DATCON | DATA READINESS CONDITION INDEX

Manufacturing: DATCON 4

An Industry on Solid Ground

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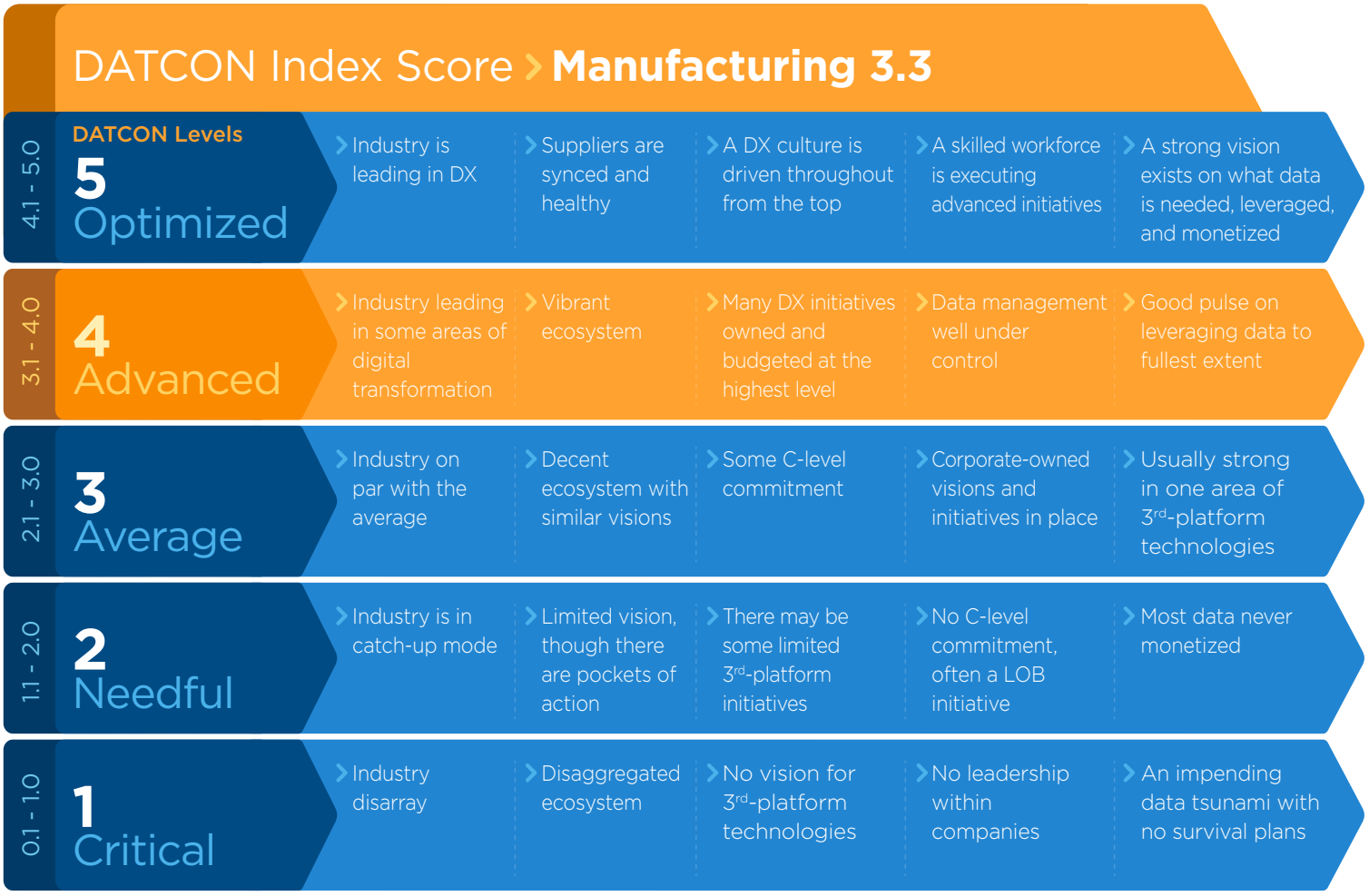
ANALYZE THE FUTURE

Executive Summary

DATCON stands for **DAT**a readiness **CON**dition (DATCON)

The goal of the DATCON index is to expose the strengths, opportunities, and data competency for a given industry, specifically as it relates to managing, analyzing, leveraging, and capitalizing on data. This project is designed to analyze various industries regarding their own Dataspheres and levels of data management, usage, leadership, and monetization capabilities (see "Methodology" for more details).

Figure 1



Source: IDC's Data Age 2025 study, sponsored by Seagate

The manufacturing industry is at DATCON 4, representing an industry that is well into an advanced data readiness condition. It leads in many areas of digital transformation, all of its DATCON assessment vectors are in an advanced stage except one, and it is well-entrenched in the all-important Internet of Things era. No industry is fully optimized, and the manufacturing industry, even in its advanced state, has room to improve; this is especially true with its investment around blockchain and artificial intelligence.

