

# Data-Driven Culture Requires Overcoming Data Governance and Data Literacy Challenges

Carlos Alberto Bassi<sup>1</sup><sup>a</sup>, Jacqueline David-Planas<sup>2</sup><sup>b</sup>, Solange Nice Alves-Souza<sup>2</sup><sup>c</sup>  
and Luiz Sergio de Souza<sup>3</sup><sup>d</sup>

<sup>1</sup>Information System, Escola de Artes, Ciências e Humanidades, Universidade de São Paulo, São Paulo, Brazil

<sup>2</sup>Departamento de Engenharia de Computação e Sistemas Digitais, Escola Politécnica,  
Universidade de São Paulo, São Paulo, Brazil

<sup>3</sup>Faculdade de Tecnologia de São Paulo, São Paulo, Brazil

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**Abstract:** Organizations are progressively working towards becoming data driven. To achieve this, they need to cultivate a comprehensive culture grounded in behaviors, practices, and training, while also ensuring governance in data sharing, collection, policies, tools, and processes. Data Governance (DG) and Data Literacy (DL) offer essential resources to support this cultural shift. However, the implementation of DG and DL faces a variety of organizational challenges. This study aims to identify and analyze these challenges, with a focus on their intersections and implications for building a sustainable Data-Driven Culture (DDC). The challenges for this research were derived from a scoping review of the literature of case studies on the implementation of DG and DL, complemented by data collected through a completed web form and interviews with professionals involved in the DG initiatives. The analysis revealed a significant overlap in the challenges of DG and DL, highlighting the importance of integrated strategies. Organizations that prioritize and address these shared challenges will significantly accelerate the development of a robust DDC and enhance the value derived from data.

## 1 INTRODUCTION

Data-Driven Culture (DDC) is understood as a pattern of behaviors and practices among a group of people who share the conviction that the availability, comprehension, and use of data and information are critical to their organization's success (Chaudhuri et al., 2024).

Becoming data-driven involves developing capabilities, tools and, crucially, a culture of acting based on data (Anderson, 2015).

For the past decade, becoming data-driven has been consistently identified as a top priority for organizations. Empirical evidence indicates significant benefits: data-driven companies demonstrate, on average, 5% higher productivity and 6% greater prof-

itability compared to their competitors (Storm and Borgman, 2020).

The findings suggest that Data Governance (DG) and Data Literacy (DL) precede DDC. Consequently, the research offers a significant theoretical contribution by providing empirical evidence and elucidating the role of DG as a precursor to DDC. Interestingly, despite the recognized importance of DG in managing data relevant to organizational decision-making, current literature lacks a clear understanding of the nomological network linking DG constructs and other analytical capabilities (Fattah, 2024).

DG encompasses the exercise of authority, control, and shared decision-making (planning, monitoring, and execution) in the management of data assets (Data Management Association, 2017). DG establishes policies, standards, processes and frameworks with the definition of roles and responsibilities that define and enforce the rules of engagement, decision rights, and accountability for the effective management of information assets (Putro et al., 2016; Al-

<sup>a</sup> <https://orcid.org/0009-0001-2524-7478>

<sup>b</sup> <https://orcid.org/0000-0001-7661-0401>

<sup>c</sup> <https://orcid.org/0000-0002-6112-3536>

<sup>d</sup> <https://orcid.org/0000-0002-7855-0235>

Dossari and Sumaili, 2021). According to Jim and Chang, the DG functions as a guided framework that should address organizational objectives and business processes (decision-making, culture and values), legal and compliance obligations (accountability), risk management (privacy and security), data management (data quality and metadata), and designated roles of individuals (data stewards and data owners) (Jim and Chang, 2018).

DL characterizes the ability to collect, manage, evaluate, and apply data critically (Ridsdale et al., 2015) and is often defined as the ability to transform information into actionable knowledge and practices through the collection, analysis, and interpretation of diverse data types (Koltay, 2015). DL improves purpose-specific data handling skills, encompassing the ability to select, clean, analyze, visualize, critique, interpret, and communicate data narratives, enabling effective data use (Wolff et al., 2016) as a foundation for organizational value creation (Ansyari et al., 2022).

