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From Knowing to Data-Driven Organizations: Review and Conceptual Framework

Hannes Fischer
TU Dresden, hannes.fischer@mailbox.tu-dresden.de

Martin Wiener
TU Dresden, martin.wiener@tu-dresden.de

Susanne Strahringer
TU Dresden, susanne.strahringer@tu-dresden.de

Julia Kotlarsky
The University of Auckland, j.kotlarsky@auckland.ac.nz

Katja Bley
TU Dresden, katja.bley@tu-dresden.de

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From Knowing to Data-Driven Organizations: Review and Conceptual Framework

Full research paper

Hannes Fischer

Chair of Business Information Systems, esp. Business Engineering
TU Dresden
Dresden, Germany
Email: hannes.fischer@mailbox.tu-dresden.de

Martin Wiener

Chair of Business Information Systems, esp. Business Engineering
TU Dresden
Dresden, Germany
Email: martin.wiener@tu-dresden.de

Susanne Strahringer

Chair of Business Information Systems, esp. Information Systems in Trade and Industry
TU Dresden
Dresden, Germany
Email: susanne.strahringer@tu-dresden.de

Julia Kotlarsky

Business School, Information Systems and Operations Management
University of Auckland
Auckland, New Zealand
Email: j.kotlarsky@auckland.ac.nz

Katja Bley

Chair of Business Information Systems, esp. Information Systems in Trade and Industry
TU Dresden
Dresden, Germany
Email: katja.bley@tu-dresden.de

Department of Computer Science
Norwegian University of Science and Technology
Trondheim, Norway
Email: katja.bley@ntnu.no

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, it seems that different understandings of such an organization emerged. The study at hand sets forth to synthesize the fragmented body of research through a review of DDO understandings in the IS and related literatures. Based on the review results and drawing on the concept of the 'knowing organization,' our study identifies five core elements of a DDO (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 an ideal-typical DDO combines an outside-in view with an inside-out view, thereby setting itself apart from its predecessor, the knowing organization. Theoretical and practical contributions as well as directions for future research are discussed.

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

1 Introduction

To prepare themselves for the digital future, organizations worldwide are increasingly engaging in large-scale digital transformation initiatives. 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 and Brynjolfsson (2012) reported a 5% increase in productivity and 6% growth in profitability for public North American companies driven by data; and Rubin and Rubin (2013) observe higher stock returns for such companies. Relatedly, 84% of executives believe most to all of their employees should utilize data to help them perform their job duties (Thusoo and Sarma 2017), as organizations that act based on data show significant advantages over competitors (Berndtsson et al. 2018; Constantiou and 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 and Brynjolfsson 2012; Svensson et al. 2019). It is in this context that organizations are striving to become a *data-driven organization* (DDO; Davenport and Bean 2018; Hartmann et al. 2016) to profit from the value potential embedded in data.

With the growing interest in the concept of a DDO, however, multiple understandings of this concept emerged in the academic and practitioner literature. In particular, existing DDO understandings seem to vary considerably, ranging from rather simplistic understandings to more complex understandings. For example, while Schüritz (2017) refers to a DDO as an organization which simply “uses data and analysis to help drive action” (p. 394), other authors such as Thusoo and 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. In combination 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 of the DDO phenomenon’s nature.

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 meet our research objectives, we use a two-step process. First, we follow what can be described as a theoretical review approach (Paré et al. 2015) 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 do so, 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 results and the resulting conceptual DDO framework. We conclude by discussing the main contributions of our study, along with its limitations and associated directions for future research.

2 Conceptual Foundations

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

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 and 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), requiring both coordination and cooperation, which in turn need (data and) information next to motivation and trust (Gulati et al. 2005; Lawrence and Lorsch 1967). Generally, the organization concept can be considered from two complementary perspectives: a system-oriented and a processual 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 and 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 and Kruse 2019, p. 10) and “collect, manage, and use the information they receive” (West and Turner 2014, p. 301).

