

Data-Driven Organizations: Review, Conceptual Framework, and Empirical Illustration

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Abstract

With companies and other organizations increasingly striving to become (more) data-driven, there has been growing research interest in the notion of a data-driven organization (DDO). In existing literature, however, different understandings of such an organization emerged. The study at hand sets forth to synthesize the fragmented body of research through a review of existing DDO definitions and implicit understandings of this concept in the information systems and related literatures. Based on the review results and drawing on the established concept of the “knowing organization,” our study identifies five core dimensions of a DDO—namely, data sourcing & sensemaking, data capabilities, data-driven culture, data-driven decision-making, and data-driven value creation—which we integrate into a conceptual DDO framework. Most notably, the proposed framework suggests that—like its predecessor, the knowing organization—a DDO may draw on an outside-in view; however, it may also draw on an inside-out view, or even combine the two views, thereby setting itself apart from the knowing organization. To illustrate our conceptual DDO framework and demonstrate its usefulness, we apply this framework to three empirical examples. Theoretical and practical contributions as well as directions for future research are discussed.

Keywords: Data-driven organization (DDO), DDO understandings, DDO dimensions, Knowing organization, Literature review, Conceptual DDO framework, Empirical examples.

1 Introduction

To prepare themselves for the digital future, organizations around the world are increasingly engaging in large-scale digital transformation initiatives (cf. Fischer et al., 2023). Many of these initiatives revolve around data (Gartner, 2021), which have been widely acknowledged as a key driver of economic growth (McKinsey, 2013; WEF, 2021). For example, McAfee & Brynjolfsson (2012) report a 5% increase in productivity and 6% growth in profitability for public North American companies driven by data; and Rubin & Rubin (2013) observe higher stock returns for such companies. Relatedly, according to Thusoo & Sarma (2017), 84% of executives believe that most to all of their employees should use data to help them perform their job duties as organizations that act based on data show significant advantages over

competitors (Berndtsson et al., 2018; Constantiou & Kallinikos, 2015). Among other things, this is because organizations that are driven by data have been found to operate with improved processes and innovative data-enabled products and business models (Sivarajah et al., 2017), and to make better decisions in general (McAfee & Brynjolfsson, 2012; Svensson et al., 2019). It is in this context that organizations are striving to become a *data-driven organization* (DDO; Davenport & Bean, 2018; Hartmann et al., 2016) to benefit from the value potential embedded in data.

With the growing interest in the concept of a DDO, however, multiple understandings of this concept¹ have emerged in the academic and practitioner literature. More specifically, existing DDO understandings appear to vary considerably, ranging from rather simplistic to more complex. For example, while Schüritz (2017) refers to a DDO as an organization that simply “uses data and analysis to help drive action” (p. 394), other authors such as Thusoo & Sarma (2017) include multiple characteristics such as data-driven culture, data-based decision-making and technological capabilities in their more complex DDO understanding.

These diverse understandings in both the academic and practitioner literature make it challenging for scholars to further advance the body of knowledge on this emerging phenomenon. Combined with the steadily increasing number of publications in the information systems (IS) and related literatures, these conceptual challenges led us to the conclusion that a systematic review of existing understandings is needed and that an integrative conceptual DDO framework will help consolidate the state of the art and reveal the core nature of the DDO phenomenon.

Against this backdrop, our study aims to (1) synthesize different understandings of DDOs in the literature, and (2) derive a conceptual DDO framework that integrates the identified understandings. To achieve our research objectives, we employ a two-step process. First, we follow established guidelines to conduct a systematic literature review of DDO understandings. Second, based on the insights gained, we draw on the concept of the ‘knowing organization’ (Choo, 1996) to develop a conceptual DDO framework. To this end, our study is structured as follows: In the next section, we review key concepts related to the notion of a DDO and introduce our guiding framework. We then detail our methodological approach, followed by the presentation of our review findings and the resulting conceptual DDO framework. Subsequently, to illustrate our framework and demonstrate its applicability and usefulness, we apply it to three empirical examples (two DDOs and one organization that is arguably not data-driven). Finally, we conclude by discussing the main contributions of our study, along with its limitations and related directions for future research.

2 Conceptual Foundations

The notion of a DDO combines the concepts of an ‘organization’ and ‘data’. After reviewing these two concepts and their interrelationships, we will introduce Choo’s (1996) concept of the *knowing organization*, which we will use as the theoretical basis for developing our conceptual framework of a DDO.

¹ In this paper, we use the term “DDO understanding” as an umbrella term for both *explicit* DDO definitions and (more or less) *implicit* descriptions of this concept.

2.1 The Concept of an Organization

Broadly speaking, “organizations are systems of coordinated action among individuals and groups whose preferences, information, interests or knowledge differ” (March & Simon, 1993, p. 2). In this regard, it has been argued that an organization fulfills two main functions: division of labor and (re-) integration of efforts (Puranam et al., 2014), which require both coordination and cooperation, which in turn need (data and) information next to motivation and trust (Gulati et al., 2005; Lawrence & Lorsch, 1967). In general, the organization concept can be considered from two complementary perspectives: a system-oriented and a process-oriented perspective (Hall, 1977).

From a system-oriented perspective, and in line with modern organizational theory, an organization can be seen as an open system that continuously affects and is affected by its environment (e.g., Boulding, 1956; Katz & Kahn, 1978). As such, organizations can be described as “sensemaking systems’ which perpetually create and re-create conceptions of themselves and of all around them” (Johnson & Kruse, 2019, p. 10) and “collect, manage, and use the information they receive” (West & Turner, 2014, p. 301).

From a process-oriented perspective, theorists such as Weick (1969) consider the noun ‘organization’ itself, with its implications of a static and figured-out concept, to be a “myth” (p. 88). Rather, he argues, people engage in the process of organizing, defined as “the resolving of equivocality in an enacted environment by means of interlocked behaviors embedded in conditionally related process” (Weick, 1969, p. 11). Essential to this process are the acts of information processing and decision-making, two concepts that Simon (1976) and Choo (1996) place at the center of their definitions of an organization. Simon’s (1976) notion of an organization is “the pattern of communications and relations among a group of human beings, including the processes for making and implementing decisions. This pattern provides to organization members much of the information and many of the assumptions, goals, and attitudes that enter into their decisions” (p. 18). Choo presents the concept of an organization as a combination of both a process-oriented and a system-oriented view. On the one hand, he builds on Simon’s (1976) process-oriented, decision-centric view of organizations; on the other hand, he draws on the system-oriented modern organizational theory, viewing organizations as systems that interact with their environment. Integrating these two perspectives, he describes his understanding of an organization as a “decision-making system” (Choo, 1996, p. 331).

In today’s era of digitalization, the design of organizations and division of work is considerably influenced by emerging technologies such as data analytics that transform organizational decision-making, coordination and control (Faraj & Leonardi, 2022; Kellogg et al., 2020; Schwer & Hitz, 2018; Yoo et al., 2012). In this regard, the impact of these information technologies (IT) goes far beyond aligning IT to business functions (cf. Brown & Magill, 1994), as they fundamentally reshape business strategies (cf. Bharadwaj et al., 2013; Morakanyane et al., 2017) and the underlying organizations (Yoo et al., 2012), thereby redefining their identity and value proposition (Wessel et al., 2021). As a consequence, for Faraj & Leonardi (2022), IT is an inherent part of today’s understanding of an organization. Building on this contemporary understanding, we develop our conceptual DDO framework.

2.2 The Concepts of Data and Data-Drivenness

The term *data* refers to a “representation of facts, concepts or instructions in a formalized manner, suitable for communication, interpretation, or processing by humans or by automatic means” (Hicks, 1993, p. 668). In the organizational context, Martin & Powell (1992; cited in Hinton, 2006) describe data as “the raw material of organizational life; it consists of disconnected numbers, words, symbols, and syllables relating to the events and processes of the business” (p. 10). By providing context and meaning to data through human or automated interpretation and processing, they are transformed into information (Hicks, 1993; Tuomi, 1999), that in turn can be used in management decision-making (Powell & Martin, 1992; as cited in Hinton, 2006).

Building on this understanding of data, the concept of *data-drivenness* can be explored. Etymologically, the term *drivenness* refers to being propelled, guided, or controlled by something and is rarely used in isolation. Consequently, “data-drivenness” can be defined as the property of being propelled, guided, or controlled by data. Originally, the concept of data-drivenness was mainly applied to individual business functions that are particularly reliant on data, such as marketing (cf. data-driven marketing; see e.g., Malhotra et al., 1999). However, as digitalization has progressed, entire value chains and business models have become centered around data, giving rise to the notion of data-driven business models (DDBM) (cf. e.g., Wiener et al., 2020)². Nowadays, this development has progressed to the point where entire organizations are *propelled, guided, or controlled by data*, giving rise to the notion of DDOs (Thusoo & Sarma, 2017). Arguably, this notion can be seen as a contemporary version of what Choo (1996) refers to as the “knowing organization” (KO). As such, we build on Choo’s conceptualization of the KO and use it as a guiding framework.

