Fraunhofer ISST

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ISST-REPORT

DATA STRATEGY PRAXIS REPORT

TOOLS AND APPROACHES IN THE CURRENT DATA ECONOMY

■ ISST-Report

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TOOLS AND APPROACHES IN THE CURRENT DATA ECONOMY

The digital era continuously changes the way we live, work and interact. Data and Information are essential drivers of new technologies and innovations. In order to cope with rapid advances in the global market, organizations are forced to adapt to economic changes. Presence in the global market demands harmonized business processes across the entire organization and puts data as an enterprise asset in the heart of that. Organizations need to respond to strategic and operational challenges requiring high-quality data. To fuel their growth organizations are seeking new ways to exploit data and information assets.

Corporates throughout various industries need high-quality data and reliable data management processes in order to meet strategic business objectives and long-term goals. But still many enterprises are struggling in technically executing high data management standards. Too often these enterprises lag a data-driven culture, precisely a profound and long-term organization wide Data Strategy. Concretely, they miss a well-defined and executed Data Strategy to ensure that data is managed like an asset and used to its full potential.

The Fraunhofer Institute for Software and Systems Engineering ISST combines long-term scientific and economical experience in the fields of Data Management and sets high standards for its strategic approach. Our scientists are constantly seeking out new trends and setting high benchmarks to support organizations on their pursuit for well-defined offensive and defensive data strategies.
This work serves as an overview on what data strategy in economical environments mean and shows the full bandwidth of a skilful executed data strategy. It presents the current understanding of data strategy in various industries and domains and shows how the Fraunhofer ISST can assist you to initiate your journey to your individual data strategy.

ISST – Series of Reports:

Within the Series of "ISST Reports", the Fraunhofer Institute for Software and Systems Engineering ISST, publishes its white paper. Thematically, it examines trends and technologies in computer sciences and takes up innovative subjects from some of the Institutes research projects. They provide insights into the current state of research concerning "Data Ecosystems", Fraunhofer ISST's main research topic.

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REACH BUSINESS GOALS WITH AN EFFECTIVE DATA STRATEGY

An economic organization is measured on its own vision and goals. But too often organizations do not reach their objectives to the fullest satisfaction. A well-defined, long-term and organization wide data strategy enables the management of data as a valuable asset and therefore generates sustainable competitive advantage. It is a gateway for harmonized business processes, high value analytics and data-oriented value generation.

1
Reach business goals with an effective Data Strategy

Due to innovative technologies, society is constantly changing. These technologies change the way people live, act and communicate. The business world is also constantly evolving through digital technologies. They fuel the speed at which markets are changing due to changes in consumer tastes, increasingly shorter product life cycles, competitive movements, technological progress and globalization. Innovation is one of the most important ways in which companies can differentiate their products and services from the competition and thus maintain lasting growth (Wong et al., 2016). The establishment of various technologies and the application of information technology has created a new flood of data. Data is the basis for the digital economy. It not only enables new services, new customer acquisitions or new pricing models, but also provides decisive innovations in new markets (Otto und Österle, 2016). To regard data as an (strategic) asset, it has to be used, managed, analyzed, handled, governed and its quality has to be secured and maintained (Oppenheim, Stenson und Wilson, 2003, Davenport, Barth und Bean, 2012) continuously.

To consider the internal and external data assets of an organization as a valuable asset, companies face not only challenges but more important major opportunities. If a company excels in the way it manages and utilizes its data and includes it in its crucial decision making, it can strive for long term sustainable success and competitive advantage. A company's data strategy gives the general direction in that regard. It can serve as the foundation for future and present success and outline a roadmap for business intentions and goals. However, more often organizations fail to define a profound and distinctive far-reaching data strategy. Their data-thinking is often stuck in use case orientated ways and data silos hinder different parts of the organization to fully unfold their potential.

This report aims to assist organizations in the creation and design of their own unique data strategy. Therefore, it aims to fulfil three purposes:

- Define the purpose and scope of a data strategy, which perspective views and elements it contains and why it is relevant for the sustainable competitive advantage and success of the organization
- Give an overview of current data strategy tools in the economy, evaluate them and outline their key elements
- Identify open (research) questions and currently not adequate addressed elements for practitioners

In order to do that, this report is structured as follows:

- Conception and foundational definition of data strategy to give an overview about the topic and the relevant questions in order to address the existing challenges
- Market analysis of available reference models and methods for the design of such a strategy
- Comparison of available models and methods to derive common features, differentiations and white spots

2

DATA STRATEGY CONCEPT

The concept and definition of a holistic data strategy is well debated in science and economy. However, one thing is very clear: the relevance of data strategy for success. Many examples show how a well-executed and advanced data strategy leads to market success and organizational growth. Several scientific studies proof that the strategic approach for the management of data improves go-to-market metrics and maximizes strategic gain in the short and long run.

2
Data Strategy Concept

2.1
Relevance of Data Strategy

Before a profound definition of data strategy and its key elements is given, this section answers the question why a data strategy is relevant in the first place. To answer that, the Harvard Business Review Analytic Services conducted a survey on 189 business mainly based in the U.S. and ranging from 500-999 employees up to 10.000 or more employees. The conducted survey aimed at improving the understanding of the relationship between data strategy and business growth as well as how forward-thinking executives use data as a competitive advantage across their organizations. The results of the survey have been published by John Hurley in the Harvard Business Review (Hurley, 2018). The survey elaborates a distinct connection between a company's market performance and its data strategy state. Hurley concludes that 60% of executives say that their companies are highly focused on investing in data and data analytics and that 74% of companies with advanced data strategies have a better market position than competitors do. Furthermore, it is twice as likely for companies with advanced data strategies to achieve 30% revenue growth over the conducted time. Despite these implications, less than half of the surveyed companies say they have a confound data strategy (see Figure 1). These results are remarkable, since further survey analysis showed that companies with advanced data strategies are twice as likely (as those with below-average or poor data strategies) to report their revenues to grow more than 30% over the past two years. Only a marginal number of organizations with advanced strategies have flat or declining revenues whereas 37% of organizations with below-average strategies showed declining revenues.

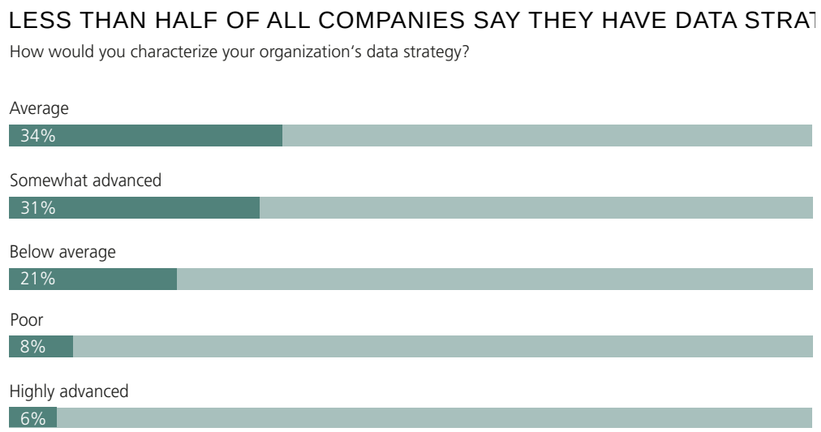

Fig. 1: Evaluation of companies' data strategy (Hurley, 2018)

While this survey shows that a significant margin of companies still lack an explicit data strategy and the determination for it, another survey published in the Harvard Business Review displays the barriers and obstacles of a profound data strategy. The Harvard Business Review Analytic Services published a survey conducted on

185 companies globally spread concerning the questions „Do companies have a data strategy that's working? If not, what's standing in the way?". The results concluded that 69% of participants say their organization needs a comprehensive data strategy in order to meet its strategic goals over the next three years, yet only 35% say their organization's analytics and data management capabilities are on course to meet those goals. It is said that in order to achieve the promise of an enterprise data strategy, organizations plan to dramatically increase their use of analytics and cognitive capabilities for everything from business intelligence to machine learning. Yet these organizations struggle with challenges like lack of analytical expertise, data silos, legacy technologies or lack of internal resources (see Figure 2). Half of the companies say they struggle with data silos, data sources and analytics skills. Only 4% expect their organizations to place high or essential priority on improving their data strategy or use advanced prescriptive analytics rather than descriptive analytic methods. (Hurley, 2018)

More than half of participants acknowledges these major challenges but stated a well-developed data strategy would be beneficial to meet their business goals and gain maximum value from their data. (Harvard Business Review Analytic Services, 2019)

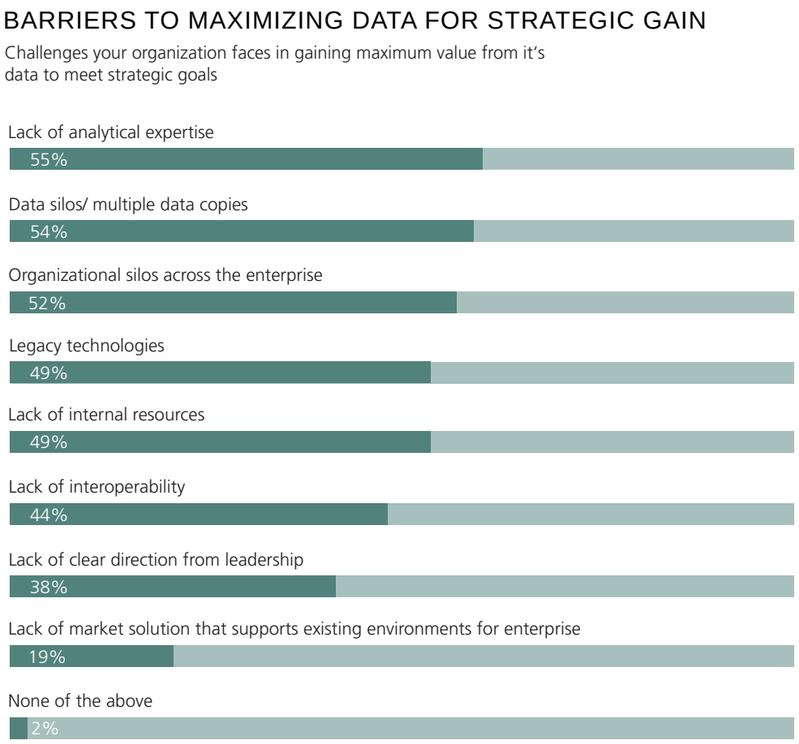

Fig. 2: Barriers to maximizing data for strategic gain (Harvard Business Review Analytic Services, 2019)

The two surveys display the relevance of a company's data strategy for a variety of reasons and advantages including sustainable competitive advantage and company growth. These advantages of a profound data strategy and the right use of data range from more customers, increased customer loyalty, bigger share of wallet to higher profit margins (see Figure 3).