From a processual perspective, theorists such as Weick (1969) consider the noun organization itself, with its implications of a static and figured-out construct, as a “myth” (p. 88). According to him, people rather 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 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 his fundamental understanding of 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, seeing organizations as systems interacting with their environment. Integrating these two perspectives, he describes his understanding of an organization as a “decision making system” (Choo 1996, p. 331).

2.2 The Concepts of Data and Data-Drivenness

Generally, 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 and 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 data with context and meaning through interpretation and processing by humans or by automatic means, they are transformed into information (Hicks 1993; Tuomi 1999), which in turn can be used in management decision-making (Powell & Martin, 1992; cited in Hinton 2006).

Building on this understanding of data, the concept of *data-drivenness* can be explored. Etymologically, the term drivenness relates to being propelled, guided, or controlled by something and is rarely used in isolation. Consequently, “data-drivenness” can be defined as the characteristic of being propelled, guided, or controlled by data. Data-drivenness was originally 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, with the progression of digitalization, whole value chains and business models have become centered around data, creating the notion of data-driven business models (cf. e.g., Wiener et al. 2020).¹ 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 and Sarma 2017). Arguably, this notion can be seen as a ‘successor’ 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 extensively cited in the IS and related literatures, Choo (1996) describes and refines the core elements of a learning organization and their interplay. Building on his understanding of an organization as a “decision making system” (Choo 1996, p. 331), he describes knowing organizations 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). According to Choo (1996), a KO is an organization that effectively integrates the organizational knowing cycle, consisting of three interconnected organizational functions, in which “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). As illustrated in Figure 1, these three distinct functions (or elements) of the KO—namely, *sensemaking*, *knowledge creating*, and *decision making*—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). More specifically, in the KO, the *sensemaking* function takes on the task of making sense of changes and

¹ A business model describes how an organization creates and captures value (Amit and Zott 2001). As such, a business model can be centered around data without requiring the underlying organization to be driven by data and vice versa. For example, the former is the case when a traditional company sells data (and thus generates value) without its individual functions (e.g., marketing) being data-driven.

developments in the organization’s external environment. To do so, the organization acts as a sensemaking system that subjectively filters out relevant information and forms 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 KO’s second function, *knowledge creation*, is focused on the human-centric exchange of learning, e.g., through training and the conversion of tacit into explicit knowledge (and vice versa). Through this knowledge sharing between organizational members, supplemented by external knowledge, an organization generates new capabilities and innovates. Finally, the KO involves the *decision making* function that 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 come up with decisions that lead to goal-directed, adaptive internal behavior.