2.3 Guiding Framework: The Knowing Organization

In his seminal article on the KO, which has been cited extensively in the IS and related literature, Choo (1996) describes and refines the core functions of a learning organization and their interplay. Building on Choo’s understanding of an organization as a “decision making system” (Choo, 1996, p. 331), knowing organizations can be described as organizations with “the ability to use information to gain a better understanding of their activities and their environment [and] achieve a competitive advantage by making better decisions and having clearly defined courses of action” (Parra, 2022, p. 8), where “the creation and use of information [obtained from the external environment] play a strategic role in determining an organization’s capacity to grow and adapt” (Choo, 1996, p. 329). According to Choo (1996), a KO is an organization that effectively integrates the organizational knowing cycle, consisting of three interrelated organizational functions—namely, sensemaking, knowledge creating, and decision-making—that build on each other to form an outside-in view of how organizations absorb and utilize information (Choo, 1996) by taking in signals and knowledge from the environment and processing these external inputs into internal knowledge, decisions, and behavioral changes (Choo, 1996) (see Figure 1). The *sensemaking* function is responsible for making sense of changes and developments in the organization’s

² It should be noted that a business model can be centered around data without requiring the underlying organization to be data-driven, and vice versa. Please refer to section 6 for a more detailed discussion on the conceptual distinction between a DDO and an organization with a DDBM.

external environment, by subjectively filtering out relevant information and forming possible explanations from past experiences (Choo, 1996). An important part of this step is the organization's purpose, which helps contextualize information during the interpretation. The second function of the KO, *knowledge creating*, focuses on the human-centric exchange of learning, e.g., through training and the conversion of tacit into explicit knowledge (and vice versa). Through this exchange of knowledge among between organizational members, supplemented by external knowledge, an organization generates new capabilities and innovates. Finally, the *decision-making* function draws on the generated knowledge, as well as shared purpose and meaning, to make rational, purposeful decisions. To do so, organizational decision makers design decision alternatives, adopt a set of evaluation criteria, and evaluate the alternatives to eventually arrive at decisions that lead to purposeful, adaptive internal behavior.

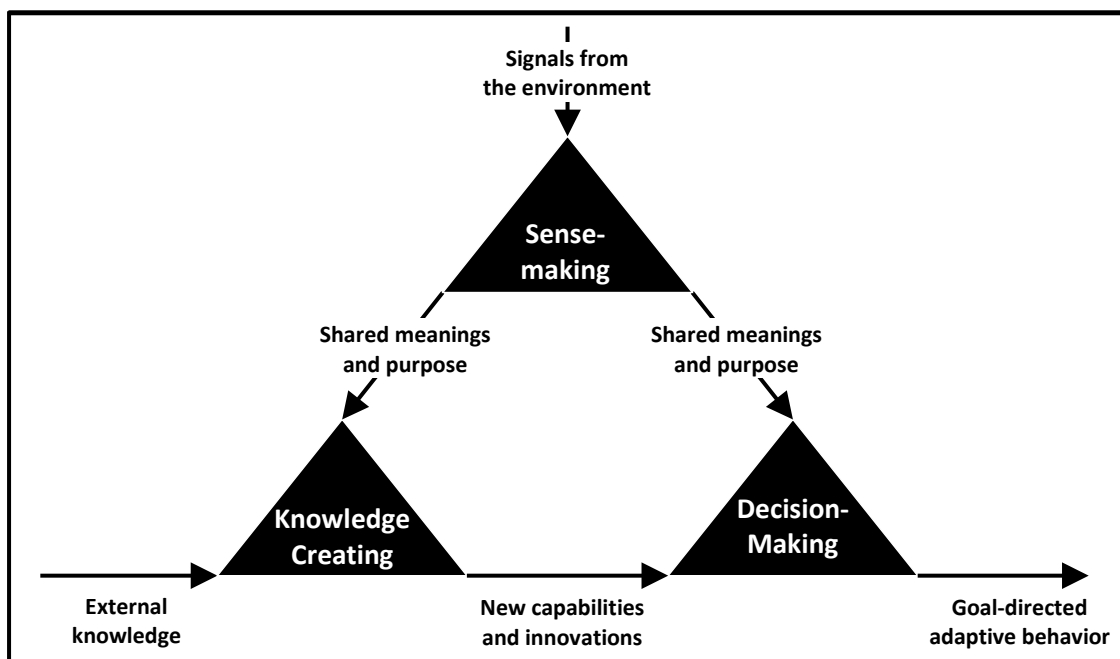


Figure 1. Conceptual Framework of the KO (based on Choo, 1996, 2001)

As noted above, we acknowledge that Choo's (1996) KO framework and its functions are still relevant to today's organizations and thus provide a solid foundation for conceptualizing the notion of a DDO. At the same time, however, we also argue that Choo's framework needs to be updated and extended to account for the significant changes brought about in by the digital age. While Choo's (1996) KO framework was developed during an era focusing on creating organizational knowledge (Parra, 2022), today – three decades later – organizational decision-making is characterized by data and extensive reliance on digital technologies (Faraj & Leonardi, 2022; Parra, 2022), which should be reflected in the conceptual framework. Furthermore, the original framework has an exclusive emphasis on internal value creation through decision making, thereby disregarding the relevance of external value creation. This suggests that the outside-in focus inherent in Choo's (1996) framework is too narrow, as today's organizations also actively influence their environment in line with the open systems perspective of modern organizational theory.

3 Research Methodology

To effectively organize prior literature on DDOs, we followed established guidelines (Webster & Watson, 2002) and conducted a systematic literature review. Our review approach showed several similarities to what Paré describes as a theoretical review (Paré et al., 2015). This particular type of review is often used to “tackle an emerging issue [such as the DDO phenomenon] that would benefit from the development of new theoretical foundations” and its primary goal is to “develop a conceptual framework” (Paré et al., 2015, p. 188). Furthermore, a theoretical review is usually broad in scope and draws on both conceptual and empirical sources (without quality assessment), which are mainly analyzed through content analysis or interpretive methods (Paré et al., 2015).

To conduct such a review, we adopted a hermeneutic approach (cf. Boell & Cecez-Kecmanovic, 2014; Wittgenstein & Anscombe, 1989), in which we continuously transitioned between search and acquisition of literature on the one hand and analysis and interpretation of our findings on the other hand. Through this iterative and integrated approach, we were able to “re-interpret individual publications and their importance within a bigger ‘whole’” (Boell & Cecez-Kecmanovic, 2014, p. 265) already during the search process, as we broadened our understanding of the literature.

3.1 Literature Search

For our literature search and acquisition, we defined clear inclusion criteria that guided our selection of relevant studies. Specifically, only studies concerned with a conceptual perspective on DDOs (or synonymous terms such as “data-driven company” or “data-driven enterprise”) were included in our review sample. In addition, we decided, at least initially, to include only peer-reviewed, academic publications in our sample. To ensure a broad coverage of potentially relevant literature sources, we followed the four-step search process recommended by Webster and Watson (2002). Specifically, we used the website *Litbasket.io* (Boell & Wang, 2019) to conduct a keyword-based search covering the 51 most prestigious IS journals (for a list see Appendix A). Moreover, we also searched the proceedings of leading IS conferences (ICIS, ECIS, AMCIS, PACIS, HICSS, and ACIS). For both searches, we used the same keywords. Here, we anticipated that existing literature would use a broad range of different terms to refer to a DDO. Therefore, we iteratively tested and refined our search string (e.g., by adding synonyms identified in the literature) until we derived our final search string that included nine possible combinations of the terms “data-driven”, “analytics-driven”, “data-”, and the terms “organization”, “company”, and “enterprise”: as well as the term “data-drivenness” itself without any further limitations. This first step led to 42 distinct publications, of which only four elaborated on their DDO understandings. We then performed a backward search (step 2), followed by a forward search (step 3) (Webster & Watson, 2002) using *Google Scholar* to further supplement our base set of DDO-related publications. This snowball approach resulted in to 103 and 9 additional studies, respectively, yielding 10 additional descriptions of DDO understandings.

In a fourth and final step, we conducted a supplementary database search to complement our review sample and to confirm that no new DDO understandings emerge (Webster & Watson, 2002). To do this, we searched the *AIS eLibrary* (aisel.aisnet.org) using the search string described above. Furthermore, when analyzing our review sample, it became apparent that practitioner work—such as Patil (2011) and Anderson (2015)—is frequently cited in the academic literature as well (e.g., in Fabijan et al., 2017; Hupperz et al., 2021). Therefore, we

decided to extend our search to the practitioner literature, using the Google search engine (again with the above-described search string). In doing so, we identified an additional 52 publications, covering various adjacent fields and containing nine additional DDO understandings. Taken together, our four-step search process yielded a total of 206 publications, of which 23 contained an explicit description of a DDO understanding and were therefore all used as the basis for our analysis. Table 1 provides an overview of the search process. Additionally, a detailed description of the review sample can be found in Appendix B.

Category	Search process				Total
	Keyword-based search in leading outlets	Backward search	Forward search	Supplementary database search	
Total	42	103	9	52	206
Thereof studies describing DDO understandings	4	6	4	9	23

Table 1. Search process and resulting number of publications

3.2 Literature Analysis

Already in parallel and closely intertwined with the search process (cf. Boell & Cecez-Kecmanovic, 2014; Wittgenstein & Anscombe, 1989), we thoroughly examined our review sample and arrived at our conceptual DDO framework dimensions in two main steps.

First, we used a combination of descriptive coding and open coding to analyze our review sample. Initially, we captured and documented descriptive metadata such as the literature type (academic/practitioner), outlet, research focus, and publication date of each publication (see Appendix C) to grasp the context of each individual DDO understanding. The primary focus, however, was on the open coding of all DDO understandings to identify specific DDO characteristics highlighted by them. This was done by two authors in parallel and discussed iteratively within the authoring team to ensure the validity and reliability of the coding results. In case of disagreement, the relevant text passages were jointly revisited and thoroughly discussed until agreement was reached.