Cultural challenges, including a lack of perceived data value and insufficient understanding and training in relevant concepts, technologies, and best practices, significantly impact the implementation of DG in organizations across different market segments and countries (Bassi and Alves-Souza, 2023).

Many organizations establish one initiative for the implementation of DG and another for building DL to implement DDC. However, many of the challenges faced by each of these initiatives are common and, when identified and addressed, can significantly reduce efforts and accelerate the achievement of the goal of becoming a data-driven organization.

This study addresses the following research questions:

- How do DG and DL relate?
- What are the challenges in implementing DG and DL?
- Are there shared challenges between DG and DL?
- DG and DL contribute to creating DDC?

## 2 CHALLENGES

**DATA-DRIVEN CULTURE** - Organizational culture profoundly influences all aspects of action, shaping decisions related to products, personnel, customers, measurements, and resource allocation. While certain leaders attempt to incorporate cultural norms through advanced technology, others may oppose cultural transformation. Furthermore, a change in the executive mindset requires promoting a DDC

by establishing governance strategies and mechanisms, as addressed by DG, and by fostering analytical skills, as supported by DL (Fattah, 2024).

Study conducted identified that there are two enabling factors of a DDC: (i) mandatory prerequisites include an established DG and access to high-quality data, as their absence diminishes trust in analytically derived business insights and obstructs the adoption of a DDC and (ii) active involvement of top-level management is critical to develop a strategic approach to establish a DDC (Berndtsson et al., 2018).

The complexity of DDC, as it is built on organizational cultures, lies in the challenge of achieving consistency with decision-making principles (Holsapple et al., 2014).

DDC encompasses established norms, values, and behavioral patterns of an organization, leading to a structured methodology to create, collect, consolidate, and analyze data. This involves making data available to relevant stakeholders, expanding their application for business development and decision-making, and facilitating management analysis, the acceptance of learning, and knowledge sharing. Moreover, DDC reflects an inclination towards the adaptation and improvement of work methodologies and decision-making informed by data (Duan et al., 2020).

**DATA GOVERNANCE** - Organizations face significant challenges in implementing comprehensive and efficient DG programs. Frequently, professionals involved in DG implementation projects lack adequate knowledge on the necessary activities, assignment of responsibilities, interdependencies between these activities, and the repercussions of their inadequate execution (Bassi and Alves-Souza, 2023).

According to Gartner's projections, by 2025, a significant majority (80%) of organizations that seek to scale up their digital business are likely to fail without the adoption of a contemporary strategy for DG and analytics (Fattah, 2024).

The complex nature of DG implementation, which requires long-term commitment and continuous engagement, typically leads organizations to develop a series of actions to realize these objectives (Zhang et al., 2022).

Organizations have faced practical challenges in mobilizing for the adoption of DG. Data inventory remains a cumbersome process, the potential for value creation is often seen as abstract, and the necessity of DG investment is generally acknowledged only after significant regulatory pressure or data breaches (Benfeldt et al., 2020).

A comprehensive analysis of the scientific and

practice-based literature indicates a fundamental lack of understanding about the activities essential for the establishment of a DG program (Alhassan et al., 2019).

**DATA LITERACY** - DL represents an approach that strengthens goal-oriented data handling skills, which encompasses not only technical competencies such as data preparation and analysis, but also the ability to communicate insights and apply data meaningfully in decision making (David-Planas et al., 2023). These practical competencies are embedded within broader personal, professional, and social contexts and must take into account ethical issues, subjectivity, and bias.

Connecting data with value involves a personal journey that requires changes in behavior and thought processes, contextual awareness, clarity of purpose, critical reasoning, and motivation (Smolnikova, 2022). Extrinsic factors such as collaboration, effective communication, and engagement with change management are also essential to ensure consistency of this transformation. Lacking the ability to contextualize, data analysis efforts are often misdirected or unfocused (Matthews, 2016).