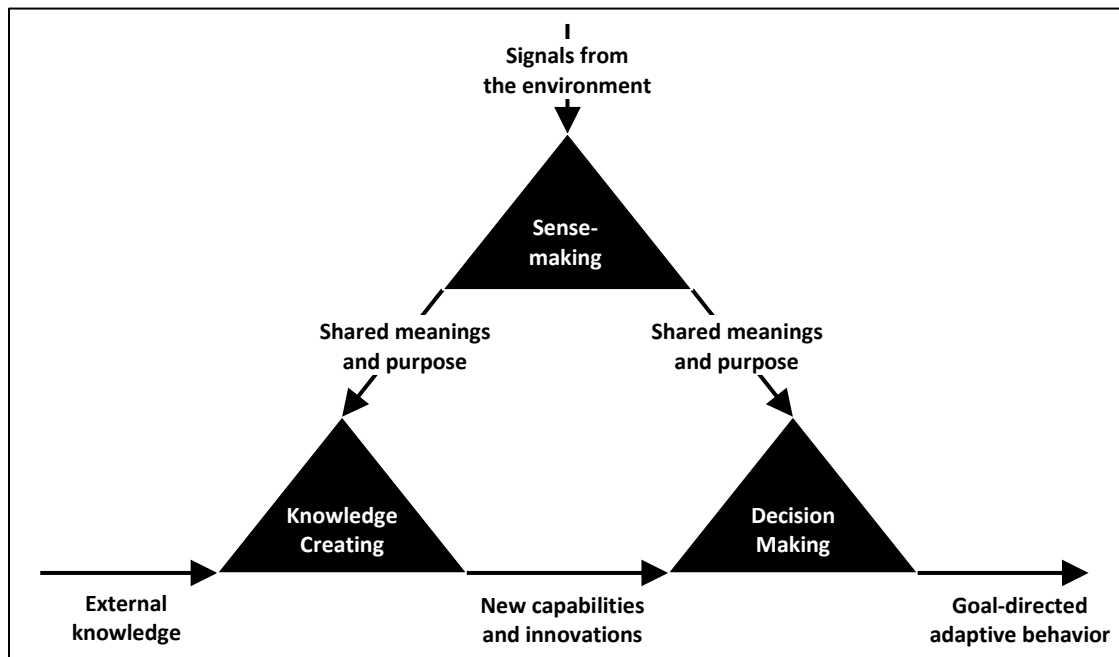


Figure 1: Conceptual Framework of the KO (Choo 1996, 2001)

As noted above, we argue that Choo’s (1996) KO framework and its elements are still relevant for 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 in order to account for the significant changes ushered in by the digital age. Whereas 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 (Parra 2022), which should be reflected in the conceptual framework. For example, the KO only takes into account input absorbed from the external environment, without explicitly considering internally available “data treasures” (e.g., IoT log files or internal reports). At the same time, the framework shows a strong focus on internal value creation through decision-making, thereby neglecting the importance of external value creation. Taken together, this suggests that the outside-in focus inherent in Choo’s (1996) framework is too limited, as today’s organizations also collect data internally and actively influence their environment in line with the open system perspective of modern organizational theory.

3 Research Methodology

To effectively organize prior literature on DDOs, we followed established guidelines (Webster and Watson 2002) and conducted a literature review which could be best described as a theoretical review (Paré et al. 2015). This particular review type is commonly 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). Further, a theoretical review is usually broad in scope and draws on both conceptual and empirical sources (without quality appraisal), which are mainly analyzed through content analysis or interpretative methods (Paré et al. 2015).

3.1 Literature Search

Before starting with our literature search, 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, at least initially, we decided to only include peer-reviewed, academic publications in our sample. To ensure a broad coverage of potentially relevant literature sources, we then followed the four-step search process recommended by Webster and Watson (2002). In particular, we used the website *Litbasket.io* (Boell and Wang 2019) to perform a keyword-based search covering the 51 most prestigious IS journals (referred to as “Basket M” on the website). 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. As such, we iteratively tested and refined our search string (e.g., by adding synonyms identified in the literature). In our final search string, we searched for all 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 led to 42 distinct publications, of which only four elaborated on their DDO understandings. On this (preliminary) basis, we performed a backward search as a second step, and a forward search as a third step (Webster and Watson 2002) using *Google Scholar* to further supplement our base set of DDO-related publications. This snowball approach led to 103 and 9 additional studies, respectively, which revealed 10 additional descriptions of DDO understandings.

In a fourth and final step, we performed a supplementary database search to complement our review sample and to confirm that no new DDO understandings surfaced (Webster and Watson 2002). To do so, we searched the *AIS eLibrary* (aisel.aisnet.org) with the above-described search string. 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). Hence, 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 another 52 publications, covering different adjacent fields and containing nine additional DDO understandings. Taken together, our four-step search process revealed a total of 206 publications, of which 23 included an explicit description of a DDO understanding. An overview of the search process (appendix A) and a detailed description of the review sample (appendix B) can be found in the online appendix (available under <https://doi.org/10.6084/m9.figshare.20477313>).

3.2 Literature Analysis

Already in parallel to the search process (see above), we thoroughly examined our review sample and arrived at our conceptual DDO framework elements in two main steps.