Second, we followed what can be described as an abductive process, in which we derived the dimensions of our conceptual DDO framework through a combination of deductive concept coding using Choo's (1996) KO framework as well as inductive coding building on the open codes identified in step one. In doing so, the emerging DDO characteristics were either mapped onto the organizational functions described in Choo's (1996) KO framework (sensemaking, knowledge creating, and decision-making), or were used to derive new DDO-specific dimensions. In total, we identified five DDO dimensions, of which three are updated functions from Choo's (1996) KO and two are additional dimensions inductively derived from our data. As a check for completeness, the five DDO dimensions were mapped again to all 23 reviewed DDO understandings, covering all mentioned characteristics (see Appendix C).

4 Results: Towards a Conceptual Framework of DDOs

4.1 DDO Understandings

Our review results reveal that the DDO understandings found in the existing literature vary considerably in terms of their level of elaboration and richness, ranging from quite simplistic understandings (based on a single DDO characteristic) to more complex understandings (referring to *multiple* characteristics of a DDO).

On the one hand, examples of quite simplistic DDO understandings can be found in Berndtsson et al. (2020) and Schüritz (2017). Both point to decision-making based on data as the single distinguishing characteristic of a DDO, which is captured in descriptions such as: “A data driven company is described as an organization that heavily relies on data to make decisions and take actions” (Schüritz, 2017, p. 394). Others such as Lee (2017) rely on the sole characteristic of “having capabilities to leverage big data” (p. 2) when describing their DDO understanding and an even more high-level understanding is presented by Halper & Stodder (2017), who tie a DDO to any kind of organizational data usage.

On the other hand, more complex DDO understandings refer to at least two unique characteristics of a DDO. For example, three studies in our review sample present the sourcing and processing of data, combined with the goal of using data to gain competitive advantage, as key DDO characteristics. A corresponding understanding is evident in Fabijan et al. (2017) who state that “data-driven companies acquire, process, and leverage data in order to create efficiencies, iterate on and develop new products, and navigate the competitive landscape” (p. 1). Likewise, Gualo et al. (2021) put particular emphasis on the importance of the quality of the obtained data and name better service to the organization’s customer as a DDO characteristic. In a similar vein, Körppen et al. (2021) raise data collection, processing and evaluation as a key characteristic and combine it with the act of making decisions based on data to describe their more internally oriented understanding of a DDO. Going even further, Olszak & Zurada (2019) and Satar (2021) add data capabilities as a further characteristic to several of the characteristics mentioned, consisting, for example, of data infrastructure, data tools and data experts (Satar, 2021). Further, studies with even more elaborate DDO understandings add to the aforementioned characteristics the notion of a data-driven culture (Grover et al., 2018), requiring a “sustained commitment from leadership and employees alike” (Kiron, 2017, p. 1) or “collaboration fostering” (Hagen & Hess, 2020, p. 1). Finally, arguably the most complex DDO understandings are presented in Kearny et al. (2016), Anderson (2015), and Davenport (2001), who make reference to five characteristics, ranging from data management and data governance to data-driven competitive advantages to data-based decision-making and a data-driven culture.

Illustrative sample quotes highlighting the characteristics mentioned in the various DDO understandings are provided in Table 2.

4.2 Underlying DDO Dimensions

Although the DDO understandings of the reviewed studies differ notably, they also share several commonalities. In particular, five central DDO dimensions—namely, *data sourcing & sensemaking*, *data capabilities*, *data-driven culture*, *data-driven decision-making*, and *data-driven value creation*—emerged from our analysis as shown in Table 2. For a comprehensive mapping of the five DDO dimensions onto the 23 DDO understandings identified in our literature review, see Appendix C.

DDO dimension [# of mentions]: Short description	Sample quotes highlighting matching characteristics
Data sourcing & sensemaking [15]: Acquisition of (external) data and their purposeful interpretation and integration	In a data-driven organization, <u>data is collected, processed and evaluated in a targeted manner</u> and used as the basis for decisions. (Körppen et al., 2021, p. 454; translated from German)
	A data-driven organization <u>acquires, processes, and leverages data in a timely fashion</u> (Patil, 2011, p. 3)
	So, what does it mean to be a data-driven enterprise? It means maximizing the value of your data and <u>treating it as an asset differentiated by its completeness, lineage, and quality</u> . [...] (Hou, 2018, p. 2)
Data capabilities [15]: Abilities of an organization to use its infrastructure, tools, and talent to purposefully manage data	Data-drivenness [in the context of organizations] is about <u>building tools, abilities, and, most crucially, a culture that acts on data</u> . (Anderson, 2015, p. 1)
	[...] as <u>the [data-driven] organization's data and analytics capabilities mature</u> , they can underpin innovative new business models that alter, sometimes radically, power arrangements within the organization. (Kiron, 2017, p. 2)
	[In the context of DDOs, the] <u>dynamic capabilities of organizations that should contribute to creating, extending, protecting and maintaining a unique database are to be considered a key point</u> (Olszak & Zurada, 2019, p. 168)
Data-driven culture [12]: Organization-wide belief and value system that fosters the understanding, management, and exploitation of data	A data-driven organization should possess three things: A culture in which everyone buys into the idea of using data to make business decisions; An organizational structure that supports a data-driven culture; Technology that supports a data-driven culture and makes data self-service. (Thusoo & Sarma, 2017, p. 43)
	Data-driven decision-making and creating a <u>data-driven culture are important aspects of a DDO</u> . (Svensson & Taghavianfar, 2020, p. 4)
	<u>An organization-wide data-driven culture musts to be established [sic]</u> in order to exploit the full potential of advanced analytics. (Berndtsson et al., 2018, p. 2)
Data-driven decision-making [11]: The act of making rational decisions based on data instead of intuition	A data driven company is described as an organization that <u>heavily relies on data to make decisions</u> and take actions. (Schüritz, 2017, p. 394)
	In theory, <u>data-driven organizations can apply data-driven decisions</u> for all types of analytics (descriptive, predictive, prescriptive), and all types of decisions (operational, tactical, strategic). (Berndtsson et al., 2020, p. 1)
	Data-driven organizations possess a culture of <u>leveraging data-driven decision-making rather than depending on the intuitions of their managers in business activities</u> . (Gökalp et al., 2021, p. 2)
Data-driven value creation [15]: An organization's actions with the ambition to create value through data (e.g., increased efficiency or product improvements)	Data-driven companies acquire, process, and leverage data in order to <u>create efficiencies, iterate on and develop new products, and navigate the competitive landscape</u> . (Fabijan et al., 2017, p. 1)
	[...] Data collected from different operational stages can <u>improve an organization's performance and create new business opportunities</u> . (Gökalp et al., 2021, p. 2)
	Data-driven enterprises enjoy <u>advantages over their competitors</u> because of the insights provided by data management and analytics and could, for instance, <u>enhance marketing strategies and planning that involves customer insight</u> . (Kearny et al., 2016, p. 4606)

Table 2. Derived DDO dimensions and sample quotes

4.3 The DDO as an Update and Extension of the Knowing Organization

The five DDO dimensions presented above form the central cornerstones of our proposed conceptual DDO framework. Three of these five dimensions (*data sourcing & sensemaking*, *data capabilities*, and *data-driven decision-making*) build on the focal dimensions of Choo's (1996) framework of the KO, whereas two dimensions (*data-driven culture* and *data-driven value*

creation) constitute novel additions. This implies that the DDO concept can be seen as a update and extension of Choo's (1996) KO concept, to make it fit with the affordances and challenges of today's data-centric digital era. Most notably, with the two added dimensions, the DDO framework emphasizes the importance of a data-driven culture and introduces the dimension of (external) data-driven value creation, which acts as the capstone for an additional inside-out focus, complementing the existing outside-in orientation (see Figure 2). The distinct interaction of the individual dimensions becomes apparent when considering the two orientations in detail.

Outside-in view: Our results show that, like the KO, a DDO strives to make sense of its environment, processes the information obtained, and uses them to drive decision-making, thereby demonstrating an outside-in focus. Naturally, however, these three dimensions operate considerably more data-centric. In line with Choo's (1996) sensemaking function, the central purpose of the *data sourcing & sensemaking* dimension is to obtain data, filter them by their relevance, and harmonize and contextualize them. Next to inherent internal data, the focus of this dimension lies particularly on data from the external environment, which must first be actively sourced. Furthermore, due to today's (overwhelming) amount of big data, the *sourcing & sensemaking* dimension additionally entails a data governance dimension to ensure data quality, regulation, and protection. Closely intertwined with the *sourcing & sensemaking* dimension is the dimension of information processing. While Choo (1996) describes this function as a human-centric knowledge creating process that deals with tacit knowledge, the concept of the DDO draws on *data capabilities* (i.e., tools, infrastructure, and experts) to process the information obtained in order to generate innovation, new capabilities, and actionable insights. The outside-in orientation of the conceptual DDO framework concludes with the dimension of *data-driven decision-making*, which—similarly to Choo's (1996) perspective—involves rational decision-making. Contrary to the KO, however, the DDO not only facilitates those decisions based on harmonized personal interpretations of incoming signals, but takes into account factual data, providing an even more objective decision basis. However, to truly benefit from the potentially increased objectivity and implement the DDO dimensions mentioned, about half of the reviewed DDO understandings highlight the need for a *data-driven culture* as an additional dimension, providing a shared understanding and purpose behind the required efforts.

Inside-out view: According to our analysis, DDOs demonstrate a new, fifth dimension concerned with (external) *data-driven value creation*, which is not reflected in Choo's (1996) framework of the KO. This outwardly directed dimension presents the capstone of an inside-out perspective on DDOs, complementing Choo's (1996) outside-in view by focusing on the internal workings of the DDO leading to external value creation. The internal dimensions *data-driven culture*, *data capabilities*, and *data-driven decision-making* interact with the objective of going beyond internal decision-making and thereby create actual value through data. This fifth, externally oriented dimension named *data-driven value creation* draws on new capabilities and innovations provided by the DDO's *data capabilities* as well as goal-directed adaptive behavior caused by the *data-driven decision-making* to achieve (external) data-driven impact.