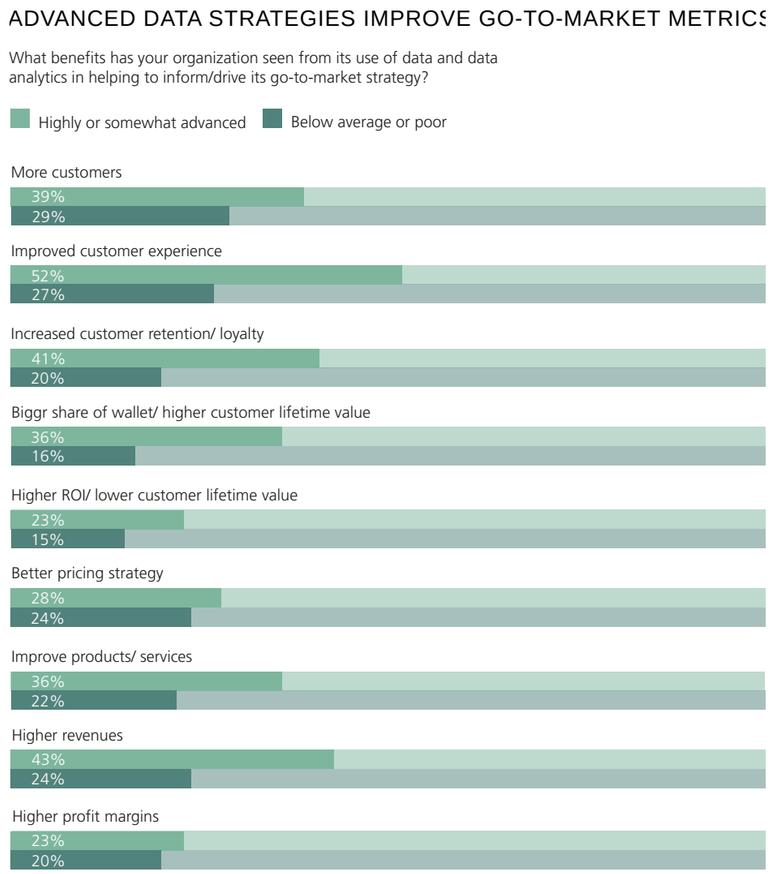

Fig. 3: Benefits of use of data in an advanced manner (Hurley, 2018)

2.2

Definition of Data Strategy

In order to examine a resolute definition of data strategy, scientific papers and publications of a variety of economic organizations have been utilized. After a brief analysis, it can be said that to the current state there is no widely accepted and general definition of data strategy throughout companies and scientists alike. One possibility to examine a strategy in that case is to work on the explicit term and yield different data strategy definitions and key elements. In regard to that, CHEN ET AL. (2010) refer in their study on information systems strategies to MINTZBERG (1987) and his work on the definition of the term "strategy". This definition contains five key aspects of a strategy, namely (1) a plan, (2) a ploy, (3) a pattern, (4) a position and (5) a perspective (Mintzberg, 1987, Chen et al., 2010). A data strategy therefore should include some or all of these aspects. One definition is given by Gurevich and Dey, which says:

"A data strategy is a common reference of methods, services, architectures, usage patterns and procedures for acquiring, integrating, storing, securing, managing, monitoring, analyzing, consuming and operationalizing data. It is, in effect, a checklist for developing a roadmap toward the digital transformation journey that companies are actively pursuing as part of their modernization efforts.

This includes clarifying the target vision and practical guidance for achieving that vision, with clearly articulated success criteria and key performance indicators that can be used to evaluate and rationalize all subsequent data initiatives. A data strategy does not contain a detailed solution to use cases and specific technical problems. Nor is it limited to high-level constructs intended only for senior leadership. Sustaining a successful data strategy requires executive sponsorship and governance for alignment with corporate objectives and enforced adherence. As corporate objectives evolve, so should the data strategy — keeping up not only with how the business is operating but also with how supporting technologies and related innovations are maturing." (Gurevich und Dey, 2018, S. 3)

PENTEK ET AL (2017) elaborated a reference model for data management in the digital economy. The reference model describes the design areas of data management and the key elements. It aims at structuring the main design areas of effective data management, while – at the same time – addressing the requirements of the digital and data-driven economy. During the elaboration, different fields like data governance, data architecture and data management are excerpted profoundly. Furthermore, a definition for data strategy, which plays the central role in their data management reference model, is given. The definition for data strategy sounds as follows:

"Data strategy defines the scope and objectives of data management and specifies the roadmap for providing the data management capabilities required"

According to LOTH (2017) publication in the Journal "Information – Wissenschaft & Praxis"[1], a data-driven strategy is deeply entangled with an organization's capability to analyze and implement data in its business strategy and decision making:

"In order to develop a data-centric strategy, it is first necessary to understand how a company conducts analyses and how it deals with the results: what data is collected, what happens to it and how does it affect our decisions? In a modern data strategy, there is no step in decision making that is not accompanied by analysis. This is the only way to ensure that investments in business intelligence and analytics are optimally placed at the service of the company's strategic goals. It is therefore essential to understand analytics as a vital part of your own data strategy and to plan accordingly."

MARR (2017) gives another definition on the terms of the creation of a data strategy:

"Creating a robust data strategy is one thing, but it must also be properly executed across the organization. Successful data strategy execution relies upon every layer of the company buying into the data strategy and understanding the importance of putting data at the heart of decision making and business operations. Business leaders should be looking to create a strong data culture across the company, with data being recognized as a key business asset. But a data strategy is not carved in stone – especially when you consider how fast the technology around data and analytics is moving. Instead, a good data strategy should evolve as new technologies are discovered and as the business's needs change. Therefore, you should revisit and renew your data strategy on a regular basis to ensure it meets the business's ongoing needs and challenges."

1 The journal „Information - Wissenschaft und Praxis (IWP)" published by DGI is a leading German-language journal in the fields of information science and information practice

Another valuable approach to data strategy is published in the Harvard Business Review by DALLEMULE and Davenport (2017). According to them, a data strategy is relevant for organizing, governing, analyzing and deploying an organization's information assets. Without such strategic management, many companies struggle to protect and leverage their data. Their article describes a framework for building a robust data strategy (DalleMulle und Davenport, 2017, S. 1). The framework (see Figure 4) identifies two possible stances for a data strategy. According to the authors, a data strategy has offensive and defensive elements. The authors define their idea of data strategy as follows:

"Data defense and offense are differentiated by distinct business objectives and the activities designed to address them. Data defense is about minimizing downside risk. Activities include ensuring compliance with regulations (such as rules governing data privacy and the integrity of financial reports), using analytics to detect and limit fraud, and building systems to prevent theft. Defensive efforts also ensure the integrity of data flowing through a company's internal systems by identifying, standardizing, and governing authoritative data sources, such as fundamental customer and supplier information or sales data, in a "single source of truth." Data offense focuses on supporting business objectives such as increasing revenue, profitability, and customer satisfaction. It typically includes activities that generate customer insights (data analysis and modeling, for example) or integrate disparate customer and market data to support managerial decision making through, for instance, interactive dashboards."

The data strategy aims to optimize data extraction, standardization, storage and access within the company. The data architecture is enabled by a single source of truth and the data management aims for maximum control. The offensive data strategy stance targets competitive position and profitability improvement. Main activities are the optimization of data analytics, modelling, visualization, transformation and enrichment. The data management sets for flexibility and the architecture relies on multiple versions of the truth. According to the author, companies need to set their data strategy fitting to the key objectives and permanently challenge their data strategy for readjustments. (DalleMulle und Davenport, 2017)

	Defense	Offense
Key objectives	Ensure data security, privacy, integrety, quality, regulatory compliance, and governance	Improve competetive position and profitability
Core activities	Optimize data extraction, standardization, storage and access	Optimizie data analytics, modeling, visualization, transformation and enrichment
Data management orientation	Control	Flexibility
enabling architecture	SSOT (Single source of truth)	MVOTs (Multiple versions of truth)

Fig. 4: The Elements of Data Strategy (DalleMulle und Davenport, 2017)

Data strategy is a ubiquitous topic and is discussed in a wide range of practical oriented publications. In order to find definitions of data strategy in these disseminations several companies and their insights, whitepapers and publications have been analyzed. Valuable results yielded for example SAS, which define data strategy as:

"A data strategy establishes a road map for aligning these activities across each data management discipline in such a way that they complement and build on one another to deliver greater benefits. A data strategy is a plan designed to improve all of the ways you acquire, store, manage, share and use data." (SAS, 2019, S. 4)

SIX ELEMENTS OF A DATA STRATEGY

Data Strategy Concept

SAS conclude with the five core components of a data strategy which are „Identify data and understand its meaning of structure, origin or location“, „Persist data in a structure and location that supports easy, shared access and processing“, „Package data so it can be reused and shared, and provide rules and access guidelines for the data“, „Move and combine data residing in disparate systems, and provide a unified, consistent data view“, “Establish, manage and communicate information policies and mechanisms for effective data usage“.