In the first step, we used a combination of descriptive coding and open coding to analyze our review sample. Initially, we captured and documented descriptive meta data 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 author team to ensure the validity and reliability of the coding results. In case of disagreement, the respective text passages were jointly revisited and thoroughly discussed until agreement was reached.

In the second step, we followed what can be described as an abductive process, in which we derived the elements 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 surfacing 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 elements. In total, we identified 5 DDO elements, of which three are updated elements from Choo’s (1996) KO and two are additional elements inductively derived from our data. As a check for comprehensiveness, the five DDO elements were mapped again to all 23 reviewed DDO understandings, covering all mentioned characteristics (see online appendix C).

4 Results: Towards a Conceptual Framework of DDOs

4.1 DDO Understandings

Our review results reveal that the DDO understandings evident in existing literature differ considerably in terms of their level of elaboration and richness, ranging from rather 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 refer to decision making based on data as the single distinguishing characteristic of a DDO, resulting in descriptions such as the following one: “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 abstract understanding is presented by Halper and 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 in combination with the ambition to use data to gain competitive advantages 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). The same applies to Gualo et al. (2021) who 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 and Zurada (2019) and Satar (2021) supplement several mentioned characteristics with data capabilities as a further characteristic, consisting of e.g. data infrastructure, data tools, and data experts (Satar 2021). Further, studies with even more elaborate DDO understandings add the notion of a data-driven culture (Grover et al. 2018) to the aforementioned characteristics, requiring a “sustained commitment from leadership and employees alike” (Kiron 2017, p. 1) or “collaboration fostering” (Hagen and Hess 2020, p. 1). Finally, the arguably 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 can be found in Table 1.

4.2 Underlying DDO Elements

Although the DDO understandings of the reviewed studies differ notably (as summarized above), they also share several commonalities. In particular, five central DDO elements—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 1. For a comprehensive mapping of the five DDO elements onto the 23 DDO understandings identified through our literature review, see the online appendix (appendix C).

DDO element

[# of mentions]:

Short description

Sample quotes highlighting matching characteristics

Data sourcing & sensemaking [15]:

Provision of relevant, contextualized, and harmonized information to the organization

In a data-driven organization, data is collected, processed and evaluated in a targeted manner and used as the basis for decisions. (Körppen et al. 2021, p. 454; translated from German)

A data-driven organization acquires, processes, and leverages data in a timely fashion (Patil 2011, p. 3)

So, what does it mean to be a data-driven enterprise? It means maximizing the value of your data and treating it as an asset differentiated by its completeness, lineage, and quality. [...] (Hou 2018, p. 2)

<p>Data capabilities [15]: Abilities of an organization to use its infrastructure, tools, and talent to purposefully manage data</p>	<p>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)</p> <p>[...] as the [data-driven] organization's data and analytics capabilities mature, they can underpin innovative new business models that alter, sometimes radically, power arrangements within the organization. (Kiron 2017, p. 2)</p> <p>[In the context of DDOs, the] dynamic <u>capabilities of organizations that should contribute to creating, extending, protecting and maintaining a unique database are to be considered a key point</u> (Olszak and Zurada 2019, p. 168)</p>
<p>Data-driven culture [12]: Organization-wide belief and value system that fosters the understanding, management, and exploitation of data</p>	<p>A data-driven organization should possess three things: <u>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.</u> (Thusoo and Sarma 2017, p. 43)</p> <p>Data-driven decision-making and creating a <u>data-driven culture are important aspects of a DDO.</u> (Svensson and Taghavianfar 2020, p. 4)</p> <p><u>An organization-wide data-driven culture musts to be established</u> in order to exploit the full potential of advanced analytics. (Berndtsson et al. 2018, p. 2)</p>
<p>Data-driven decision making [11]: The act of making rational decisions based on data instead of intuition</p>	<p>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)</p> <p>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)</p> <p>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)</p>
<p>Data-driven value creation [15]: An organization's actions with the ambition to create value through data (e.g., increased efficiency or product improvements)</p>	<p>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)</p> <p>[...] 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)</p> <p>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)</p>