Despite increasing recognition of the importance of DL, its practical development and evolution still face significant challenges. For instance, many professionals and organizations still lack the necessary competencies to extract value from data, thus limiting their potential to generate significant benefits (Frank and Walker, 2016). Furthermore, the absence of a well-established DDC within organizations, coupled with a lack of commitment from their leaders in this endeavor, contributes to the difficulty in implementing efficient data-based decision-making practices.

The Global Data Literacy Benchmarking 2023 (Data to the People, 2023) reveals that despite increased awareness of the topic, few professionals possess the skills to teach or assist others regarding the importance of a data-driven approach. This scenario underscores the urgency of promoting DL as a fundamental organizational competency that can be instrumental in creating competitive advantages and maximizing the value extracted from available data (Smolnikova, 2022).

### 3 RESEARCH

**DATA GOVERNANCE** - This stage involved conducting a Scoping Review (SR) of case studies to identify the main challenges facing organizations in the implementation of DG projects. The entire procedure followed, the analysis of the identified chal-

lenges, and the main findings is detailed in the article 'Challenges to Implementing Effective Data Governance: A Literature Review' (Bassi and Alves-Souza, 2023). A supplementary SR conducted, focusing on theses and dissertations that also addressed case studies of the implementation of the DG project, employing the same systematization adopted. Fifty-eight challenges were identified and subsequently categorized into 11 groups, displayed in Table 1.

Table 1: Challenges in implementing DG and DL.

| Category       | Challenge                                                   | Scoping Review |         | Professionals |         |
|----------------|-------------------------------------------------------------|----------------|---------|---------------|---------|
|                |                                                             | DG (58)        | DL (35) | DG (36)       | DL (26) |
| Data           | o Data Silos                                                | X              | X       | X             | X       |
|                | o Data Quality                                              | X              | X       | X             | X       |
|                | o Data Sanitization                                         | X              |         |               |         |
|                | o Data Standardization                                      | X              |         |               |         |
|                | o Data Volume                                               | X              | X       | X             | X       |
|                | o Life Cycle                                                | X              | X       |               |         |
|                | o Metadata                                                  | X              |         |               |         |
|                | o Master Data                                               | X              |         |               |         |
|                | o Data Collection                                           | X              |         |               |         |
|                | o Traceability                                              | X              |         |               |         |
|                | o Data Integration                                          | X              | X       |               |         |
|                | o Data Inventory                                            | X              |         |               |         |
|                | o Assignment of Responsibility / interest                   | X              | X       | X             |         |
|                | o Existing / Updated Documentation                          |                |         | X             | X       |
|                | o Data Diversity                                            |                |         | X             | X       |
| Security       | o Established Quality Criteria                              |                |         | X             | X       |
|                | o Identification of Relevant Data                           |                |         | X             | X       |
|                | o Consent                                                   | X              | X       |               |         |
| Policies       | o Confidentiality / Privacy                                 | X              | X       |               |         |
|                | o Sharing                                                   | X              | X       |               |         |
|                | o Data Governance                                           | X              | X       |               |         |
| Process        | o Data privacy and security                                 | X              | X       |               |         |
|                | o Data quality management                                   | X              |         |               |         |
|                | o Conflicts of interest                                     | X              |         |               |         |
|                | o Established / Updated Policies                            |                |         | X             | X       |
|                | o Well-defined / Clear Policies                             |                |         | X             | X       |
| Infrastructure | o Existing / Updated Documentation                          |                |         | X             |         |
|                | o Data quality control and monitoring                       | X              | X       |               |         |
|                | o Degree of harmonization                                   | X              | X       |               |         |
|                | o Variations in processes                                   | X              | X       |               |         |
|                | o Established / Updated Processes                           |                |         | X             | X       |
| Technologies   | o Existing / Updated Documentation                          |                |         | X             |         |
|                | o Well-defined / Clear Processes                            |                |         | X             |         |
|                | o Compatibility across platforms and standards              | X              | X       |               |         |
|                | o Use of external infrastructure                            | X              |         |               |         |
|                | o Alignment with application architecture                   | X              |         |               |         |
| Organizational | o Fragmented architecture with legacy systems               | X              |         |               |         |
|                | o Standardized Big Data systems                             | X              |         |               |         |
|                | o Existing / Updated Documentation                          | X              |         | X             | X       |
|                | o Diversity of Technologies / Environments / Systems        |                |         | X             |         |
|                | o Tool Support                                              | X              |         | X             | X       |
| Organizational | o Obsolete / Inadequate Infrastructure / Systems            |                |         | X             |         |
|                | o Implementation of Adjustments in Infrastructure / Systems |                |         | X             |         |
|                | o Existence of a Responsible Area / Department              | X              | X       | X             | X       |
|                | o Employee Turnover                                         | X              |         | X             |         |
|                | o Organization Size                                         | X              |         | X             |         |
|                | o Decentralized Structure                                   | X              |         | X             |         |
|                | o Growth speed                                              | X              |         |               |         |
|                | o Competitive edge                                          | X              | X       |               |         |
|                | o Expectation of short-term results                         | X              | X       |               |         |
|                | o Alignment / collaboration between organizational units    | X              | X       |               |         |
|                | o Local practices                                           | X              | X       |               |         |
|                | o Compliance with Laws / Regulations                        |                |         | X             | X       |
|                | o Management Support                                        |                |         | X             | X       |
|                | o Well-defined / Clear Strategy                             |                |         | X             | X       |
|                | o Constant Organizational Changes                           |                |         | X             | X       |
|                | o Financial Investment                                      |                |         | X             | X       |
|                | o Human Resources                                           |                |         | X             | X       |