Wilder-James and Kurth from the company Silicon Valley Data Science give the following definition of data strategy:

„A modern data strategy is a roadmap to enable data-driven decision-making and applications that helps an enterprise achieve its strategic imperatives. An effective data strategy helps an enterprise make technology choices, grounded in business priorities, to get the most value from their data.“ (Wilder-James und Kurth, 2017, S. 13)

In the McKinsey& Company Quarterly publication “Three keys to building a data-driven Strategy“, Barton and Court give the following definition for a data strategy:

And as data-driven strategies take hold, they will become an increasingly important point of competitive differentiation. In our work with dozens of companies in six data-rich industries, we have found that fully exploiting data and analytics requires three mutually supportive capabilities. First, companies must be able to identify, combine, and manage multiple sources of data. Second, they need the capability to build advanced-analytics models for predicting and optimizing outcomes. Third, and most critical, management must possess the muscle to transform the organization so that the data and models actually yield better decisions. Two important features underpin those competencies: a clear strategy for how to use data and analytics to compete and the deployment of the right technology architecture and capabilities. Just as important, a clear vision of the desired business impact must shape the integrated approach to data sourcing, model building, and organizational transformation. That helps you avoid the common trap of starting by asking what the data can do for you. Leaders should invest sufficient time and energy in aligning managers across the organization in support of the mission.“ (Barton und Court, 2013, S. 1)

In addition Barton and Court name key elements of a data strategy which are “choose the right data“, “source data creatively“, “get the necessary IT support“, “build models that predict and optimize business outcomes“, “transform your company’s capabilities“, “develop business-relevant analytics that can be put to use“, “embed analytics in simple tools for the front lines“ and “develop capabilities to exploit big data“.

While the definitions of the individual authors differ in the choice of words and in details, partly due to the adoption of a different perspective and the background of the authors, some similarities can be identified. In order to define a general understanding of data strategy, we consolidated the crucial elements and key words of each data strategy definition. This analysis resulted in six general key elements supported by the various data strategy elaborations. In the following we would like to present these key elements.

1. Clear vision, mission and business objective alignment

A profound data strategy is based on a clear data vision, a perception of the organizations data value generation, general data management, its data culture and future state on data value creation and innovation. This vision is aligned with the business objectives and goals of the organization, in fact the data strategy is set out to support the business needs, objectives and goals. However, in order to support the entire business, a data strategy can suggest to define a new business model or new way of value creation. In any way, a data strategy articulates clear success criteria on how to achieve the data strategy objectives and support the business goals. A data strategy changes and assists the organization on how the business is operated and value is created with data. Furthermore, it defines the current state and the motivation for a data strategy based on organization maturity and primary constraints on data supporting the strategy.

A data strategy defines a clear data vision in alignment with and to support business objectives as well as defines success criteria	defines the scope and objectives	(Pentek, Legner und Otto, 2017)
	business objectives	(DalleMulle und Davenport, 2017)
	business priorities	(Wilder-James und Kurth, 2017)
	business's needs	(Marr, 2017)
	clarifying the target vision	(Gurevich und Dey, 2018)
	how the business is operating	(Gurevich und Dey, 2018)
	alignment with corporate objectives	(Gurevich und Dey, 2018)
	clearly articulated success criteria	(Gurevich und Dey, 2018)
	clarifying the target vision	(Gurevich und Dey, 2018)
	company's strategic goals	(Loth, 2017)

2. Long-term benefits and competitive advantage

A well-defined, developed and implemented data strategy carries several different long-term benefits along. The strategy ensures the integrity of flowing data and generates new insights and value. Thereby it supports and enables managerial data-driven decision making, which – carried out correctly – can create a sustainable competitive advantage. A data strategy can build the foundation to efficiently and effectively use ones data thus create the opportunity to operate more efficiently, increase value, improve profitability and raise customer satisfaction. Furthermore, a data strategy can enable the use of and the creation of new technologies and data management capabilities.

A data strategy generates a variety of long-term benefits and competitive advantages	increasing revenue, profitability, and customer satisfaction	(DalleMulle und Davenport, 2017)
	generate customer insights	(DalleMulle und Davenport, 2017)
	support managerial decision making	(DalleMulle und Davenport, 2017)
	data-driven decision-making	(Wilder-James und Kurth, 2017)
	ensure the integrity of data flowing	(DalleMulle und Davenport, 2017)
	new technologies	(Marr, 2017)
	data management capabilities	(Pentek, Legner und Otto, 2017)

3. Constitution of a road map and objectives

A clear data vision and articulated success criteria are the foundation of a profound data strategy. A data strategy does not only define these fundamentals but also sets out a plan to achieve them. In form of e.g. a road map, the data strategy sets out strategic imperatives to create a framework and scope for future data activities and objectives. In order to establish a well-defined and successful data strategy, a road map needs to be developed and pursued. In that manner, the data strategy road map targets key performance indicators, goals and objectives as well as data strategy enablers like people, technology and organizational capabilities around the data lifecycle. The road map can not only define data requirements and strategic imperatives but also rationalize use cases into workloads or map business objectives to certain use cases as well as set an action plan.

A data strategy constitutes an action plan to achieve the data strategy objectives	specifies the roadmap	(Pentek, Legner und Otto, 2017)
	road map	(SAS, 2019)
	plan	(SAS, 2019)
	a roadmap	(Wilder-James und Kurth, 2017)
	strategic imperatives	(Wilder-James und Kurth, 2017)
	developing a roadmap	(Gurevich und Dey, 2018)
	plan accordingly	(Loth, 2017)

4. Organizational and technological assessment and change management

Establishing an organization-wide data strategy involves notable changes in various fields regarding technological, organizational or data analytical/management areas. In order to develop and integrate a data strategy into the general business activities, a company might need to transform its data capabilities and IT support. Therefore, to choose the right data, enable data sourcing and successful model building, technology choices need to be made and business-relevant analytics need to be developed and integrated. If data is not at the heart of one's value creation process, the organization's entire approach on data needs to be assessed and challenged. Different indications and actions need to be conducted to define the current data state and maturity of the organization. Preparing for change and determining how to work requires the identification and exploitation of current constraints in the data value generation, data architecture, infrastructure, management and governance.

Establishing a data strategy requires several data-related organizational, technological and analytical measures of assessment and change	choose the right data	(Barton und Court, 2013)
	transform your company's capabilities and IT support	(Barton und Court, 2013)
	data sourcing and model building	(Barton und Court, 2013)
	develop business-relevant analytics	(Barton und Court, 2013)
	using analytics	(DalleMulle und Davenport, 2017)
	supporting technologies	(Gurevich und Dey, 2018)
	putting data at the heart	(Marr, 2017)
	understand analytics	(Loth, 2017)
	make technology choices	(Wilder-James und Kurth, 2017)

5. Long-term and organization-wide data strategy establishment

A data strategy challenges the way an organization approaches and uses data. In order to create a strong data culture across the organization and to mature new data innovations, a data strategy seeks for an organization-wide transformation. Additionally, just like business objectives evolve, so does a data strategy. It needs to be revisited and renewed on a regular basis, asking constantly if the data strategy still supports the business objectives. Therefore, a data strategy is a long-term intention, setting deep roots and supporting data-driven value creation throughout the organization, breaking up data silos and mavericks.

Establishing a data strategy is a long-term and organization-wide transformation in order to mature innovations and a strong data culture	across the organization	(Barton und Court, 2013)
	on a regular basis	(Marr, 2017)
	organizational transformation	(Barton und Court, 2013)
	supporting innovations	(Gurevich und Dey, 2018)
	strong data culture	(Marr, 2017)
	As corporate objectives evolve, so should the data strategy	(Gurevich und Dey, 2018)
	related innovations are maturing	(Gurevich und Dey, 2018)
	across the organization	(Marr, 2017)
	revisit and renew	(Marr, 2017)

6. Sets boundaries and objectives for data management

A successful data strategy requires the support of a data sponsorship and governance. In that regard the data strategy serves as a common reference for data management disciplines like data architecture, services, methods, usage, governance and procedures. It defines the goals, objectives and how to improve the way the organization acquires, stores, manages, shares and uses data. In that way, the data strategy is most optimal when it is complement, improving and built on the data management respectively data governance. Furthermore, it identifies, standardizes and governs secure and authoritative data sources. However, a data strategy sets the framework and goals for data management and data governance, it does not precisely specify it during the development of a profound data strategy.

A data strategy sets the framework and goals for the data management and data governance	acquire, store, manage, share and use data	(SAS, 2019)
	executive sponsorship and governance	(Gurevich und Dey, 2018)
	compliance with regulations	(DalleMulle und Davenport, 2017)
	authoritative data sources	(DalleMulle und Davenport, 2017)
	complement and build on one another	(SAS, 2019)
	identifying, standardizing, and governing	(DalleMulle und Davenport, 2017)
	applications	(Wilder-James und Kurth, 2017)
	simple tools	(Barton und Court, 2013)
	common reference of methods, services, architectures, usage patterns and procedures	(Gurevich und Dey, 2018)
	data management discipline	(SAS, 2019)
	acquire, store, manage, share and use data	(SAS, 2019)
	requires executive sponsorship and governance	(Gurevich und Dey, 2018)
	compliance with regulations	(DalleMulle und Davenport, 2017)

3

DATA STRATEGY MARKET ANALYSIS

We conducted a market analysis to exhibit how different companies in various industries and domains interpret data strategy. For that, we analysed several data strategy tools and insights that circulate in today's economy. These tools provide a comprehension of key elements and crucial parts of data strategies as well as point out the variety of approaches. This serves as an overview on how data strategy can support your business objectives and provide great benefits.