Table 1: Derived DDO elements and sample quotes highlighting matching characteristics

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

Putting together the five central DDO elements that surfaced from our analysis of existing literature, the conceptual framework of a DDO emerges. Three of these five elements (*data sourcing & sensemaking, data capabilities, and data-driven decision making*) thereby represent revised versions of the three functions offered by Choo's (1996) framework of the KO, whereas two elements (*data-driven culture and data-driven value creation*) constitute novel additions. This supports that the DDO concept can be seen as a successor of Choo's (1996) framework of the KO, which has been revised and complemented to fit today's data- and technology-centric digital era. In particular, with the two added elements, the DDO framework empathizes the importance of a data-driven culture and introduces the element 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 concrete interaction of the individual elements becomes apparent when considering the two orientations in detail.

Outside-in view: Our results show that, similar to the KO, a DDO strives to make sense of its environment, processes the obtained information, and uses them to drive decision making, thereby demonstrating an outside-in focus. Naturally, however, these three elements operate considerably more data-centric. In line with Choo’s (1996) sensemaking function, the central purpose of the *data sourcing & sensemaking* element is to obtain data, filter them by their relevance, and harmonize and contextualize them. As DDOs inherently also create data internally, the reviewed DDO understandings highlight that the *sourcing & sensemaking* function should not only take into account data originating in the external environment, but also consider internal sources. Furthermore, due to today’s (overwhelming) amount of big data, the sourcing & sensemaking element additionally entails a data governance function to ensure quality, regulation, and protection of data. Closely intertwined with the sourcing & sensemaking element is the function of information processing. Whereas Choo (1996) describes this function as a human-centric knowledge creating process concerned with tacit knowledge, the concept of the DDO draws on *data capabilities* (i.e., tools, infrastructure, and experts) to process the obtained information in order to generate innovations, new capabilities, and actionable insights. The outside-in orientation of the conceptual DDO framework concludes with the element of *data-driven decision making*, which—similarly to Choo’s (1996) perspective—involves rational decision making. Contrary to the KO, however, the DDO does not only facilitate those decisions based on harmonized personal interpretations of incoming signals, but takes into account factual data, therefore providing an even more objective decision basis. However, to truly profit from the potentially increased objectivity and actually implement the mentioned DDO elements, every second reviewed DDO understanding highlights the need for a *data-driven culture* as an additional element, providing a shared understanding and purpose behind the required efforts.

Inside-out view: According to our analysis, DDOs demonstrate a new, fifth element concerned with (external) *data-driven value creation*, which is not reflected in Choo’s (1996) framework of the KO. This outwardly directed element 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 elements *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 element named *data-driven value creation* draws on new capabilities & innovations provided by the DDO’s *data capabilities* as well as goal-directed adaptive behavior caused by the *data-driven decision making* in order to achieve (external) data-driven impact.