Our conceptual DDO framework, building on the five emerged dimensions, and interweaving both an outside-in as well as an inside-out view, is depicted in Figure 2 below.

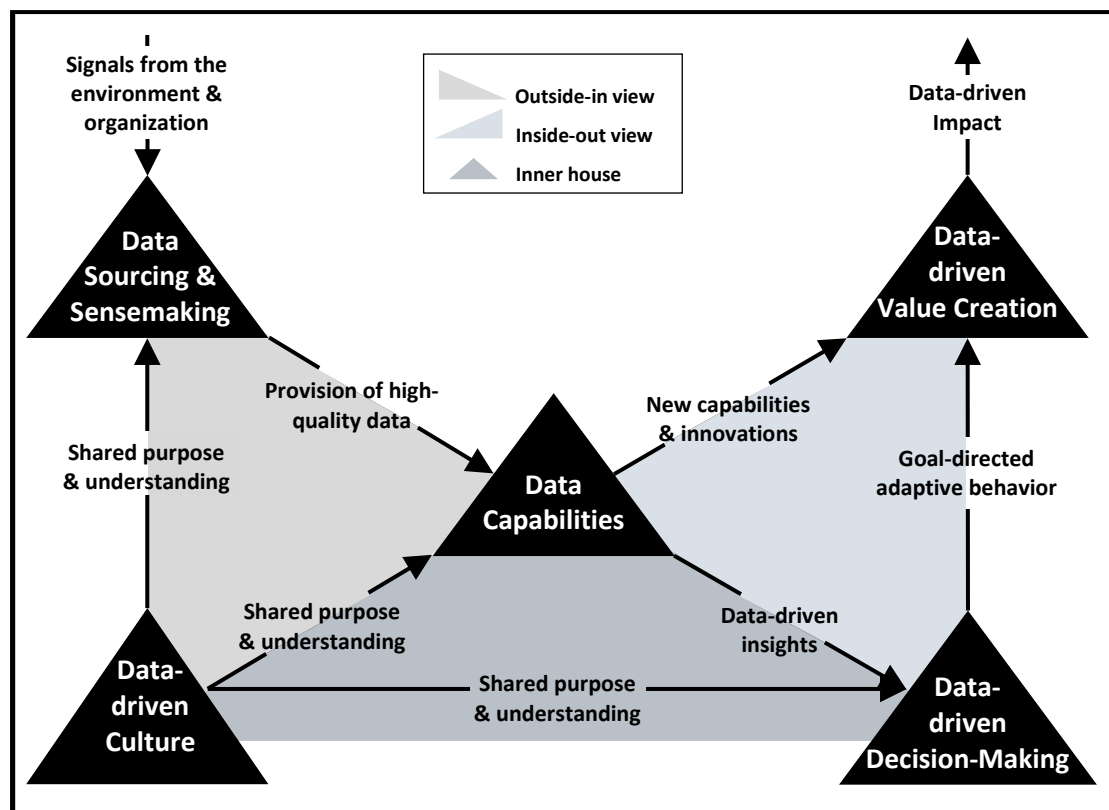


Figure 2. Conceptual DDO Framework

As becomes apparent from Figure 2, three dimensions—namely, data-driven culture, data capabilities, and data-driven decision-making—are included in both the outside-in and the inside-out view of a DDO. This suggests that these three dimensions form the foundation of a DDO, indicating that they could be considered the core dimensions of such an organization. In the following, we will refer to this subset of dimensions as the *inner house* of a DDO.

On this basis, we define a DDO as an organization (1) with a data-driven culture, enabling and inspiring organizational members on all levels to embrace data as the backbone of their actions and decisions; (2) with access to data capabilities including tools, talent, and infrastructure to gain insights from data; and (3) with organizational members consequently making their decisions based on data-driven insights. Further, depending on its specific focus, a DDO may also be characterized by a particular emphasis on (4) systematically acquiring data and purposefully interpreting and integrating these data (outside-in view), and/or on (5) creating data-driven value (inside-out view).

5 Empirical Illustrations of the Conceptual DDO Framework

To illustrate the general applicability of our conceptual DDO framework and demonstrate how its five DDO dimensions characterize and help differentiate DDOs, we draw on three empirical examples. When selecting Pharma, Automotive and Sports as empirical examples, we deliberately chose diverse organizations from different industries with annual revenues of more than one billion euros and a global presence to ensure comparability. To collect the actual case data, we integrated multiple types of sources such as semi-structured interviews with one top-level key informant each, internal documents provided by the key informants, and publicly available information, into a case database and coded the data along the five

DDO dimensions of our conceptual framework. The case study companies as well as our case study methodology are detailed in Appendix D. Below, we present these three cases using our conceptual DDO framework.

Pharma, one of the world's largest pharmaceutical companies, has transformed itself into a DDO mainly to improve efficiency and decision-making, with its Head of Digital Transformation stating, "we want to help patients as fast as possible—therefore we need to speed up our time to market through smarter decisions." The organization demonstrates all three DDO dimensions of the inner house of our conceptual DDO framework to a medium to high degree with an emphasis on data-driven decision-making. For example, in important meetings at Pharma, there is a deliberate search for decisions that should be made in a more data-driven way and the required data is subsequently sourced, processed, and presented in the form of a dashboard. Regarding the data capabilities that enable this way of working, Pharma's entire data infrastructure is designed to have data flow along the value chain and across divisions, with data analysis tools and necessary upskilling training being provided to all employees. As the reliability of and adherence to laboratory test results can be a matter of life and death in this industry, staff are inherently already aware of the value of data and therefore already cultivate a data-driven culture. This sense of ownership and responsibility of both data owners and users is further fostered by making the origin and use of data transparent throughout the whole organization. Centered around this inner house, Pharma also demonstrates the two additional DDO dimensions data sourcing & sensemaking, and data-driven value creation to a medium to high degree. Because Pharma is at its core a clinical research organization, the generation, access, and interpretation of high-quality clinical data (i.e., data sourcing and sensemaking) is an integral part of its operating model. Also, building on this operating model, Pharma ultimately creates externally-oriented data-driven value through more efficient, more precise, and smarter clinical trials, ultimately leading to clinical solutions being available earlier on the market.

Automotive, the data-driven car manufacturer we studied, primarily demonstrates an inside-out DDO perspective, building on the inner house of our conceptual DDO framework. To enable this, Automotive places great emphasis on data quality and availability, with more than 150 employees being dedicated to improving data quality and developing comprehensive data portals that make available data more transparent and accessible. Furthermore, the top management has decided to make all data free of use (i.e., without licenses/chargebacks to the organizational unit that owns the data) to further foster data exploration. However, Automotive also demonstrates an inside-out orientation, as it focuses on internally exploring data use cases which lead to innovative, data-enabled products and services (e.g., data-driven applications in cars) or even fundamentally new income streams (e.g., selling traffic data). This focus on data-driven value creation is evidenced by the current 600-800 data use cases whose evaluation, budgeting, and development is managed centrally through a dedicated use case funnel process. To enable this kind of data-driven value creation, Automotive's management equally developed and strengthened all DDO dimensions of the inner house of our conceptual DDO framework. For example, this is reflected in the organization's data capabilities, where data analytics tools and basic data analytics training are available for tens of thousands of employees. Complementary to this mandatory training, all staff are regularly presented showcases (i.e., successful, and particularly impressive or innovative data use cases) that illustrate the value and innovation potential of data to inspire them to work in a more data-driven way, which could be seen as

a manifestation of a data-driven culture. According to the Vice President Data Transformation of Automotive, this data-driven culture on all levels is a cornerstone of their DDO understanding, as it is the main driver for their employees and managers to make decisions in a data-driven way.

Sports, a global sports brand, also pursues the goal of becoming a DDO but is currently at a much earlier stage of its transformation compared to Pharma and Automotive, as it demonstrates all five DDO dimensions to a low to medium level. Starting with data sourcing & sensemaking, the organization currently has several non-integrated and inconsistent data pools, with employees navigating the data landscape through manual data requests via email. The lack of a single source of truth also inhibits data-driven decision-making, as conflicting data sets can—intentionally or unintentionally—lead to the adoption of a misleading decision-making basis. Regarding data-driven value creation, Sports has identified data use cases which are critical to success (e.g., supply chain optimization) and started to develop them accordingly. However, these use cases are built on a non-integrated database and without standardized tools, leading to further incompatibilities and further fragmentation, according to the Tech Strategy Lead. These factors also undermine the establishment of a data-driven culture, as employees who have been convinced to work in a more data-driven way cannot do so due to a lack of data tools and skills as well as a lack of reliable data itself. In summary, and in consideration of the lower-level demonstration of the DDO dimensions of the inner house of our conceptual DDO framework, it can therefore be argued that Sports is not (yet) a data-driven organization. A summary of the current state of all three empirical examples along the five DDO dimensions can be found in Table 3.

When comparing the three empirical examples along the five dimensions of our conceptual DDO framework, notable differences across the firms become apparent. All three organizations demonstrate each DDO dimension to varying degrees, thereby indicating their focus and the progress of their digital transformation towards a DDO. As presented in Table 2, both Pharma and Automotive strongly demonstrate the inner house dimensions of a DDO as well as data sourcing & sensemaking and data-driven value creation. However, when looking at the general orientation of the DDO, a different focus emerges. The top-level management of Pharma puts particular emphasis on exploiting data to achieve internal improvements through data-driven decision-making, hence focusing on an outside-in DDO view. The Automotive top-level manager, on the other hand, primarily points to data exploration leading to innovative, product- and customer-oriented data use cases, thereby focusing on an inside-out DDO view. In contrast, Sports—notwithstanding its ambition to eventually become a DDO—currently demonstrates all five DDO dimensions to a much lower degree, indicating a generally earlier stage in the digital transformation process towards a DDO. Figure 3 illustrates the degree to which each of the empirical examples currently demonstrates the DDO dimensions, thereby highlighting both the different foci as well as differences in the overall degree to which the dimensions are demonstrated.