3
Data Strategy Market Analysis

We conducted a market analysis to find relevant data strategy tools that can be used by practitioners to design their data strategy and derive implications for their company and business. In the following chapter, this market analysis will be presented. For that, section 3.1 explains the market procedure and is followed by the market analysis results presented in section 3.2.

3.1
Market Analysis Procedure

In the second chapter we elaborated why a well-developed and fully applied data strategy is not only relevant but also essential for companies and organizations to have sustainable success and competitive advantage. In this chapter we want to further elaborate what tools are available for organizations to support them while developing their own data strategy. Therefore, we conducted a market analysis to find the most recent data strategy tools and frameworks which can currently be used by the companies. For that market analysis we pursued two goals. Firstly, we provide an overview of companies and organizations that offer data strategy tools. We give insights of their organizational key facts and point out their domains to better understand their perspectives and how they operate. Second, we elaborated their specific data strategy tools and offerings. To answer the first search question, we analyzed a variety of economic journals, consulting companies and service companies in different branches and economic areas. We applied different key words in google search to find companies and organizations that are active in the field of data strategy, digital strategy, digital transformation, strategy and technology consulting, change and process improvement, IT consulting and cyber solutions. We analyzed well-known consulting companies like Boston Consulting Group or Booz Allen Hamilton, Finance, IT and Data Service companies like IBM or Wirecard and scientific consulting organizations like CDQ AG or Measurelab Ltd. The search yielded several results, which were analyzed, parsed and evaluated, to extract relevant findings and examples. In order to answer the second analysis question, we searched in reports, white papers, websites and insights published by the selected organizations and companies. We analyzed these publications in terms of data strategy frameworks, tools, elaborations and developments. These results were taken into further examination to evaluate whether the tools were current, branch-specific, extensive, practical and useful. The analysis provided valuable results, covering a variety of branches and cross-cutting industries. Beyond that, the tools display different forms, ranging from fully applicable road maps to strategic canvases. The goal of this search was to conduct a well decided, profound and structured analysis, which secures the necessary rigor and depth. In the following section the most valuable results will be examined and presented.

3.2
Overview of current Data Strategy Tools in the Economy

The following section serves as an overview on data strategy frameworks and tools in the current economic environment. Several organizations with their respective data strategy approaches will be outlined, explained and eventually evaluated. While there are several different tools and frameworks on data strategy, we based the following selection on the general tool quality and assorted criteria concerning the establishment of the organization in the respective domain as well as success factors like time of foundation or company size.

1) Booz Allen Hamilton Data Strategy Framework

Vendor	Booz Allen Hamilton
Headquarter	McLean, VA
Domain	Management-Consulting
Founded	1914
Employees	26300
Website	http://www.boozallen.com
Published	2017

Booz Allen Hamilton is a strategy and technology consulting company that provides management and technology consulting as well as engineering services to leading Fortune 500 corporations and governments. Founded in 1914, the global firm employs over 26000 people with expertise in consulting, analytics, digital solutions, engineering and cyber transformation for industries ranging from defense to health to energy and international development. In 2017 the company published their data strategy framework (see fig. 14), conducted by the vice president for data solutions and machine intelligence and several associates. The framework aims to lead organizations through their data to drive business outcomes and realize a quicker, greater return on investment centered on the data lifecycle. The framework starts with an organization's data vision, which includes its planned achievements with data in support of its broader business and mission needs. The framework then centres on the six phases of the data lifecycle and defines clear data goals, identifies key people and technology and considers cultural implications for each data lifecycle phase. Eventually, data governance and data management underpin the framework and define the functions that ensure oversight, control, and execution of these data activities. The framework encourages organizations to structure and develop their data strategy around six data lifecycle phases, putting data on the main stand to support business goals and enable business objectives. According to the authors, this approach allows organizations to ensure the consideration of unique data lifecycle nuances required to treat data as a true asset. Additionally, it provides organizations with a certain level of flexibility as they can freely tailor their approach to match the realities that exist within their data environment.

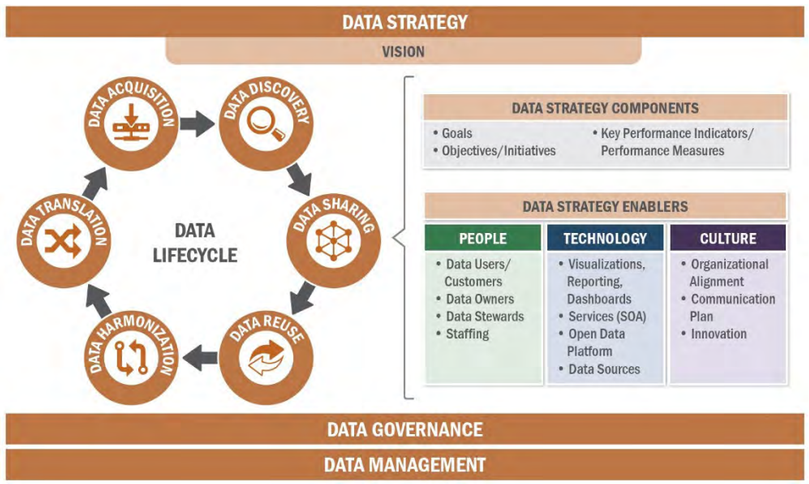

Fig. 5:
Booz Allen Hamilton Data Strategy Framework (https://www.boozallen.com/s/insight/thought-leadership/a-framework-to-guide-your-data-strategy.html)

2) CDQ Data Strategy Canvas and Reference Model

Vendor	CDQ AG
Headquarter	St. Gallen, St. Gallen
Domain	IT and Services
Founded	2006
Employees	11-50
Website	https://www.cdq.ch
Published	2019

The CDQ AG, formed in 2006, is a company specialized in data quality, data sharing and data management. They offer many services, solutions and publications in that regard. These publications include the data strategy canvas (see figure 7) and the data management reference model (see figure 8).
In 2019, Prof. Dr. Christine Legner and Tobias Pentek from the CDQ published the data strategy canvas. The canvas helps operators to define the key elements and sets building blocks of a respective data strategy. The canvas itself contains of seven areas. The area "need for action" defines the motivation for a data strategy, derived from the current state of data usage in the company. The area "vision" defines the aspiration for data and its future role. The area "Mission and scope" defines the boundaries and purposes of the data initiative. The area "business value" explains how data contributes to business success. Furthermore, the key capabilities in terms of people roles and responsibilities, similar to data governance, are set. The code of conduct and transformation areas define the implementation and mind-set of the data strategy. Similar to the preceding tool, this canvas is filled in the described sequence actively during a team cooperation with profound discussions and revisions.

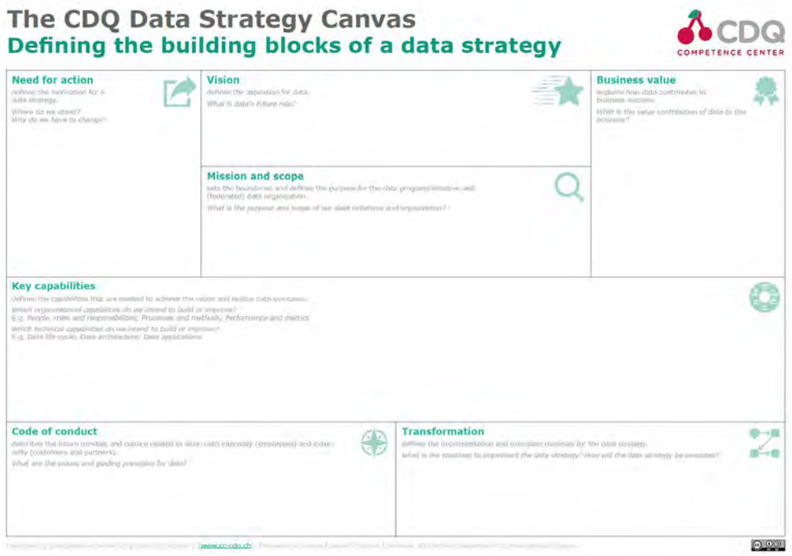

Fig. 6:
CDQ Data Strategy Canvas (https://www.cc-cdq.ch/request-publications#16)

The data management reference model organizes design areas for data management in three categories – goals, enablers and results – which are linked in a continuous improvement cycle. In the centre of the reference model is the data strategy (as defined in section 1.2). It serves as the guideline and sidepost for all activity in data management. The goals define the strategic direction for the data management. Enablers facilitate the goals and the results measure the achievement of the goals. The dynamic nature of the model recommends a process to adjust the goals and improve the enablers (see figure 8) (Pentek, Legner und Otto, 2017, S. 78).

