharing Business Models*". These categories represent the evolution of Data-Driven Services and Data Sharing to their respective business models. We justify the arrangement because data sharing is a subset of data-driven services. For example, the taxonomy of Azkan et al. (2020) takes on a distinct service view by using data in business models. The counterpart in data sharing fundamentals is represented by the taxonomy of Gelhaar, Gürpinar, et al. (2021) and Gelhaar, Groß, and Otto (2021). Both taxonomies deal with fundamental topics but do not yet raise them to the level of business models. On the other hand, the taxonomies of Hartmann et al. (2014) and Dehnert et al. (2021) deal with the basic characteristics of DDBMs without addressing the aspect of data sharing. The taxonomy of Möller et al. (2020) investigates the use of APIs in DDBMs, resulting in a first adjacency to data sharing. The taxonomy developed here combines the insight gained from previous taxonomies and specifies them to the specific case of DSBMs. The significant difference between DDBMs and DSBMs is

that DSBMs rely more on the core activity of data sharing, while for DDBMs, it is only relevant that data is used as a core resource. This shows that DSBMs is a more specific manifestation of DDBMs. Their core activities are based on data but focus more specifically on exploiting this data and its dissemination. In general, the goal is to exchange data for monetary values, but companies are often not yet aware of the actual value of their data. The analysis of the companies clearly showed that only a fraction of the companies has a concrete revenue model, mainly relying on subscriptions.

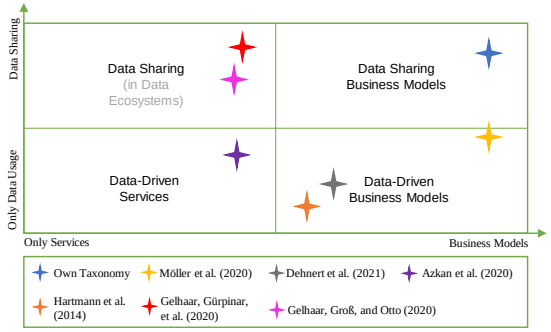

Figure 2. Comparison of taxonomies

DSBMs focus primarily on providing data-sharing services. It is also apparent that specific factors such as the security aspect are not addressed in traditional DDBMs. Due to their novelty and the challenges companies face regarding data sharing, the security aspect must be a clear core component. In addition, the incentives that companies can use to acquire customers and keep themselves aware of what can motivate them to share data are relevant. The latter is aimed at companies that use this taxonomy to align their existing business model with data sharing.

6. Contributions, Limitations, Outlook

Data sharing business models represent a new subfield of business model research. In this context, our work contributes to the existing research as it provides an overview of possible design criteria for DSBMs. From a **scientific point of view**, DSBMs are relatively unexplored so far. With the empirical analysis of 80 DSBMs, we elevate this 'raw' knowledge to a more abstract level and codify it in a taxonomy. Moreso, we complement existing research on DDBMs (e.g., Hartmann et al. (2014); Möller et al. (2020)) through the facet of data sharing. Subsequently, we extend the previously dominant essence of using *data as a key resource* and shift it to *sharing data as a key activity* to generate business models. Given that the taxonomy we propose is not specific to an industry, we provide a general taxonomy that is a potential for subsequent research to undertake deep dives into DSBMs in particular fields (e.g., manufacturing or healthcare).

From the **practitioner side**, this research offers tremendous potential for use in developing and realigning existing business models on data, and specifically on data sharing. DSBMs also contribute to the data sharing economy by going beyond the B2B perspective. Due to the practical nature of the taxonomy, which is based on data from existing companies operating in the market, the design options presented here represent the most critical aspects of the taxonomy. It can help practitioners find inspiration in designing new business models based on data sharing. Due to the often reluctant attitude of companies when it comes to sharing data, the taxonomy is a checklist giving them a tool to consider essential aspects when designing business models around data sharing. To this end, we hope that our work contributes to enhancing confidence in DSBMs.

Our research has **limitations**. The taxonomy builds on two databases to extract empirical examples. Subsequently, using additional databases might yield more specimens that could extend the sample in future work. Also, we tried to search very broadly utilizing the keyword 'data sharing.' Naturally, it is possible that other keywords could produce more results. However, given that we could extract a sample of 80 objects, we see this as an extension, not a ramification of our work. The same goes for the point in time the study was performed. New companies join the market every day while others falter. Our study can only attest to the particular snapshot in time that we investigated. Also, the literature hosts a variety of business model frameworks that could have served as meta-dimensions. In our case, the VISOR Framework was an excellent basis to build upon, yet, using other frameworks is a possibility.

This work represents a fundamental contribution to the development and analysis of DSBMs. This results in some **implications for future work**. As explained earlier, the database should be expanded to verify the findings further, lending them more robustness. To draw more precise insights from the analysis, the next step should be to examine the companies for specific patterns. One way to achieve this is using cluster analysis to extract specific archetypical configurations. Also, our work, as of now, does not focus on a particular industry. A potential avenue for more research is to go into detail about specific industries (e.g., manufacturing) and extract what data sharing business models are specific for them. One could expect that healthcare has other requirements (e.g., trust, data anonymization) than manufacturing, which could be investigated.

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