DDO dimension	Empirical Example		
	Pharma	Automotive	Sports
Data sourcing & sensemaking	<p>Cockpit provides overview of available data and access instructions to all employees</p> <p>Very high data quality due to clinical research standards</p> <p>Significant investment and manual effort made to integrate and harmonize data pools</p> <p><i>Degree of demonstration: medium-high</i></p>	<p>Full transparency on available data through data portal</p> <p>Data freely available to everyone (no internal licenses/chargebacks)</p> <p>>150 people dedicated to continuous data quality enhancement</p> <p><i>Degree of demonstration: medium-high</i></p>	<p>No consistency between individual data sources</p> <p>Highly in-transparent data landscape which is navigated by employees through manual data requests via email</p> <p><i>Degree of demonstration: low</i></p>
Data capabilities	<p>Data infrastructure completely rebuilt to allow integrated data flow</p> <p>Data tools are provided as standardized out-of-the-box toolkit</p> <p>Both data scientists and clinical staff are upskilled to integrated clinical data scientist role</p> <p><i>Degree of demonstration: medium-high</i></p>	<p>Cloud-based, scalable data infrastructure</p> <p>Data tools freely available for all relevant employees</p> <p>Basic training on data analytics and use case identification for >40.000 employees</p> <p><i>Degree of demonstration: high</i></p>	<p>Data infrastructure currently consists of incompatible data pools</p> <p>No established toolset, analyses are mainly run ad-hoc</p> <p>Organization is not able to attract and retain talent mainly due to salary and leadership style</p> <p><i>Degree of demonstration: low-medium</i></p>
Data-driven culture	<p>Data usage is made more transparent to foster sense of ownership and accountability</p> <p>Business unit-overarching workshops where dashboards are jointly built and presented to inspire workforce</p> <p><i>Degree of demonstration: medium-high</i></p>	<p>Dedicated show case space where lighthouse use cases are presented to >40.000 employees to inspire them</p> <p>Focus on mitigating fears of more (performance) transparency</p> <p><i>Degree of demonstration: medium-high</i></p>	<p>Frontrunners have been identified and placed in each business unit to act as change influencers</p> <p>Employees try to act data-driven but are hindered by lack of data as well as capabilities</p> <p><i>Degree of demonstration: low-medium</i></p>
Data-driven decision-making	<p>Deliberate search for (recurring) decisions in meetings that should be made in a more data-driven way</p> <p>Data dashboards are developed for all important decisions</p> <p><i>Degree of demonstration: high</i></p>	<p>Importance of data as objective decision basis is conveyed and fostered through data-driven culture</p> <p><i>Degree of demonstration: medium-high</i></p>	<p>No objective decision basis due to multiple, inconsistent, or even conflicting data sources</p> <p>Data can easily be manipulated to underpin favored message</p> <p><i>Degree of demonstration: low-medium</i></p>
Data-driven value creation	<p>Focus on improving existing processes (e.g., decision-making) through data</p> <p>Use case identification is mainly decision-driven</p> <p>Deliberate development of cross-divisional use cases to foster exchange of data and insights</p> <p><i>Degree of demonstration: medium</i></p>	<p>Focus on innovative data use cases (e.g., new products & services)</p> <p>Dedicated innovation funnel for data use case ideas with central intake, approval, and monitoring</p> <p>Currently 600-800 registered data use cases</p> <p><i>Degree of demonstration: high</i></p>	<p>Monolithic implementation of single use cases for must-win battles</p> <p><i>Degree of demonstration: low-medium</i></p>

Table 3. Overview of empirical examples (along the conceptual DDO framework)

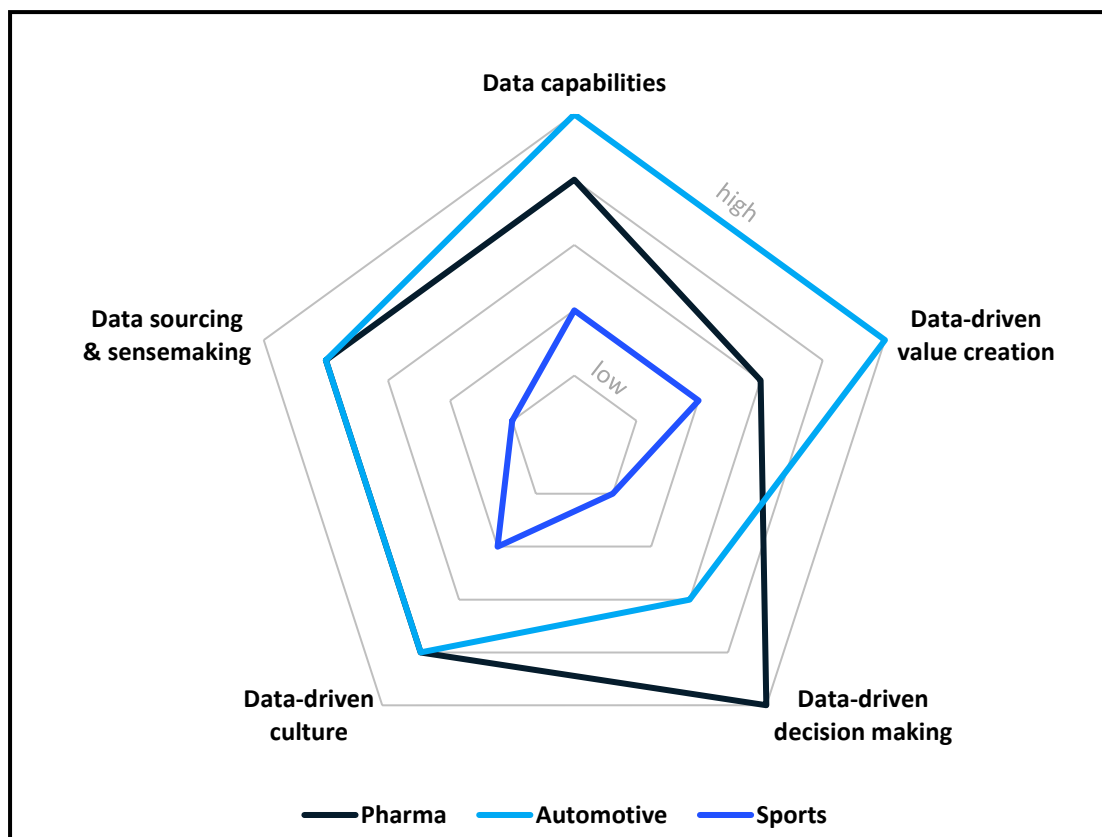


Figure 3. Comparison of three organizations along five DDO dimensions

When comparing the three empirical examples along the five dimensions of our conceptual DDO framework, notable differences across the firms become apparent. All three organizations demonstrate each DDO dimension to varying degrees, thereby indicating their focus and the progress of their digital transformation towards a DDO. As presented in Table 2, both Pharma and Automotive strongly demonstrate the inner house dimensions of a DDO as well as data sourcing & sensemaking and data-driven value creation. However, when looking at the general orientation of the DDO, a different focus emerges. The top-level management of Pharma puts particular emphasis on exploiting data to achieve internal improvements through data-driven decision-making, hence focusing on an outside-in DDO view. The Automotive top-level manager, on the other hand, primarily points to data exploration leading to innovative, product- and customer-oriented data use cases, thereby focusing on an inside-out DDO view. In contrast, Sports—notwithstanding its ambition to eventually become a DDO—currently demonstrates all five DDO dimensions to a much lower degree, indicating a generally earlier stage in the digital transformation process towards a DDO. Figure 3 illustrates the degree to which each of the empirical examples currently demonstrates the DDO dimensions, thereby highlighting both the different foci as well as differences in the overall degree to which the dimensions are demonstrated.

6 Discussion

The DDO concept has gained increasing relevance within IS research during the recent era of digital transformation, resulting in a variety of DDO definitions that differ considerably in terms of their underlying DDO characteristics. Therefore, the study at hand aims to (1)

synthesize the various understandings of DDOs in the existing literature, and (2) derive a conceptual DDO framework that integrates the identified understandings, thereby updating and extending Choo's (1996) concept of the KO to modern organizations in the digital age. By doing so, this study makes important theoretical contributions to the IS literature and offers practical implications.

6.1 Theoretical and Practical Contributions

The theoretical contribution of our study consists of one primary contribution accompanied by three complementary contributions that expand upon it. The main theoretical contribution of the study at hand is the synthesis of existing DDO knowledge through the identification of five central DDO dimensions (*data sourcing & sensemaking*, *data capabilities*, *data-driven culture*, *data-driven decision-making*, and *data-driven value creation*) that emerged from our literature review and the integration of those dimensions in our conceptual DDO framework.

Relatedly, our DDO conceptualization shows that a DDO may draw on an outside-in view—similar to its predecessor, the knowing organization—but it may also draw on an inside-out view or even combine the two views, thereby updating and extending Choo's (1996) knowing organization. As three of the five identified DDO dimensions (*data capabilities*, *data-driven culture*, and *data-driven decision-making*) are shared by all combinations, we propose these dimensions to be core dimensions, and refer to them as the inner house of a DDO. Consequentially, our conceptual DDO framework helps identify DDOs, as demonstrated by our illustrative examples. While Automotive and Pharma demonstrate all three inner house dimensions to a relatively high degree and can therefore be considered DDOs, Sports is arguably not a DDO (yet), as it exhibits only lower levels of those three dimensions.