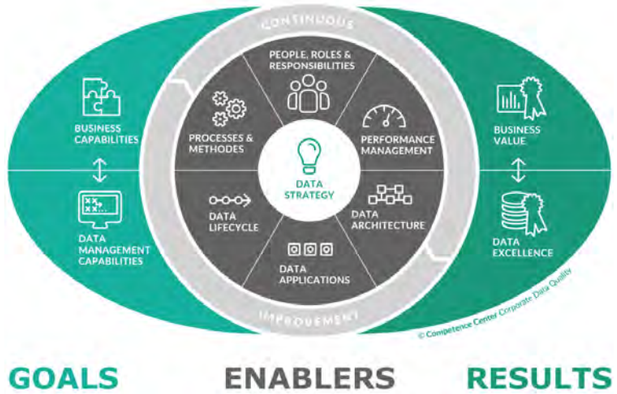

Fig. 7:
Data Management Reference Model (Pentek, Legner und Otto, 2017)

3) Measurelab Data Strategy Canvas

Vendor	Measurelab
Headquarter	Lewes, East Sussex
Domain	Internet and Consulting
Founded	2013
Employees	11-50
Website	https://www.measurelab.co.uk
Published	2018

Founded in 2013, Measurelab Ltd. is a data and marketing analytics consulting company, specialized in data analysis and optimization, data collection and engineering. One of their services includes the Data Strategy Canvas (see figure 16). The canvas is familiar to the business model canvas published by Strategyzer[1]. It serves as a tool to determine the company's data strategy whether the organization focuses on an offensive or defensive stance in the data strategy. The canvas starts in the centre with the data strategy goal and works from there on outwards. First the applicant defines how the data strategy will support the business goals in an offensive and defensive manner, since, according to the authors, the goal for the data strategy is determined by the business model and business goals. In the next steps, the canvas helps the applicant define its needed tools and technologies, data sources, skills, capabilities and channels to fulfil his data strategy. To support these determinations, a comprehensive view on the customers and data suppliers is conducted, before strengths and weaknesses in terms of advantages and threats are specified.

1 (https://www.strategyzer.com/canvas/business-model-canvas).

Fig. 8:
Measurelab Data Strategy Canvas (https://www.measurelab.co.uk/blog/what-is-a-data-strategy-and-do-i-need-one/)

4) Boston Consulting Group Data Comprehensive Model

Vendor	Boston Consulting Group
Headquarter	Boston Massachusetts
Domain	Management-Consulting
Founded	1963
Employees	10001+
Website	http://www.bcg.com
Published	2017

The Boston Consulting Group is globally one of the biggest management and strategy consulting companies. They published a Data Comprehensive Model in which the data strategy is defined in the first key issue "vision". The data strategy in this model defines the reasoning in why one is interested in data, the goals of the data strategy and clarifying if the data strategy improves current practices or forces a radical transformation. In this model, the data strategy defines the use cases and the analytics methods. Furthermore, it determines the data governance in terms of measured data quality indicators, data management organization and basic data hygiene actions. Ultimately the data strategy gives road for the data infrastructure and data technologies (see figure 10). The framework is applied in five critical steps, working the figure from top to bottom. In step one a vision for the business is set, in step two use cases for a portfolio of initiatives are determined, in step three an analytics operating model is devised, specifying how the data analytics functions are supposed to work. In step four a data governance structure and strict data governance rules are established before crucial decisions concerning the data infrastructure are made. The framework supports the applicant in each and every step.

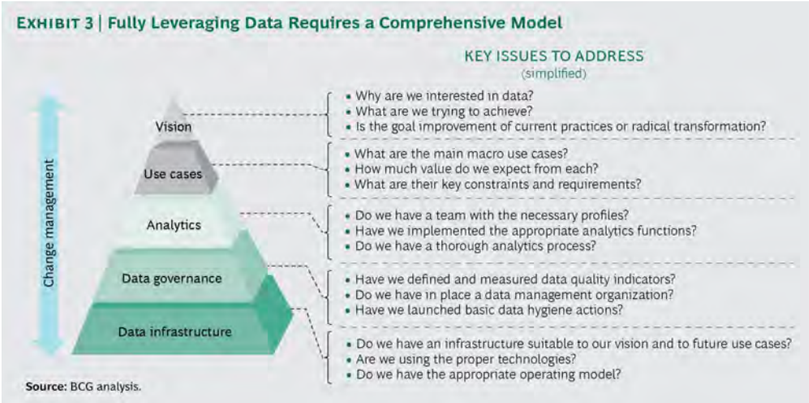

Fig. 9:
BCG Data Comprehensive Model (https://www.bcg.com/publications/2017/digital-transformation-transformation-data-driven-transformation.aspx)

5) Keller Schroeder Data Strategy Framework

Vendor	Keller Schroeder
Headquarter	Evansville, IN
Domain	IT and Service
Founded	1978
Employees	51-200
Website	http://www.kellerschroeder.com
Published	2019

Keller Schroeder is an information technology consulting services firm, a reseller and a systems integrator of hardware and software products. Founded in 1978, Keller Schroeder employs around 200 people and serves clients in cross-industry markets ranging from manufacturing, finance, utilities and healthcare. Their field of expertise ranges from infrastructure solutions, application development IT consulting, cyber security, data strategy and more. Keller Schroeder operates in the performance improvement business and aims to leverage technology tools and services to help their clients achieve their objectives more successfully.
The company published a data strategy road map as they define data strategy as the organizational capability to manage the data lifecycle and apply Advanced Analytics to business operations to extract value from data assets. The data strategy framework aims to guide organizations in developing their own data strategy so that they max effectively navigate the next ten-year horizon. According to the authors, implementing a data strategy is a significant culture shift for many organizations as new insights and new ideas will challenge decision-making. The framework (see fig. 10) relies on key organizational capabilities such as data literacy, data governance, data quality improvement, data self-service etc. It is structured in six phases, with key activities and outcomes for each phase. The phases are divided into subsequent sequential activities. Published with the framework, Kellerschroeder added abstracts to each phase, which include the description of the phase, key considerations, implementation information and exhibits, figures, tools and templates.

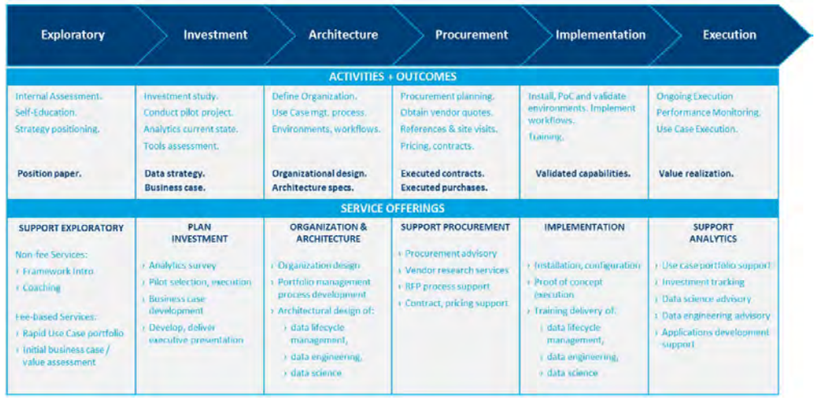

Fig. 10:
Keller Schroeder Data Strategy Road Map (https://www.kellerschroeder.com/data-strategy-framework/)

6) Global Data Strategy Framework and Roadmap

Vendor	Global Data Strategy Ltd
Headquarter	Boulder, Colorado
Domain	Management-Consulting
Founded	2015
Employees	2-10
Website	http://www.globaldatastrategy.com
Published	2017

Global Data Strategy ltd. is an international information management consulting company specializing in the alignment of business drivers with data-centric technology. In 2019 Donna Burbank published a data strategy framework and a data strategy road map & assessment to help her clients understand the relationship between data strategy and data management, as well as illustrating areas where their organization may need to mature to use data in the most strategic way possible. The framework (see figure 12) consists of five levels. To apply the framework, the levels are conducted from top to bottom to illustrate the client areas where the organization may need to mature to use data in the most strategic way possible. The first level defines an alignment of business priorities and data strategy. In this case either the business strategy drives the data strategy or the data strategy enables new business possibilities. In the second level, the data governance in terms of managing people, processes, policies and culture around data is defined. The data governance puts the data strategy into practice. The third level is about leveraging and managing data for strategic advantages. It defines data management practices such as data quality, master data management and data warehousing. The fourth level addresses the coordination and integration of external and disparate data sources. The management and inventory of data sources is defined in the fifth level.

Fig. 11:
Global Data Strategy Framework (https://globaldatastrategy.com/our-services/data-strategy/)

In addition to the framework, the Global Data Strategy ltd. published a data strategy road map consisting of several minor tools to align the business and data strategy, assess the current state, propose future state and perform the roadmap (see figure 13).

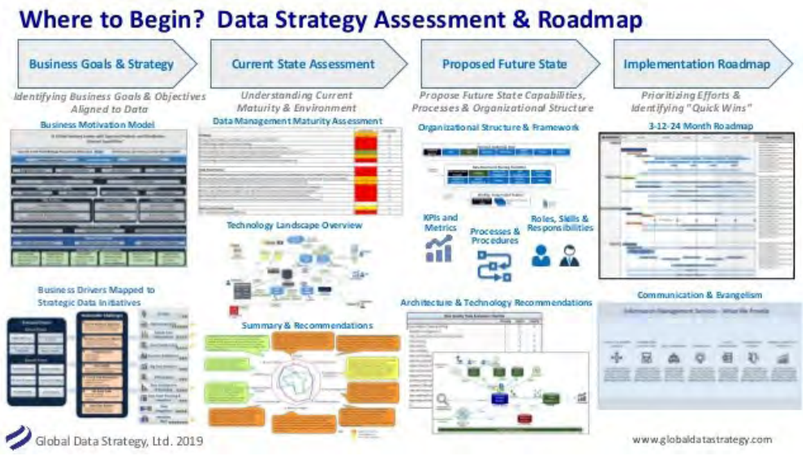

Fig. 12:
Global Data Strategy Roadmap (https://globaldatastrategy.com/our-services/data-strategy/)

7) IBM Big Data Hub Maturity Model

Vendor	IBM
Headquarter	Armonk, New York, NY
Domain	IT and Services
Founded	1911
Employees	10.001+
Website	http://www.ibm.com
Published	2014

IBM is an IT and consulting company with its headquarters located in New York. The IBM Big Data Hub is their communication and publication platform for general big data topics. On this platform, IBM published a big data & analytics maturity model that helps organizations assess their current capabilities in order to generate value from big data investments in support of strategic business initiatives.