Table 1: Challenges in implementing DG and DL (cont.).

| Category             | Challenge                                                                                    | Scoping Review |    | Professionals |    |
|----------------------|----------------------------------------------------------------------------------------------|----------------|----|---------------|----|
|                      |                                                                                              | DG             | DL | DG            | DL |
| Cultural             | o Perception of Value / Benefits                                                             | X              | X  | X             | X  |
|                      | o Understanding / Culture / Knowledge / Training in Concepts and Technologies involved       | X              | X  | X             | X  |
|                      | o Understanding / Training in Security and Privacy                                           | X              | X  |               |    |
|                      | o Knowledge of frameworks and best practices                                                 | X              | X  |               |    |
|                      | o Collaboration / information sharing with communities / third parties                       | X              | X  |               |    |
|                      | o Resistance                                                                                 |                |    | X             | X  |
|                      | o Employee Engagement                                                                        |                |    | X             | X  |
| Frameworks           | o Experience                                                                                 |                |    | X             | X  |
|                      | o Alignment / Communication                                                                  |                |    | X             | X  |
| Project              | o Adapted to the needs of the organization                                                   | X              | X  |               |    |
|                      | o Capacity to promote data sharing                                                           | X              |    |               |    |
|                      | o Organization-wide approach                                                                 | X              | X  |               |    |
|                      | o Existing and active Management Committee                                                   | X              |    |               |    |
|                      | o Engagement / commitment and/or resistance to the project / changes by those involved       | X              | X  |               |    |
|                      | o Experience / knowledge of the resources involved                                           | X              | X  |               |    |
|                      | o Understanding the activities required for a Data Governance Program                        | X              |    |               |    |
| Regulations          | o Perception of the benefits of conducting the project                                       | X              | X  |               |    |
|                      | o Limited resources and deadlines                                                            | X              | X  |               |    |
|                      | o Planning / Prioritization                                                                  |                |    | X             | X  |
|                      | o Policies / regulations on data processing                                                  | X              | X  |               |    |
|                      | o Policies / rules of control / regulation of the segment in which the organization operates | X              | X  |               |    |
| External Environment | o Antitrust                                                                                  | X              |    |               |    |
|                      | o Public interest in data                                                                    | X              |    |               |    |
|                      | o Transparency in the use of data                                                            | X              | X  |               |    |
|                      | o Privacy and Data Security                                                                  | X              | X  |               |    |
| End of Table 1       | o Political and/or institutional instability                                                 | X              | X  |               |    |
|                      | o Political support                                                                          | X              | X  |               |    |

Subsequently, within the scope of research to specify a guide with practical and coordinated actions that help organizations implement DG, data were collected through a web-based questionnaire administered to professionals from organizations that intend to implement or are currently conducting DG projects. The aim was to identify the main challenges that prevent organizations from conducting DG actions and the main challenges faced by organizations when conducting DG actions.