As a second related contribution, the empirical applications of our conceptual DDO framework suggest that DDOs may have different foci. On the one hand, there are organizations like Pharma that focus on *exploiting data* to enhance their decision-making processes and improve their internal processes using (external) data, thereby drawing on the outside-in view of the DDO. On the other hand, organizations such as Automotive, which take an inside-out view of DDO, focus on *exploring data* with their internal data capabilities, data-driven culture and data-driven decision-making to create externally-oriented, data-driven value.

As a third related theoretical contribution, our conceptual DDO framework helps to clarify the differentiation between a DDO and the related concept “data-driven business model” (DDBM). Both phenomena exhibit data-driven value creation as a central dimension and it can be argued that further DDO dimensions contribute to key resources (data sourcing & sensemaking, data capabilities, and data-driven culture) and activities (data-driven decision-making) of a DDBM. However, we also argue that several types of DDBMs do not necessarily exhibit the other four dimensions next to data-driven value creation, nor do they require an underlying KO. Wiener et al. (2020) distinguish between organizations that (1) use data to inform strategic decision-making, improve internal operations, or enrich/develop products, services, and customer experience, (2) sell collected or aggregated data to other data users, or (3) facilitate data, for example, through infrastructure solutions or consulting services. While the first type is clearly in the spirit of the reviewed DDO understandings and therefore constitutes a DDO, we argue that organizations do not necessarily have to be data-driven

themselves to sell data or facilitate their use. Thus, DDOs and organizations with a DDBM should not be treated as synonymous.

Finally, as a practical contribution, our DDO framework can be used as a conceptual tool that may help practitioners concerned with DDOs in several ways. First, it can serve as a target state for digital transformations. By applying our framework, practitioners can develop a roadmap for transforming their organization into a DDO or identify gaps in their current organization. Also, by mapping organizations onto the five core dimensions of our framework, practitioners can compare and contrast different organizations. This comparative analysis can provide valuable insights into organization-specific foci—as demonstrated with Automotive and Pharma—as well as general industry-specific best practices, and opportunities for cross-industry learning.

6.2 Limitations and Further Research Directions

Regarding *limitations and future research directions*, we acknowledge that not all publications in our review sample had an exclusive focus on DDOs. In particular, for publications where DDOs are not the focus of the study, this could have an influence on the level of elaboration in the respective descriptions of DDO understandings. However, since half of the four shortest DDO understandings (based on only one characteristic) in our review sample were extracted from publications explicitly focused on DDOs, we consider this potential bias to be acceptable. Secondly, the study at hand presents only a simplified scale to measure the degree to which organizations demonstrate the respective DDO dimensions. To demonstrate the applicability of our framework for identifying and comparing illustrative examples, we believe this pragmatic approach to be appropriate. However, future research could expand on these dimensions with more refined scales. This operationalization could also open up the opportunity for configurational studies (e.g., fsQCA; c.f. Ragin, 2008) to examine successful configurations of DDO dimensions for different foci (e.g., data exploitation vs. data exploration) and to test our proposition of the inner house dimensions being core dimensions for a DDO. Finally, our conceptual framework could also help to study the nature of digital transformation processes of organizations towards a DDO, as our five DDO dimensions could guide and inform research regarding the different aspects of such a transformation. In this context, it would be particularly interesting to explore the order in which the dimensions are addressed in the context of a digital transformation, as addressing all of them simultaneously does not seem feasible due to the high level of complexity.

7 Conclusion

In conclusion, our study provides an integrated, conceptual framework of the DDO, a phenomenon that is gaining increasing attention as organizations strive to become more data-driven. By synthesizing the existing, fragmented body of research, we identified five DDO dimensions (*data sourcing & sensemaking, data capabilities, data-driven culture, data-driven decision-making, and data-driven value creation*) and integrated them into a conceptual DDO framework. The proposed framework suggests that a DDO can draw on both an outside-in view or an inside-out view or both, thereby setting it apart from its predecessor, the knowing organization, which draws exclusively on an outside-in view. Using the DDO framework to analyze empirical examples, the study at hand demonstrates both the framework's general applicability and its practical relevance. For example, our framework can help practitioners identify and compare DDOs, as well as support them describe the current and target states

of their organization and thus in derive a roadmap for its digital transformation toward a DDO. Against this backdrop, we hope that our study results will serve as an analytical tool for managers, as well as inform and inspire future research on the exciting topic of DDOs.

References

- Anderson, C. (2015). *Creating a data-driven organization: Practical advice from the trenches*. Sebastopol, CA, USA: O'Reilly.
- Berndtsson, M., Forsberg, D., Stein, D., & Svahn, T. (2018). Becoming a Data-driven Organization. *ECIS 2018 Proceedings, Portsmouth, UK*, 43. https://aisel.aisnet.org/ecis2018_rip/43
- Berndtsson, M., Lennerholt, C., Svahn, T., & Larsson, P. (2020). 13 Organizations' Attempts to Become Data-Driven. *International Journal of Business Intelligence Research*, 11(1), 1–21. <https://doi.org/10.4018/ijbir.2020010101>
- Bharadwaj, A., El Sawy, O. A., Pavlou, P. A., & Venkatraman, N. (2013). Digital Business Strategy: Toward a Next Generation of Insights. *MIS Quarterly*, 37(2), 471–482. <https://doi.org/10.25300/misq/2013/37:2.3>
- Boell, S., & Cecez-Kecmanovic, D. (2014). A Hermeneutic Approach for Conducting Literature Reviews and Literature Searches. *Communications of the Association for Information Systems*, 34(12). <https://doi.org/10.17705/1CAIS.03412>
- Boell, S., & Wang, B. (2019). Wwww.litbaskets.io, an IT Artifact Supporting Exploratory Literature Searches for Information Systems Research. *ACIS 2019 Proceedings, Perth, WA, Australia*, 71. <https://aisel.aisnet.org/acis2019/71/>
- Boulding, K. (1956). General Systems Theory. *Management Science*, 2(3), 197–208. <https://doi.org/10.1287/mnsc.2.3.197>
- Brown, C. V., & Magill, S. L. (1994). Alignment of the IS Functions with the Enterprise: Toward a Model of Antecedents. *MIS Quarterly*, 18(4), 371. <https://doi.org/10.2307/249521>
- Choo, C. W. (1996). The knowing organization: How organizations use information to construct meaning, create knowledge and make decisions. *International Journal of Information Management*, 16(5), 329–340. <https://doi.org/10/bbw629>
- Choo, C. W. (2001). The knowing organization as learning organization. *Education + Training*, 43(4/5), 197–205. <https://doi.org/10.1108/eum0000000005482>
- Constantiou, I. D., & Kallinikos, J. (2015). New Games, New Rules: Big Data and the Changing Context of Strategy. *Journal of Information Technology*, 30(1), 44–57. <https://doi.org/10.1057/jit.2014.17>
- Davenport, T. H. (2006). Competing on analytics. *Harvard Business Review*, 84(1), 98–107.
- Davenport, T. H., & Bean, R. (2018, February). Big Companies Are Embracing Analytics, But Most Still Don't Have a Data-Driven Culture. *Harvard Business Review*. <https://hbr.org/2018/02/big-companies-are-embracing-analytics-but-most-still-dont-have-a-data-driven-culture>

- Davenport, T. H., Harris, J. G., De Long, D. W., & Jacobson, A. L. (2001). Data to Knowledge to Results: Building an Analytic Capability. *California Management Review*, 43(2), 117–138. <https://doi.org/10.2307/41166078>
- Fabijan, A., Dmitriev, P., Olsson, H. H., & Bosch, J. (2017). The Evolution of Continuous Experimentation in Software Product Development. *International Conference on Software Engineering 2017 Proceedings, Buenos Aires*, 770–780. <https://doi.org/10.1109/icse.2017.76>
- Faraj, S., & Leonardi, P. M. (2022). Strategic organization in the digital age: Rethinking the concept of technology. *Strategic Organization, Argentina*, 20(4), 771–785. <https://doi.org/10.1177/14761270221130253>
- Fischer, H., Wiener, M., & Strahringer, S. (2023). Embarking on the Digital Transformation Journey toward a Data-Driven Organization: Empirical Insights into Transformation Starting Points. *ECIS 2023 Proceedings, Kristiansand, Norway*, 298. https://aisel.aisnet.org/ecis2023_rp/298/
- Gartner. (2021). Embarking on the Digital Transformation Journey toward a Data-Driven Organization: Empirical Insights into Transformation Starting Points. Stamford, Conn, USA: Gartner. <https://www.gartner.com/en/newsroom/press-releases/2021-05-05-gartner-finds-72-percent-of-data-and-analytics-leaders-are-leading-or-heavily-involved-in-digital-transformation-initiatives>
- Gökalp, M. O., Gökalp, E., Kayabay, K., Koçyiğit, A., & Eren, P. E. (2021). The development of the data science capability maturity model: A survey-based research. *Online Information Review*, 46(3), 547–567. <https://doi.org/10.1108/oir-10-2020-0469>
- Grover, V., Chiang, R. H. L., Liang, T.-P., & Zhang, D. (2018). Creating Strategic Business Value from Big Data Analytics: A Research Framework. *Journal of Management Information Systems*, 35(2), 388–423. <https://doi.org/10.1080/07421222.2018.1451951>
- Gualo, F., Rodriguez, M., Verdugo, J., Caballero, I., & Piattini, M. (2021). Data quality certification using ISO/IEC 25012: Industrial experiences. *Journal of Systems and Software*, 176. <https://doi.org/10.1016/j.jss.2021.110938>
- Gulati, R., Lawrence, P. R., & Puranam, P. (2005). Adaptation in vertical relationships: Beyond incentive conflict. *Strategic Management Journal*, 26(5), 415–440. <https://doi.org/10.1002/smj.458>
- Hagen, J. A., & Hess, T. (2020). Linking Big Data and Business: Design Parameters of Data-Driven Organizations. *AMCIS 2020 Proceedings*, 5. https://aisel.aisnet.org/amcis2020/data_science_analytics_for_decision_support/data_science_analytics_for_decision_support/5
- Hall, R. H. (1977). *Organizations: Structure and Process*. Englewood Cliffs: Prentice Hall.
- Halper, F., & Stodder, D. (2017). *What It Takes to Be Data-Driven: Technologies and Best Practices for Becoming a Smarter Organization*. TDWI. <https://tdwi.org/research/2017/12/bi-all-ppm-all-best-practices-report-what-it-takes-to-be-data-driven>
- Hartmann, P. M., Zaki, M., Feldmann, N., & Neely, A. (2016). Capturing value from big data – a taxonomy of data-driven business models used by start-up firms. *International Journal of Operations & Production Management*, 36(10), 1382–1406. <https://doi.org/10.1108/ijopm-02-2014-0098>