Even though this framework is not a data strategy tool in particular, its aim is to support the user to understand the current state of data capabilities in the organization in order to meet the organization's business objectives. In that manner, this framework accomplishes the key element of a data strategy, namely assessing the current state in order to find gaps, which need to be addressed to reinforce the business objectives and goals. Therefore, this framework is a well-appointed tool to help users work towards and create their organization's data strategy. The maturity levels are divided in five stages for six areas. With this tool a company can assess not only its data-driven business strategy but also its information and analytics system, its data culture and execution, data architecture and data governance. Each of the six areas in the model is targeted individually by using assessment methods like interviews and questionnaires to receive a clear view of the current state of the data culture within an organization. The framework serves as a tool to not only form a considered assessment of the desired target state but also to identify gaps and provide a guidance on the steps required to realize the end state. Current weaknesses can be identified in order to establish a data-driven business strategy and perform the needed transformations in the respective fields.

	Ad hoc	Foundational	Competitive	Differentiating	Breakaway
Business strategy	Big data is discussed but not reflected in business strategy whose use of data extends simply to financial and regulatory reporting.	The business strategy recognizes that data can be used to generate business value and ROI, though realization is largely experimental.	The business strategy encourages the use of insight from data within business processes.	The business strategy realizes competitive advantage using client-centric insight.	Data drives continuous business model innovation.
Information	The organization uses its historical structured data to observe its business.	Information is used to effectively manage the business.	Information is applied to improve operational processes and client engagement.	Relevant information in context is used as a differentiator.	Information as a strategic asset.
Analytics	Analytics are limited to describing what has happened.	Analytics are used to inform decision makers why something in the business has happened.	Analytical insight is used to predict the likelihood of what will happen to some current business activity.	Predictive analytics is used to help optimize an organization's decision making so that the best actions are taken to maximize business value.	Analytical insight optimizes business processes and is automated where possible.
Culture and Execution	The application of analytical insight is the choice of the individual and has little effect on how the organization operates.	The organization understands the causes behind what they observe, but its culture is largely resistant to adapting to take advantage of the insight.	The organization is able to make limited business decisions using analytical insight to improve operational efficiency and generate more value.	Decision makers are well informed with insight from analytics and the organization is capable of acting to maximize resulting business value.	The organization and its business processes continuously adapt and improve using analytical insight in line with strategic business objectives.
Architecture	The organization does not have a single, coherent information architecture.	Information architecture framework exists, but does not extend to new data sources or advanced analytics capabilities.	Best practice information architectural patterns for big data and analytics are defined and have been applied in certain areas.	Information architecture and associated standards are well defined and cover most of the volume, velocity, variety and veracity capabilities and structured/unstructured consumption needed for differentiation.	Information architecture fully underpins business strategies to enable complete market disruption with volume, velocity, variety and veracity specifications applied.
Governance	Information governance is largely manual and barely sufficient to stand up to legal, audit and other regulatory scrutiny.	Understanding of data and its ownership are defined and managed in a piecemeal fashion.	Policies and procedures are implemented to manage and protect core information through its life in the organization.	The degree of confidence in information and resulting insights is reflected in decision making.	Information governance is integrated into all aspects of the business processes.

Fig. 13:
IBM Big Data Hub Data Analytics Maturity Model (https://www.ibmbigdatahub.com/blog/big-data-analytics-maturity-model)

8) Breakthrough Data Strategy Canvas

Vendor	Breakthrough Healthcare
Headquarter	Ellicot City, Maryland
Domain	Health & Hospital
Founded	2018
Employees	1-10
Website	http://breakthrough.healthcare
Published	2019

Breakthrough Healthcare is a consulting and data analytics company that provides organizational strategy services, clinical registry services and dataset measure development for medical societies and healthcare associations.

In association with the Quality Clinical Data Registry they designed the data strategy canvas and framework to quickly surface organization's priorities, data opportunities and innovative ideas that will serve as the foundation of the corresponding data strategy.
The canvas (see figure 5) consists of six sections with respective sublevels. The first section deals with the data strategy mission, therefore helps to navigate your overall goals of your data strategy and your data activities. The second section defines the company data goals. They conclude that an effective data strategy breaks down departmental barriers and uses data to the benefit of the entire organization and its stakeholders. The stakeholder section includes direct and indirect stakeholders that could benefit from the data strategy goal. In the landscape section the applicant scans the partners, competitors, opportunities and threats that might occur with the new data strategy. The fifth section defines the data that should be captured, stored analysed and used, in dependence of your previous sections. It considers existing data in your company and new data that should be acquired. The last section defines the solutions, the creative and analytical process of combining everything captured into potential programs, products, services, or initiatives.
The canvas is most effectively used actively in a team using sticky notes in a workshop environment. It is filled from left to right and from top to bottom. After filling in your mission at the top, the users work their way through each section of the canvas, from Goals, Stakeholders, Landscape, Data, and finally, Solutions. It is recommended to plan sufficient effort for evaluation, discussion and reflection to refine the canvas.

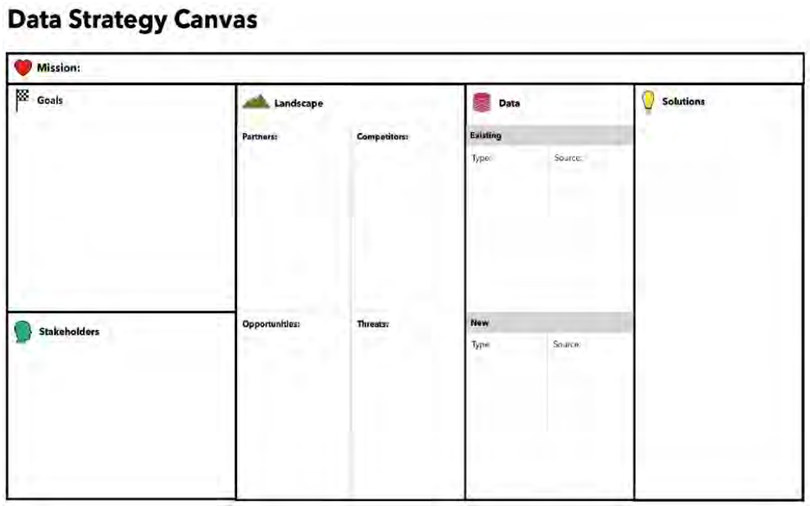

Fig. 14:
Breakthrough Data Strategy Canvas (https://www.prometheusresearch.com/resources-guides-and-whitepapers/)

9) Equifax Data Strategy Framework Template

Vendor	Equifax
Headquarter	Atlanta, GA
Domain	IT and Services
Founded	1899
Employees	10001+
Website	https://www.equifax.com
Published	2010

Equifax is an IT and services company located in Atlanta, Georgia. They published a template for a data strategy framework. According to Equifax' publication their data strategy focuses on generating revenue growth by acquiring and leveraging data sources. Explicitly the data strategy tells what data is needed, why data is needed and how that data will be acquired and integrated in solutions. The data strategy is an integral part of the Equifax Growth Strategy. The framework focuses on customer problems and market needs, leveraging existing data, acquiring new data to fill gaps, using analytics to assess data value, establishing data management and governance and leveraging best practices. It has eight columns (see figure 9), defining the customer need, needed data, integration strategy, purchase plans, addressed customers and competitive scenario. The framework is filled from left to right, using subcategories and keywords. Before the approach on the framework, a 360 degree financial view of the target customer of the business objective is conducted. This view includes consumer assets and income. The framework supports to answer the question about what data is needed, why the data is needed and how the data will be acquired and integrated in the solutions.

Customer Need	Data Need	Integration Strategy	Buy, Build or Purchase	Customers Addressed	Competitive Scenario	Revenue Impact	Priority
What is the customer problem being solved?	What data is needed to solve the customer problem?	How will the data be integrated to make it useable for products and analytics? Dependencies?	Buy the data company/M&A, Build the data ourselves or Purchase from a data company	Industry Top 20 Regional	Behind Competition Parity w/Competition Ahead of Competition	High Medium Low	High Medium Low

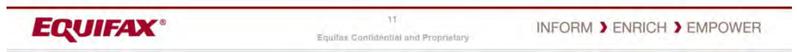

Fig. 15:
Equifax Template Data Strategy Framework (http://www.dataversity.net/wp-content/uploads/2011/03/TUE_1130_Carter_John.pptx)

10) Big Data Framework Big Data

Vendor	Big Data Framework
Headquarter	Bonn, NRW
Domain	IT and Services
Founded	2017
Employees	11-50
Website	http://www.bigdataframework.org
Published	2018

The Big Data Framework is an independent organization for the development and advancement of Big Data practices and certification. Founded in 2017 and located in Germany, Big Data Framework aims to inspire, promote and develop excellence in Big Data practices, analysis and applications across the globe. The organization formulated and excerpt on formulating a big data strategy.