It was assumed that the research population should encompass organizations in different stages of DG implementation (initial stage, advanced stage, and planning), of varying sizes (small, medium, and large), and from diverse market segments.

To ensure comprehensive representativeness, a minimum population of 81 participants was estimated. This estimate accounted for at least 3 organizations for each of the 3 different sizes, each of the 3 different implementation stages, and each of the 3 different market segments. According to the National Education Association, the necessary sample size for research should be 82% of the defined population (Krejcie, 1970).

There was effective participation of 67 professionals, with the following profile (Bassi et al., 2024):

- More than 75% of the professionals have more

than 3 years of experience in DG.

- 85% work in medium to large-sized organizations.
- Professionals work in organizations across a wide range of market segments.

Thirty-six challenges were identified from interviews with professionals and subsequently grouped into 7 categories, as presented in Table 1.

**DATA LITERACY** - DL involves critical thinking and the development of multifaceted competencies that integrate data and contextual understanding, both at individual and collective levels, with the goal of generating meaningful impact in organizations (Kristiana et al., 2023; Prado and Ángel Marzal, 2013). A value-oriented approach to DL goes beyond technical or business skills by emphasizing the human dimension of data use.

(David-Planas et al., 2023) present preliminary findings from an ongoing scoping literature review aimed at exploring the challenges and critical success factors related to the promotion of DL. As part of this research, the authors posit that the connection between data and value necessitates a multifaceted approach involving, for example, behavioral and mindset shifts, continuous motivation, as well as the development of technical skills and contextual understanding of data use. Furthermore, extrinsic factors, such as collaboration, effective communication, resources, institutional sponsorship, and change management, are equally essential to ensure consistent and sustainable organizational transformation (DiLab et al., 2022; McCosker et al., 2022; Ansyari et al., 2022; Mandinach and Jimerson, 2016). These findings were further analyzed considering the challenges of DG outlined in Table 1, highlighting the interdependence between effective DL initiatives and robust DG practices.

## 4 ANALYSIS

The successful implementation of a DG program will create a DDC and, consequently, make the organization data-driven (Bassi et al., 2024).

Evaluating solely based on the quantity of DG and DL challenges identified from the SR that will impact the construction of DDC, 60.24% of the DG challenges are also DL challenges, as illustrated in Figure 1. When analyzing the challenges based on the validation of professionals, this percentage increases to 72.22%, as illustrated in Figure 2.

Figure 3 shows how frequently each challenge related to DG implementation was mentioned in the

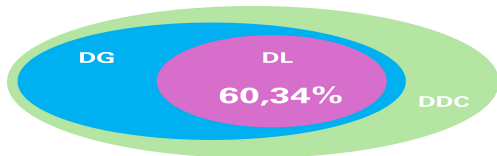


Figure 1: DDC Challenges (SR) [quantitative].

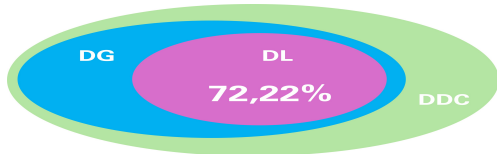


Figure 2: DDC Challenges (Professionals) [quantitative].

case studies analyzed in the DG scoping review. For clarity, only challenges cited more than once are included. Perception of the value of data as an asset, Understanding/Training in Concepts and Technologies involved in DG and Engagement/commitment and/or resistance to the project/changes by those involved constitute key challenges and are directly associated with DL and, consequently, also with data culture.