- Hicks, J. O. (1993). *Management Information Systems: A User Perspective*. Minneapolis, MN, USA: West Publishing.
- Hinton, M. (2006). *Introducing Information Management*. London, UK: Taylor & Francis. <https://doi.org/10.4324/9780080458397>
- Hou, F. (2018). *Becoming a Data-Driven Enterprise*. Accenture Labs. <https://www.accenture.com/content/dam/accenture/final/a-com-migration/r3-additional-pages-1/pdf/pdf-83/accenture-becoming-data-driven-enterprise-data-industrialization.pdf>
- Hupperz, M., Gür, I., Möller, F., & Otto, B. (2021). What is a Data-Driven Organization? *AMCIS 2021 Proceedings*, 6. https://aisel.aisnet.org/amcis2021/strategic_is/strategic_is/6/
- Johnson, B. L., & Kruse, S. D. (2019). *Educational Leadership, Organizational Learning, and the Ideas of Karl Weick: Perspectives on Theory and Practice* (1st ed.). Milton Park, UK: Routledge. <https://doi.org/10.4324/9781315114095-1>
- Katz, D., & Kahn, R. L. (1978). *The social psychology of organizations*. New York: Wiley.
- Kearny, C., Gerber, A., & van der Merwe, A. (2016). Data-driven enterprise architecture and the TOGAF ADM phases. *International Conference on Systems, Man, and Cybernetics 2016 Proceedings, Budapest, Hungary*, 4603–4608. <https://doi.org/10.1109/smc.2016.7844957>
- Kellogg, K. C., Valentine, M. A., & Christin, A. (2020). Algorithms at Work: The New Contested Terrain of Control. *Academy of Management Annals*, 14(1), 366–410. <https://doi.org/10.5465/annals.2018.0174>
- Kiron, D. (2017). Lessons from Becoming a Data-Driven Organization. *MIT Sloan Management Review*, 58(2). <https://sloanreview.mit.edu/case-study/lessons-from-becoming-a-data-driven-organization/>
- Körppen, T., Ullrich, A., & Bertheau, C. (2021). Durchblick statt Bauchgefühl – Transformation zur Data-Driven Organization. (Insight instead of gut feeling – transformation to a data-driven organization). *Wirtschaftsinformatik & Management*, 13(6), 452–459. <https://doi.org/10.1365/s35764-021-00370-7>
- Lawrence, P. R., & Lorsch, J. W. (1967). Differentiation and Integration in Complex Organizations. *Administrative Science Quarterly*, 12(1). <https://doi.org/10.2307/2391211>
- Lee, I. (2017). Big data: Dimensions, evolution, impacts, and challenges. *Business Horizons*, 60(3), 293–303. <https://doi.org/10.1016/j.bushor.2017.01.004>
- Malhotra, N. K., Peterson, M., & Kleiser, S. B. (1999). Marketing Research: A State-of-the-Art Review and Directions for the Twenty-First Century. *Journal of the Academy of Marketing Science*, 27(2), 160–183. <https://doi.org/10.1177/0092070399272004>
- March, J. G., & Simon, H. A. (1993). *Organizations*. Oxford, UK: Blackwell Business/Blackwell Publisher.
- McAfee, A., & Brynjolfsson, E. (2012). Big Data: The Management Revolution. *Harvard Business Review*. <https://hbr.org/2012/10/big-data-the-management-revolution>

- McKinsey. (2013). *Game changers: Five opportunities for US growth and renewal*.
https://www.mckinsey.com/~media/mckinsey/featured%20insights/Americas/US%20game%20changers/MGI_Game_changers_US_growth_and_renewal_Full_report
- Morakanyane, R., Grace, A., & O'Reilly, P. (2017). Conceptualizing Digital Transformation in Business Organizations: A Systematic Review of Literature. *Digital Transformation – From Connecting Things to Transforming Our Lives*, 427–443. <https://doi.org/10.18690/978-961-286-043-1.30>
- Olszak, C. M., & Zurada, J. (2019). Big Data-driven Value Creation for Organizations. *HICSS 2019 Proceedings, Grand Wailea, HI, USA*, 10. <https://hdl.handle.net/10125/59457>
- Paré, G., Trudel, M.-C., Jaana, M., & Kitsiou, S. (2015). Synthesizing information systems knowledge: A typology of literature reviews. *Information & Management*, 52(2), 183–199. <https://doi.org/10.1016/j.im.2014.08.008>
- Parra, X. (2022). Chronological Evolution of the Information-Driven Decision-Making Process (1950–2020). *Journal of the Knowledge Economy*, 32. <https://doi.org/10.1007/s13132-022-00917-y>
- Patil, D. (2011). *Building Data Science Teams*. Sebastopol, CA, USA: O'Reilly Media.
- Puranam, P., Alexy, O., & Reitzig, M. (2014). What's "New" About New Forms of Organizing? *Academy of Management Review*, 39(2), 162–180. <https://doi.org/10.5465/amr.2011.0436>
- Ragin, C. C. (2008). *Redesigning Social Inquiry*. Chicago: University of Chicago Press.
- Rubin, E., & Rubin, A. (2013). The impact of Business Intelligence systems on stock return volatility. *Information & Management*, 50(2–3), 67–75. <https://doi.org/10.1016/j.im.2013.01.002>
- Satar, N. S. B. M. (2021). Data-driven Organization and Covid-19 Pandemic: A systematic review. *Journal of Strategic Digital Transformation in Society*, 1(1), 18–32.
- Schüritz, R. (2017). How to cultivate Analytics Capabilities within an Organization – Design and Types of Analytics Competency Centers. *ECIS 2017 Proceedings, Guimarães, Portugal*, 26. http://aisel.aisnet.org/ecis2017_rp/26
- Schwer, K., & Hitz, C. (2018). Designing Organizational Structure in the Age of Digitization. *Journal of Eastern European and Central Asian Research*, 5(1). <https://doi.org/10.15549/jeecar.v5i1.213>
- Simon, H. A. (1976). *Administrative Behavior* (4th ed.). New York, NY, USA: Free Press (Simon & Schuster).
- Sivarajah, U., Kamal, M. M., Irani, Z., & Weerakkody, V. (2017). Critical analysis of Big Data challenges and analytical methods. *Journal of Business Research*, 70, 263–286. <https://doi.org/10.1016/j.jbusres.2016.08.001>
- Svensson, R. B., Feldt, R., & Torkar, R. (2019). The Unfulfilled Potential of Data-Driven Decision Making in Agile Software Development, in P. Kruchten, S. Fraser, F. Coallier (Eds.), *Agile Processes in Software Engineering and Extreme Programming. XP 2019 Proceedings, Montreal, Canada* (Vol. 355, pp. 69–85). Springer. https://doi.org/10.1007/978-3-030-19034-7_5

- Svensson, R. B., & Taghavianfar, M. (2020). Toward Becoming a Data-Driven Organization: Challenges and Benefits, in F. Dalpiaz, J. Zdravkovic, & P. Loucopoulos (Eds.), *Research Challenges in Information Science* (Vol. 385, pp. 3–19). Springer International Publishing. https://doi.org/10.1007/978-3-030-50316-1_1
- Thusoo, A., & Sarma, J. S. (2017). *Creating a Data-Driven Enterprise with DataOps. Insights from Facebook, Uber, LinkedIn, Twitter, and eBay*. Sebastopol, CA, USA: O'Reilly.
- Tuomi, I. (1999). Data Is More than Knowledge: Implications of the Reversed Knowledge Hierarchy for Knowledge Management and Organizational Memory. *Journal of Management Information Systems*, 16(3), 103–117. <https://doi.org/10.1080/07421222.1999.11518258>
- Webster, J., & Watson, R. T. (2002). Analyzing the Past to Prepare for the Future: Writing a literature Review. *MIS Quarterly*, 26(2), 13–23.
- WEF. (2021). *Data-driven Economies: Foundations for Our Common Future*. <https://www.weforum.org/publications/data-driven-economies-foundations-for-our-common-future/>
- Weick, K. E. (1969). *The Social Psychology of Organizing*. New York, NY, USA: McGraw Hill.
- Wessel, L., Baiyere, A., Ologeanu-Taddei, R., Cha, J., & Blegind Jensen, T. (2021). Unpacking the Difference Between Digital Transformation and IT-Enabled Organizational Transformation. *Journal of the Association for Information Systems*, 22(1), 102–129. <https://doi.org/10.17705/1jais.00655>
- West, R., & Turner, L. H. (2014). *Introducing Communication Theory: Analysis and Application* (6th ed.). New York, NY, USA: McGraw Hill.
- Wiener, M., Saunders, C., & Marabelli, M. (2020). Big-data business models: A critical literature review and multiperspective research framework. *Journal of Information Technology*, 35(1), 66–91.
- Wittgenstein, L., & Anscombe, G. E. M. (1989). *Philosophical investigations: = Philosophische Untersuchungen* (3rd ed., repr). Cambridge, UK: Blackwell.
- Yoo, Y., Boland, R. J., Lyytinen, K., & Majchrzak, A. (2012). Organizing for Innovation in the Digitized World. *Organization Science*, 23(5), 1398–1408.