According to the organization, a big data strategy defines and lays out a comprehensive vision across the enterprise and sets a foundation for the organization to employ data-related or data-dependent capabilities. A well-defined and comprehensive big data strategy creates various benefits and makes big data actionable for the organization. It sets out the steps that an organization should execute in order to become a data driven enterprise. The Big Data strategy incorporates some guiding principles to accomplish the data-driven vision, directs the organization to select specific business goals and is the starting point for data driven planning across the enterprise". In order to formulate a profound data strategy, Big Data Framework sets out a 5-Step-Approach to define the big data strategy. The five steps are illustrated in figure 18 and further explained in their elaboration.
The first step requires to define the business objectives in order to leverage big data in an organization. The data strategy should align with the business objectives and the enterprise strategic planning process. The second step requires an assessment of the current business processes, data sources, data assets, technology assets, capabilities and policies. Current state assessments are typically conducted with a number of interviews and similar tools with involved employees. The third step is to identify and prioritize use cases that align with the business objectives. Well-defined use cases provide a clear and effective way to define how big data technologies and solutions can realize business goals. The fourth step, which presumably takes the most time and effort, is to formulate a big data roadmap according to the desired future state. The roadmap identifies gaps in data architecture, technology, tools and processes and outlines which project will be executed first and what capabilities will be used. The last step is to embed through change management, which compasses organizational, cultural, technological and business change. In that manner, data governance becomes a crucial component of change management. Appropriate incentives and ongoing metrics should be key part of any change management program.

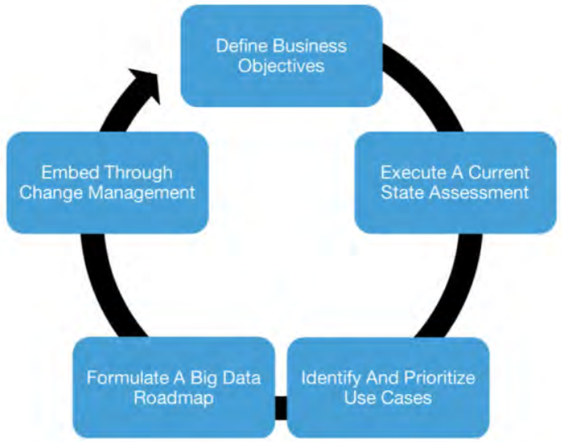

Fig. 16:
Big Data Strategy Framework Iterative Cycle (https://www.bigdataframework.org/formulating-a-big-data-strategy/)

4

DATA STRATEGY TOOL EVALUATION

In the following section we evaluated the presented data strategy tools on a scientific approach. We defined analytical dimensions to distinguish between the different approaches and classify the various tools. Apart from this, we showcased which tool chooses an offensive or a defensive stance, so that you get an understanding of the different perspectives.

Furthermore, we outlined relevant trends and tendencies that were observable during our analysis. These trends acknowledge how data strategy evolves in the economy as well as within an organization.

4
Data Strategy Tool Evaluation

4.1
Assessment of Data Strategy Tools

Several tools yielded from the research of scientific and economic publications. In the following section aspects and elements, that the various tools have in common, and differences will be outlined. Furthermore, the tools will be aggregated and compiled. A profound way to systemize the yielded frameworks is published by Etsiwah and Hilbig in the ISPIM Innovation Conference (Etsiwah und Hilbig, 2019). In their publication, the authors developed a framework to analyse certain data strategy researches. The framework is structured in five descriptive dimensions with 14 subcategories. We pursued a similar approach and created a framework with 6 dimensions and 18 respective subcategories. In the following the different dimensions will be presented and applied to the evaluation.

Dimension 1 Purpose: This dimension describes the objective of a data strategy within an organization. The categories start from an operational product level up to a corporate level, where the analysed tool sets out implications for the entire enterprise. Product development includes frameworks, which set the objective of a data strategy to develop or innovate existing products. Business development summarizes tools that implement changes on a business model level. Strategy development sets an organizational design with the objective to create a strategy based on data and not just for data or only including data. Corporate development contains cases where data strategies were developed and implemented in order to have an enterprise-wide effect with regard to technical infrastructures, processes and policies that facilitate data management.

Dimension 2 Level: The second dimension links the tools to traditional classifications of strategy in strategic management literature as it describes the scope of a given data strategy on a functional level, business level and corporate level. The focus in this dimension does not lay on the objective of the data strategy, but on the organizational level it's implemented and executed. It helps to align the data strategy to other non-data strategies within the organization. (Etsiwah und Hilbig, 2019)

Dimension 3 Tool Practice: The third dimension displays in what form the vendor offers its data strategy tool and therefore how the application is conducted. The analysis showed that the offered tools come in different forms and shapes. During the analysis three different forms of execution showed to be predominant, and we distinguished between namely method, model and general framework. A method is on hand, if the tool offers the applicant some sort of sequence of conduct, a series of steps or a continuous process. A model on the other hand, supports the applicant to align and understand different parts of a system. It helps to conceptualize, classify and range different aspects of the entire object. A general framework however describes tools that are not assigned to one of the preceding forms. Predominantly, these tools come on form of canvasses or matrices.

Dimension 4 Tool Consideration: This dimension defines how the respective tool describes the key elements objectives, action plan and benefits, which were designated crucial in the definition of data strategy. The first characteristic if fulfilled, if the tool supports the determination of data strategy goals, success factors, key performance indicators and supports the alignment with business objectives. The second characteristic is satisfied when the tool helps to define an action plan, road map, strategic imperatives or successive steps according to the definition of the third key element. The last characteristic is fulfilled if the respective data strategy tool outlines what insights, benefits, capabilities and business advantages are generated by conducting a profound data strategy.

Dimension 5 Data Asset: This dimension defines what kind of data asset will be used in the respective data strategy tool. It distinguishes between internal data assets, specifically data from sources already available for the organization and owned from the organization, and external data, concretely data that has yet to be acquired or even purchased to sufficiently reach the explicit data strategy objective.

Dimension 6 Data Management Targeting: The last dimension determines to what extent data management toppings are targeted within the respective tool. It contains four subcategories, namely Data Assessment, Data Architecture, Data Governance and Data Analytics. The category is checked if the data strategy tool addresses the corresponding data management topic and gives directions to include it in the development process.

Tool		Booz Allen Hamilton	CDQ	Measurelab	BCG	Keller	Globaler Datenstrat.	IBM	Breakthrough	Equifax	Big Data Framework
Dimension	Category										
Purpose	Product Dev.	○	○	○	○	○	○	○	○	●	○
	Business Dev.	●	●	●	○	●	○	●	○	○	●
	Strategy Dev.	○	○	○	○	○	●	○	●	○	○
	Corporate Dev.	○	○	○	●	○	○	○	○	○	○
Level	Functional	●	○	●	○	○	●	○	○	○	○
	Business	○	●	○	○	●	○	●	●	●	●
	Corporate	○	○	○	●	○	○	○	○	○	○
Tool Practice	Method	●	○	○	○	●	○	○	○	○	●
	Model	○	○	○	●	○	○	●	○	○	○
	General Framework	○	●	●	○	○	●	○	●	●	○
Tool Consideration	Objectives	◕	◕	◕	◕	◑	●	◕	◕	◑	◕
	Action Plan	◔	◕	◔	◑	◕	◕	◑	◔	◑	◑
	Benefits	◕	◕	◑	◔	◑	◑	◑	◑	◕	◑
Data Asset	Internat	●	●	◑	●	●	●	●	●	◕	●
	External	○	○	◑	○	○	○	○	●	◔	○
Data Management Targeting	Data Assessment	◑	◕	◑	◕	◕	●	●	◕	◔	●
	Data Architecture	◕	◑	◔	◕	●	◕	◕	○	◑	○
	Data Governance	◕	◑	◑	◕	○	◕	◕	◕	◑	◔
	Data Analytics	○	○	○	◕	◑	◕	◕	○	○	○

○ Not addressed
◔ Barely addressed
◑ Partly addressed
◕ Largely addressed
● Fully addressed

Fig. 17:
Data Strategy Evaluation

Data Strategy Tool Evaluation

This evaluation unfolds the dominant differences of the presented tools and therefore provides a general overview on the various specifications. We attempted another approach to showcase different forms and specifications of the presented tools. For this purpose, we divided the tools once more depending on their data strategy orientation and their tool practice. We differed between an offensive and a defensive data strategy stance according to the division made in section 2.2. Furthermore, we differentiated in the tool practice so that the resulting matrix contained six areas. We distributed the respective organizations in the appropriate areas to create a simplistic overview and differentiation in order to support an easy indexing of the data strategy tools (see Figure 18).

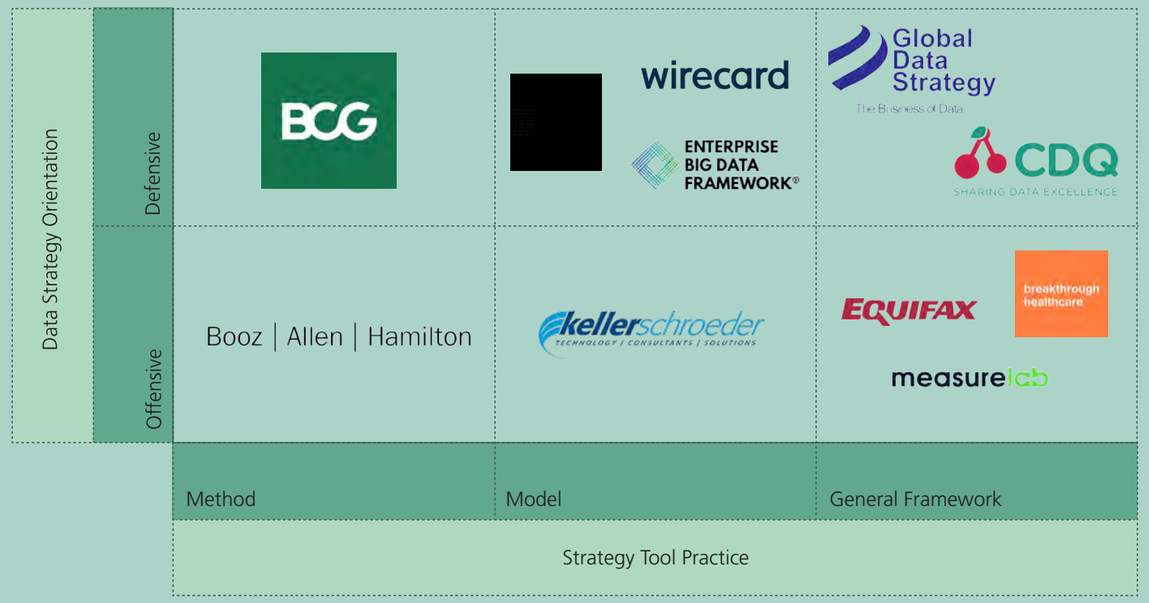

Fig. 18:
Tool Aggregation Framework

4.2

Results of Tool Assessment

A vast variety of data strategy tools yielded from our market analysis. While the tools were different in some aspects like depth and form, there are still various similarities recognizable. Predominantly, these similarities base on the key elements defined in section 2.2:

- Business objectives lay the foundation for the data strategy: Defining the organization-wide long-term data strategy takes place through alignment of the data strategy objectives with the business objectives and goals. In that manner, the majority of the tools requires a definition of the business goals and every tool sets a data strategy vision or mission on how to acquire, use, handle data respectively create value generation through data usage. This step mainly sets the basis of most of the data strategy tool applications. For this, different business values, capabilities, motivation models, technological functionalities and initiatives are compiled. The implementations of these criteria rule out the primary data strategy objectives and goals and is crucial to define the future state.