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

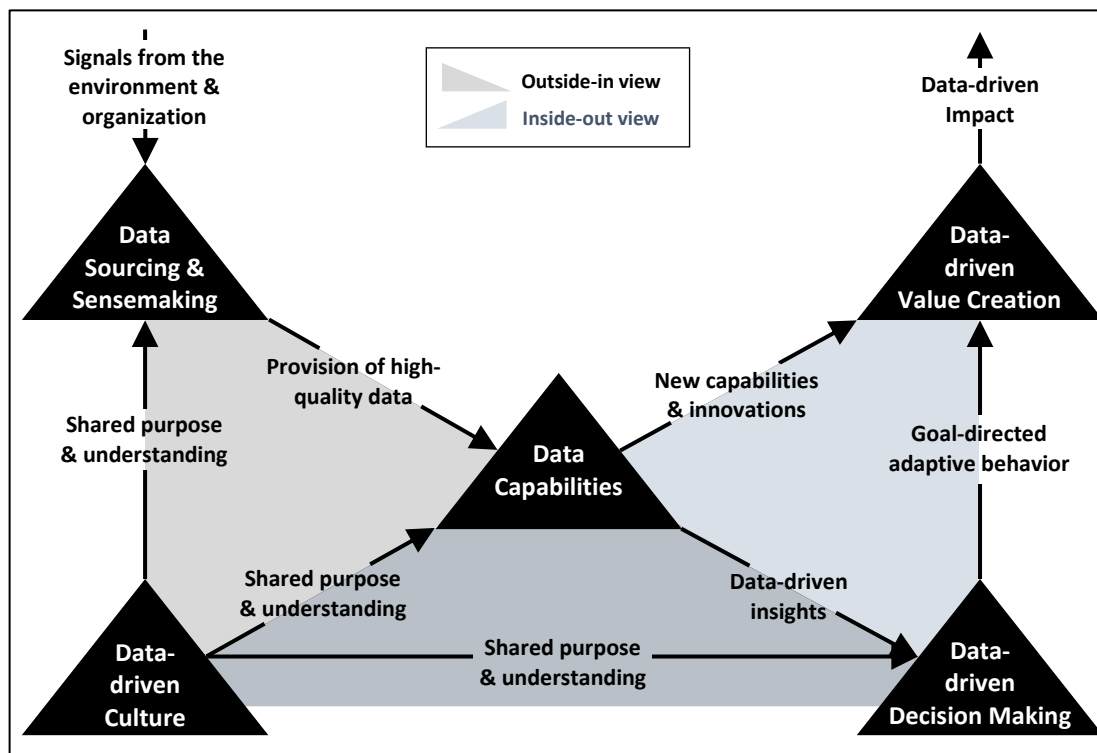


Figure 2: Conceptual DDO Framework

5 Contributions and Future Research Directions

The DDO concept has gained increasing relevance within IS research during the recent era of digital transformation, leading to a multitude of DDO definitions which vary considerably regarding their underlying DDO characteristics. The study at hand, therefore, sets forth 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 digital age organizations. By doing so, this study makes important theoretical contributions to the IS literature and also offers practical implications.

The *contribution* of our research is twofold. First, this study integrates and synthesizes existing DDO understandings through the identification of five central DDO elements (*data sourcing & sensemaking*, *data capabilities*, *data-driven culture*, *data-driven decision making*, and *data-driven value creation*). Second, we developed a conceptual DDO framework derived from the prevailing DDO understandings in the academic (as well as practitioner) literature, thereby updating and extending Choo's (1996) framework of the KO. Our DDO conceptualization demonstrates both outside-in and inside-out oriented elements and therefore provides an integrated theoretical basis for further research on the DDO phenomenon. For example, our conceptual DDO framework helps to clarify the distinction between a DDO and the related concept "data-driven business model" (DDBM). Both phenomena share data-driven value creation as a central element and one could argue that further DDO elements 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 demonstrate the other four elements 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 clearly matches 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 in order to sell or facilitate data. Hence, DDOs and organizations with a DDBM should not be treated synonymously. Finally, as a related practical contribution, our DDO framework can be used as a conceptual tool that may help practitioners define the target state by highlighting key DDO elements and their interrelations.

Regarding *limitations and future research directions*, we acknowledge that not all publications in our review sample had an exclusive scope on DDOs. Especially regarding publications for which DDOs are not in 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 focus of this study was mainly on the DDO elements themselves and, to a lesser extent, on the interplay among these elements. In this regard, one promising research opportunity could be configurational studies (e.g., fsQCA; c.f. Fiss 2011) to examine successful configurations of DDO elements. Relatedly, also different types of digital transformation processes towards a DDO could be further explored. In conclusion, we hope that our study results inform and inspire future research on the exciting topic of DDOs.

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Appendix

The appendix can be found online under <https://doi.org/10.6084/m9.figshare.20477313>.

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