Appendices

Appendix A. IS Basket Journal List

Journal Name	Basket Size			
	2XS	XS	S	M
European Journal of Information Systems	x	x	x	x
Information Systems Journal	x	x	x	x
Information Systems Research	x	x	x	x
Journal of the Association for Information Systems	x	x	x	x
Journal of Information Technology	x	x	x	x
Journal of Management Information Systems	x	x	x	x
Journal of Strategic Information Systems	x	x	x	x

MIS Quarterly	x	x	x	x
Decision Support Systems		x	x	x
Information and Management		x	x	x
Information Systems Frontiers		x	x	x
Information and Organization		x	x	x
Communications of the Association for Information Systems		x	x	x
Data Base for Advances in Information Systems		x	x	x
Expert Systems with Applications		x	x	x
Information Society		x	x	x
Communications of the ACM			x	x
Decision Sciences Journal			x	x
IEEE Transactions on Knowledge and Data Engineering			x	x
Information Processing and Management			x	x
Information Technology and People			x	x
International Journal of Human-Computer Studies			x	x
International Journal of Information Management			x	x
Journal of Information Systems			x	x
Journal of Organizational Computing and Electronic Commerce			x	x
Journal of Systems and Software			x	x
Journal of the Association for Information Science and Technology			x	x
Knowledge-Based Systems			x	x
Organization Science			x	x
ACM Transactions on Information Systems				x
Australasian Journal of Information Systems				x
Business and Information Systems Engineering				x
Computer Supported Cooperative Work				x
Computers in Human Behavior				x
European Journal of Operational Research				x
Information Systems and e-Business Management				x
Information Systems Management				x
INFORMS Journal on Computing				x
International Journal of Business Information Systems				x
International Journal of Enterprise Information Systems				x
International Journal of Information Security				x
International Journal of Information Systems in the Service Sector				x
Journal of Computer Information Systems				x
Journal of Database Management				x
Journal of Enterprise Information Management				x
Journal of Global Information Management				x
Journal of Global Information Technology Management				x
Management Science				x
OMEGA - International Journal of Management Science				x
Online Information Review				x
Scandinavian Journal of Information Systems				x

Table A1. IS Basket Overview (cf. Boell & Wang, 2019)

Appendix B. Review Sample Description

In total, our review sample consists of 23 studies, including six journal articles, seven conference papers, one book section, and nine practitioner publications of various types (e.g., books, magazine articles, and white papers), representing a wide array of disciplines and perspectives. While 15 studies are published in IS outlets that were the starting point of our search (e.g., *Journal of Management Information Systems*, *AMCIS Proceedings*), our review set also includes publications from adjacent research fields such as computer science (4) and management (4) that were identified through the backward and forward searches. This distribution is in line with the perspective offered by Hagen and Hess (2020), who refer to DDOs as socio-technical systems, which by their very nature lie at the boundary between computer science and management and thus within the focus of IS research. In terms of sectors, our review set (and especially the case studies presented) reveals a wide range of application areas (e.g., retail, manufacturing, healthcare, finance, construction, technology) and predominantly (57%) a focus on the required actions and challenges of becoming a data-driven organization, again confirming the current emergence of DDOs in practice as described in the introduction. Another indication of the topicality of DDOs can be seen in the chronological progression of the reviewed publications. As shown in Figure B1, a noticeable increase in publications can be observed from 2016 onwards, with academic publications slightly trailing those from practitioners.

Moreover, in terms of the complexity and richness of the extracted DDO understandings, a wide span can be observed in the length of the descriptions alone, ranging from short one-sentence definitions (e.g., Schüritz, 2017) to extensive concept maps (e.g., Hupperz et al., 2021) and detailed checklists (Davenport, 2006).

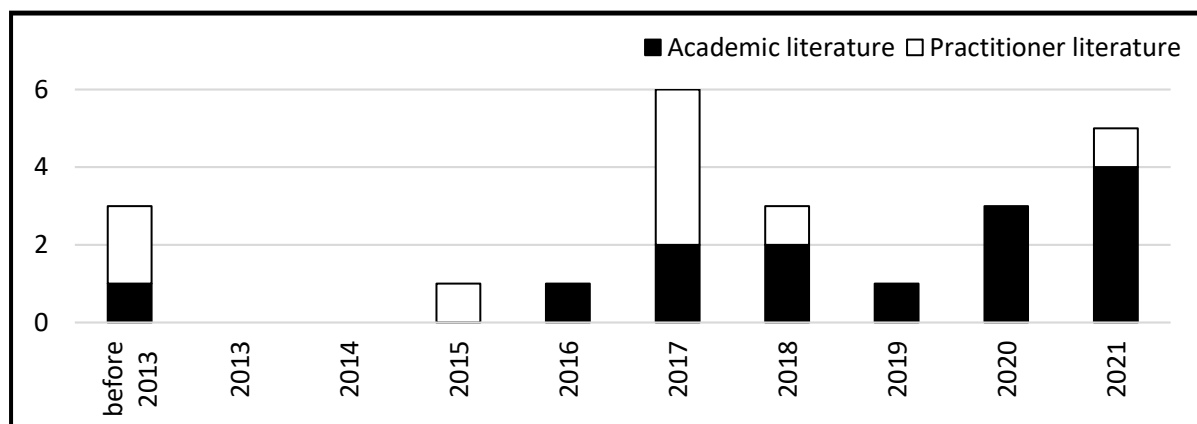


Figure B1. Distribution of publications in the sample

Appendix C. Review Sample and Identified DDO Dimensions

Source	Literature type	Explicit focus on DDO	Identified DDO dimensions				
			Data sourcing & sensemaking	Data capabilities	Data-driven culture	Data-driven decision-making	Data-driven value creation
Anderson (2015)	Practitioner	Yes	x	x	x	x	x
Berndtsson et al. (2018)	Academic	Yes		x	x	x	x
Berndtsson et al. (2020)	Academic	Yes				x	
Davenport et al. (2001)	Academic	No	x	x	x	x	x
Davenport (2006)	Practitioner	No		x	x	x	
Fabijan et al. (2017)	Academic	No	x				x
Gökalp et al. (2021)	Academic	No			x	x	x
Gualo et al. (2021)	Academic	No	x				x
Grover et al. (2018)	Academic	Yes	x	x	x		x
Hagen & Hess (2020)	Academic	Yes	x	x	x		x
Halper & Stodder (2017)	Practitioner	Yes	x				
Hou (2018)	Practitioner	Yes	x	x		x	x
Hupperz et al. (2021)	Academic	Yes		x	x		x
Kearny et al. (2016)	Academic	No	x	x	x	x	x
Kiron (2017)	Practitioner	No	x	x	x		x
Körppen et al. (2021)	Practitioner	Yes	x			x	
Lee (2017)	Practitioner	No		x			
Olszak & Zurada (2019)	Academic	No	x	x			x
Patil (2011)	Practitioner	No	x				x
Satar (2021)	Academic	Yes	x	x			x
Svensson & Taghavianfar (2020)	Academic	Yes	x	x	x		
Thusoo & Sarma (2017)	Practitioner	No		x	x	x	
Total			15	15	12	11	15

Table C1. Review sample and mapped DDO dimensions

Appendix D. Illustrative Example Research Approach

To empirically illustrate our conceptual DDO framework, we deliberately selected three organizations of different industries and sizes that are currently undergoing digital transformations toward a DDO to demonstrate the applicability of our framework across organizational types. At the same time, we chose a lower boundary of more than ten billion euros in annual revenue and a global presence to ensure comparability. Table D1 provides an overview of the industry, number of employees and revenue of the three selected organizations, as well as the role of the key informant interviewed.

Illustrative example	Staff 2021 [thousand]	Revenue 2021 [billion EUR]	Key informant role
Automotive	>100	>100	Vice President Data Transformation
Pharma	>100	10-50	Head of Transformation
Sports	50–100	10-50	Tech Strategy Lead

Table D1. Overview of analyzed organizations

To collect our data, we combined multiple sources. First, we conducted extensive online research on each company to gather contextual information such as external reports and evaluations, relevant press coverage and financial statements (including e.g., revenue). We then identified top-level managers who are responsible for the planning and implementation of the digital transformation of each company, contacted them via LinkedIn and conducted a 30-to-60-minute video call with one manager per organization. This interview was structured by a questionnaire focusing on the general DDO understanding, the digital transformation motivation and expected outcome, as well as key milestones and challenges in becoming a DDO. The entire questionnaire is available on request.

To analyze the data obtained, we performed a deductive concept coding of all the data gathered, using our five DDO dimensions as categories and transferred our findings into a tabular database organized by DDO dimension and organization. Building on this database, we performed a thorough within-case analysis for each empirical example, resulting in detailed, descriptive write-ups that we used to empirically illustrate our conceptual DDO framework.

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