- A profound data assessment is indispensable for the data vision: Both to define the data vision as well as to outline how to achieve the objectives and goals, a profound and dedicated assessment of the current state of the organization is essential. Most of the tools offer iterations to identify and exploit constraints in the data value generation. The tools analyse different data strategy enablers like relevant people, technology, communication and organizational alignment. Some tools analyse the data lifecycle in terms of data acquisition, discovery, sharing, usage and translation. Furthermore, they offer maturity assessments for the data management state and technological landscape to create a position paper. The carried out assessment is essential to define the code of conduct, data transformation, implementation and execution of the data strategy road map.

- The data strategy includes guidelines and specifications for data management areas: There's no sustainable value generation and competitive advantage without the implementation of an adequate and up to scratch data management. Every data strategy tool provides instruments to target the crucial data management questions during the data strategy development. They define required technologies, channels and data architectures. They address the entire data lifecycle and define data requirements. In this way, the data strategy develops a clear understanding on how the data management and governance has to function. Nevertheless, the given tools do not include instruments to define concrete specifications, only the desired future state of the data management, data architecture and data governance. To define how the data goals and the desired future state looks like in particular is a key element of the data strategy, without restricting and narrowing data management and governance efforts.

4.3

Trends in Data Strategy Tools

During the market analysis and evaluation of the presented tools, some tendencies are observable:

- Data strategy tools evolve from use case assessments to holistic business tools: A profound data strategy answers many questions for future procedures and by that gives guidance for organizations and people on how to create and make us of data assets and be successful with it (Wilberg et al., 2017, Valdez et al., 2019). In that fashion, many tool providers lean towards data strategy instruments not in a restricted use case oriented way but in a more holistic and integral business supporting manner. They offer assistance for the entire road map consideration up to the implementation, including manifold use case portfolio analysis, investment studies and development support. Therefore, the data strategy tools, instead of answering questions bound to a single use case and solving specific problems, serve as a long term implementation for change, knowledge and cultural improvement.

- Data analytics determination gains more and more relevance in Data Strategy: With the advancement of machine learning processes, techniques and algorithms, data analytics come more and more in the focus of data usage and management (Wilberg et al., 2018). The evolution of data analytics accelerates and modifies the advancement and change of an organization. Therefore, to create a robust data strategy, organizations have to implement, understand and improve the way it utilizes data analytics. They need to evolve from an information based descriptive analytics about the question "What happened" to an insight and action based prescriptive and semantic analytics about the questions "What does it mean and what should I do?" (Loth, 2017). The presented data strategy tools pick up on this development. They implement different options regarding data analytics e.g. skill and capability assessment, data people recommendations like recruitment of qualified, knowledgeable enterprise data executives, technology evaluations and performance measures. Data analytics receive a bigger value within the entire scope of a data strategy, since they play a crucial role in data-driven decision making and therefore need to be addressed during the buildup of a desired future state and vision of generating value using data.

- Data strategy leans from defensive towards offensive customer-centric tools: Many data strategy tools offer their users a perception and opportunity to regard defensive data strategy goals, e.g. ensuring data security, quality, compliance and regulatory. They aim on organizational improvement by optimizing data extraction, standardization, storage and access. However, more and more tools choose a more offensive approach on data strategy by including customer and competitor analyses, landscape evaluation and market share expansion goals. They attempt this approach by focusing more on optimization of data analytics, modeling, enrichment and transformation. The entire data management goal shifts from a control ambition to more flexibility and transformation (DalleMulle und Davenport, 2017). However, the presented data strategies still implement both endeavors, since the absence of either data strategy stance noticeably weakens the entire data strategy. In that regard, the tools include more and more offensive aspects while maintaining defensive essentials.

5
HOW FRAUNHOFER ISST CAN SUPPORT

The Fraunhofer ISST is an experienced institute in the field of data management throughout the entire data lifecycle. Therefore, we serve as an excellent partner and supporter to create a unique and well-defined holistic data strategy for you that is according to the premises and fulfilling the qualifications. Our experience ranges from scientific publications to a variety of industry projects. We hope to convince you as we did our other partners to guide you through the journey of the development of an unique data strategy.

5
Data Strategy Tool Evaluation

5.1
Design of Data Strategy

5.1.1
Potentials

A profound data strategy is a keystone for sustainable growth and competitive advantage in the digital era. An organization can excel at many fields, without a clear-cut and precise data strategy it can barely exploit its full potential. The process of strategic data management is ongoing and evaluates both the business and the industry in which the company operates. The objectives are then used to exploit the company's full potential and gain a competitive advantage. Part of the ongoing data strategy process is that the applied strategy and goals are evaluated at regular intervals and realigned if necessary. This aims to pick up on new technologies, competitors, economic, political or financial changes in the environment (Ayitey, 2010). But what if we can boost our bottom line by 15 to 25% of revenue?

- 52% of all information currently stored and processed by organizations around the world is considered 'dark' data
- Additional 33% of data is considered redundant, obsolete, or trivial (ROT)
- This means 85% of stored data is dark or redundant and does not support our business
- Without improving our data management while data volume is increasing "garbage in, garbage out." will become "big garbage in, big garbage out" (Redman, 2017)

One consequence is that knowledge workers waste up to 50% of their time dealing with mundane data quality issues. For data scientists, this number may go as high as 80% (Sangani, 2016).

A data strategy is the first step to raise the enormous potentials and increase the added value significantly.

5.1.2
Method

A data strategy comprises a consistent strategy for the collection, storage, organisation, analysis, use and provision of a company's data stocks. As a high-ranking part of the corporate strategy, it defines the role data plays in achieving the competitive corporate goals. The content of the data strategy are guiding principles that specify and prioritize the handling of the above-mentioned data-related disciplines. In order to develop a suitable data strategy adapted to the company, the Fraunhofer ISST works with a method that has proven itself in practice. This method comprises the different necessary steps, from the elicitation of requirements to the final communication within the company. With the help of suitable techniques, the data strategy is composed of the results of the individual steps and the individual input of the companies and is aligned along the corporate strategy and its line. In this way the company, data and IT strategy are coordinated with each other in order to avoid conflicts of objectives.

5.1.3
Our Promise

Fraunhofer ISST is your neutral, trustworthy and reliable partner from the initial scoping all the way to implementation. Our methods are backed up by scientific research and have delivered tangible results in more than 150 projects. Due to their research background, our scientists bring in enormous innovative spirit, drive and motivation. We have more than 200 publications, which make our expertise transparent and comprehensible.

We promise our partners:

- We know how to get things done in complex organizations how to transfer research results into practice and thus speed up your data strategy initiatives
- "What's next" is our passion and we work with the latest findings and methods to generate sustainable solutions for your data strategy
- We don't just design frameworks, KPIs or processes, we also support you implement and deploy them

5.2
Consulting

The lack of a data strategy can lead to incalculable consequences in your company in the course of digital transformation and the creation of added value using your data. Creating structures and creating company-wide transparency at an early stage is a guarantee for success. Individual challenges require further thinking and often also a view over the edge of the plate. We at the Fraunhofer ISST are not satisfied with creating solutions that address your requirements today, but support you in being prepared for the future. Together with you we develop the appropriate solutions for your data management. This includes the analysis of the current strategic orientation as well as the improvement of the added value of your data. We advise you on the design of a future-proof data infrastructure and architecture as well as the selection of suitable technologies. Through our research, training and above all the practical application of solutions in companies, we know the market, industry trends and technological developments. In doing so, we successfully support both globally operating large corporations and regional small and medium-sized companies, always focusing on creating business value.

150+ Projects	Reliable Partner	Business impact
We love data and know how to manage this resource! This is proven by more than 150 successful projects for large, globally active corporations.	25 years a reliable partner in the field of data management. As a trusted advisor in both the design and implementation of data-driven solutions we transfer research into practice.	Research has to create value for our customers business. That's why we focus the business impact from the very beginning.

This is proven by more than 150 successful research and consulting projects for large, internationally active companies. As a neutral and trustworthy partner, we accompany our customers in requirement engineering, design, implementation and evaluation and provide valuable support on all of these fronts. We guide you through your data management journey towards becoming a data-driven player.

5.3
Contact

We would be pleased to give you an understanding of our offer with regard to the design of your data strategy and to cooperate with you. Together we will take this important step in the digital transformation and make your company fit for the future.

Contact us without obligation for a first conversation!

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