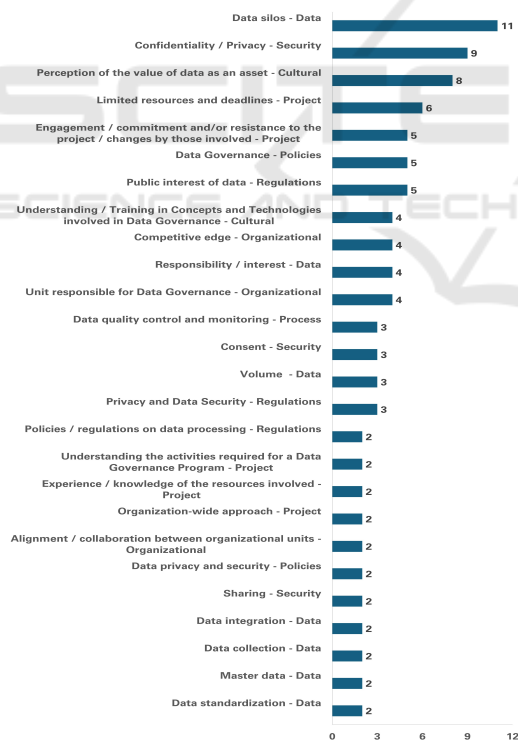


Figure 3: References of DG challenges from SR.

Figure 4 presents the number of references to the challenges in the implementation of DG according to the survey among the DG professionals. For improved visual clarity, only the chal-

lenges referenced more than ten times are included. According to the evaluation of DG professionals, the challenges directly associated with culture such as Culture/Knowledge/Training, Employee Engagement, Perception of Value/Benefits, Resistance and Alignment / Communication, tend to have greater relevance due to the direct experience gained during DG implementation.



Figure 4: Reference of DG challenges from Professionals.

Considering the number of references to the challenges, 77, 27% of the challenges of DG are also challenges of DL in SR case studies, as illustrated in Figure 5, and this percentage increases to 85,61% as illustrated according to the survey of DG professionals in Figure 6.

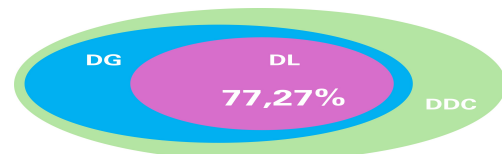


Figure 5: DDC Challenges (SR) [reference].

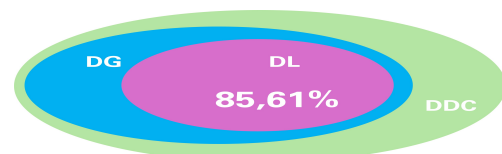


Figure 6: DDC Challenges (Professionals) [reference].

## 5 DISCUSSION

One solution identified in the literature for the successful implementation of DG is to train and improve DL for all personnel across organizations involved in the project (Kawtrakul et al., 2021)

The successful implementation of a DG program in organizations is significantly dependent on cultural aspects. These aspects comprise a framework of values, beliefs, and behaviors that dictate the organization's business practices and its relationships with customers and partners (Bassi and Alves-Souza, 2023).

A DDC should be developed through the participation of the entire organization, fostering employee interest and motivation. Furthermore, DDC must be implemented in an integrated way throughout the organization, rather than isolated silos (Anton et al., 2023).

Strong, top-down data leadership is essential for data-driven organizations. This leadership should inspire and promote a data-driven culture, actively driving and supporting all aspects of the analytics value chain, from data collection to data-driven decision-making and institutional learning (Anderson, 2015).

DG and DL are vital to encouraging and enabling data analysis within DDC. DG establishes decision-making rights and accountability to ensure appropriate behavior in managing organizational data, analytics, and information assets. Integrating DG with the overall business strategy and aligning it with data and analytical assets is critical for stakeholders. In the era of Big Data (BD), DG involves setting up and adhering to structures, rules, policies, and controls for data analysis activities (Fattah, 2024; Downes, 2023; Ifenthaler et al., 2021; Mandinach and Jimerson, 2016).

Human-centered and business value-driven DL aim to shift mindsets, transform organizational culture, and pave the way for the establishment of DG (Oliver et al., 2024; DiLab et al., 2022; Kristiana et al., 2023; Dangol and Dasgupta, 2023).

The significant interrelation between the challenges encountered in the implementation of DG and DL raises the question of which methods or technologies can facilitate their management and accelerate the establishment of a DDC.

In this scenario of rapid change and the growing need for agile data-driven decision-making, Artificial Intelligence (AI) has emerged as a potentially effective solution. The following examples illustrate their practical application:

- Traditional DG methodologies often depend on manual processes that are inherently time-consuming and susceptible to errors. In contrast,

AI-powered solutions automate a substantial portion of these tasks, thus enhancing efficiency and minimizing human fallibility. The capacity for real-time data analysis and continuous monitoring facilitates quicker responses to anomalies and security threats, a capability often unattainable to the same degree with conventional approaches. Moreover, AI's ability to process large volumes of data in real time and discern intricate patterns offers a distinct advantage over traditional methods (Azeroual, 2024).

- Generative models facilitate metadata capture, data lineage tracing, and enforcement of business rules involved in DG. In addition, they offer recommendations for data classification, access control mechanisms, and privacy compliance protocols, ensuring the adherence to corporate policies and the fulfillment of legal requirements (Sugureddy, 2023).
- The use of AI improves the agility, adaptability, and intelligence of DG frameworks, enabling organizations to proactively address the complexities and challenges inherent in contemporary data environments. AI automating processes such as quality inspections, metadata management, and compliance monitoring, thereby enhancing efficiency and consistency. Through advanced functionalities, including anomaly detection, decision support, and Natural Language Processing (NLP), AI algorithms improve an organization's data classification, tagging, and monitoring capabilities (Yandrapalli, 2024).
- The technological influence on data-driven decision-making will intensify as Machine Learning (ML) and AI intelligence systems provide recommendations derived from big data, including student keystrokes, progress, and learning outcomes recorded in educational platforms (Henderson and Corry, 2021).
- The integration of AI into Education enables the maximization of data utilization across various applications, such as data classification, chatbot deployment, academic performance assessment, dropout prediction, and learning personalization. This development signifies a substantial effort to improve efficiency, inform decision-making, and generate value within the educational sector (Dewi et al., 2024).
- The use of AI-driven tools not only supports inquiry-based learning by guiding learners through complex topics in ways that are customized to their cognitive pathways, thereby promoting the development of DL and making the

learning process more engaging (Picasso et al., 2024).

- AI enhances decision-making by extracting value from large datasets to identify trends, predict market movements, and optimize investment strategies, particularly in financial contexts (Picasso et al., 2024). It enables automated trading, improves credit risk assessments, and increases operational efficiency, reducing human error, and supporting more accurate data-driven decisions.

The successful deployment of AI systems requires a workforce that is both competent and adequately trained. Consequently, organizations must consistently invest in the continuous education of their staff to equip them with the required technical skills and knowledge (Azeroual, 2024).

## 6 CONCLUSION

The contribution of this research was to present the main challenges that organizations faced in conducting DG and DL implementation projects and for academic research, and to the extent to which these two disciplines are directly linked in the formation of a DDC.

Orienting and prioritizing the shared challenges of DG and DL will significantly contribute to the creation of a DDC. To achieve this, it will be necessary to coordinate actions and resources for the implementation of DG and DL, thereby realizing the benefits of becoming a data-driven organization.

The use of AI-based solutions will address many of the shared challenges identified in DG and DL, thereby facilitating the development of DDC.

One limitation in conducting this research was the absence of validation of DL challenges with experienced professionals from organizations that intend to implement or are currently conducting DL projects. A significant opportunity for future research is to perform a validation with specialized DL professionals.

Potential future work would involve investigating the effective utilization of AI in mitigating the challenges associated with DG and DL in practical contexts and assessing its contribution to the establishment of a DDC.

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