The following are some of the key findings earning the manufacturing industry an overall DATCON score of 3.3: (Figure 1)

- The manufacturing Datasphere is growing at a pace of around 30% per year on average (2018–2025), slightly behind the overall industry Datasphere average. Overall, manufacturing data is expected to grow 3% more slowly than the other industries. Unfortunately, the data that ends up being stored from all this growth isn't always neatly contained in a common data lake or system.

> "Our organization was built on siloes, and the communication across our various organizations is not very good."
>
> *– CISO/CFO, Leading Manufacturing Firm*

- The manufacturing industry is a well-established ecosystem of similar businesses, from an IT infrastructure and data management perspective. A plethora of products is being manufactured with different processes, but the IT and data management infrastructure is well known, being driven by time-tested analytics, feedback loops, and, now, IoT devices. This results in a desirable set of industry peers who often learn from one another and adopt various IT technologies reasonably in step with one another.

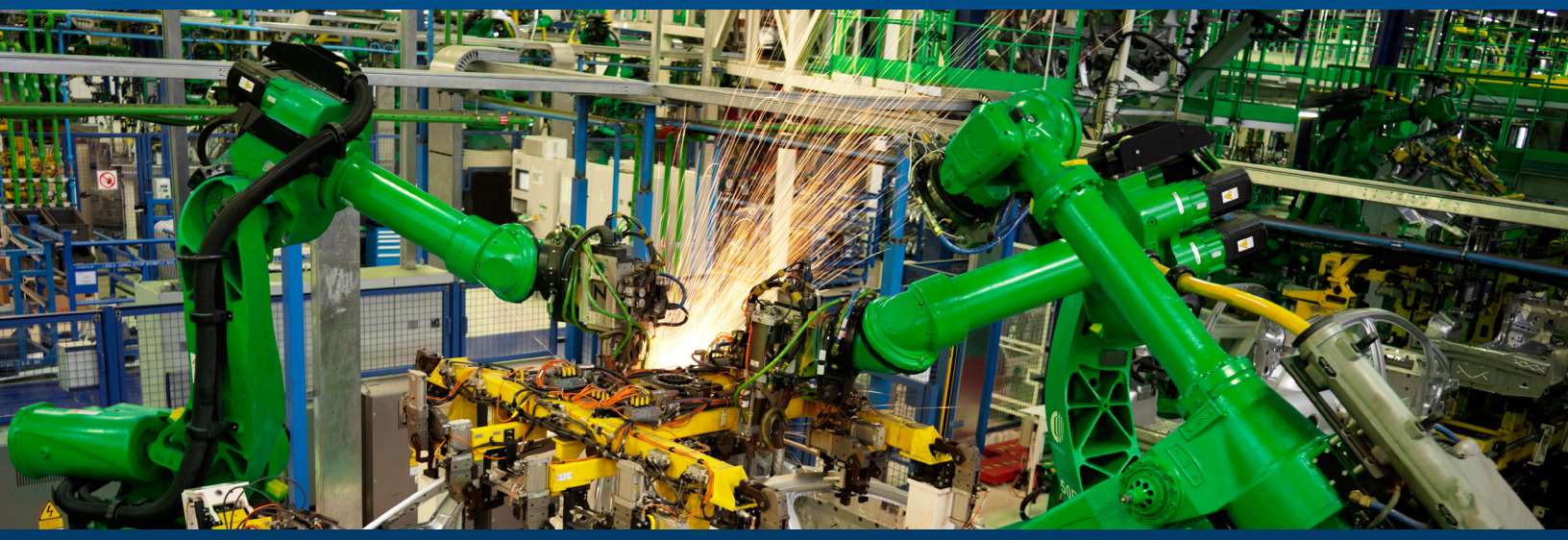
- IT investment by the manufacturing industry is relatively strong, focusing on technology directed at cost reduction through manufacturing efficiency and quality.

> "Obviously, there are initiatives that must happen to maintain the tolerances and make sure the quality control is good on products, but we've been using robotics for the last 15 years, and we continue to find new applications for robotics on our manufacturing and assembly floor.
>
> *– CISO/CFO, Leading Manufacturing Firm*

The manufacturing industry's practice of process control, which typically includes action on a specific system on the production floor with centralized monitoring, is expanding to put more automated intelligence at the edge. Human expertise is being centralized into monitoring and diagnostics centers. It is an important strategy to automate the real-time decision-making of the production floor system and then to leverage the knowledge of the technical staff over a greater portion of the manufacturing process. This approach automates the more common and mundane decision-making workflows and frees up the technical staff to employ advanced analytics and usage pattern algorithms to improve processes and ecosystems.

> We'll have more intelligence, more activity that's going on at the edge on the equipment that we build and the IoT devices … calculating it, then they're going to be bringing back more analyzed data rather than raw data.
>
> *– CISO/CFO, Leading Manufacturing Firm*

> The organization has spent 20 years centralizing our technical staff to leverage them over our global operations. IoT and disciplined data management has taken us the last mile in rapid decision-making and greater service levels to our factories.
>
> *– CISO/CFO, Leading Manufacturing Firm*

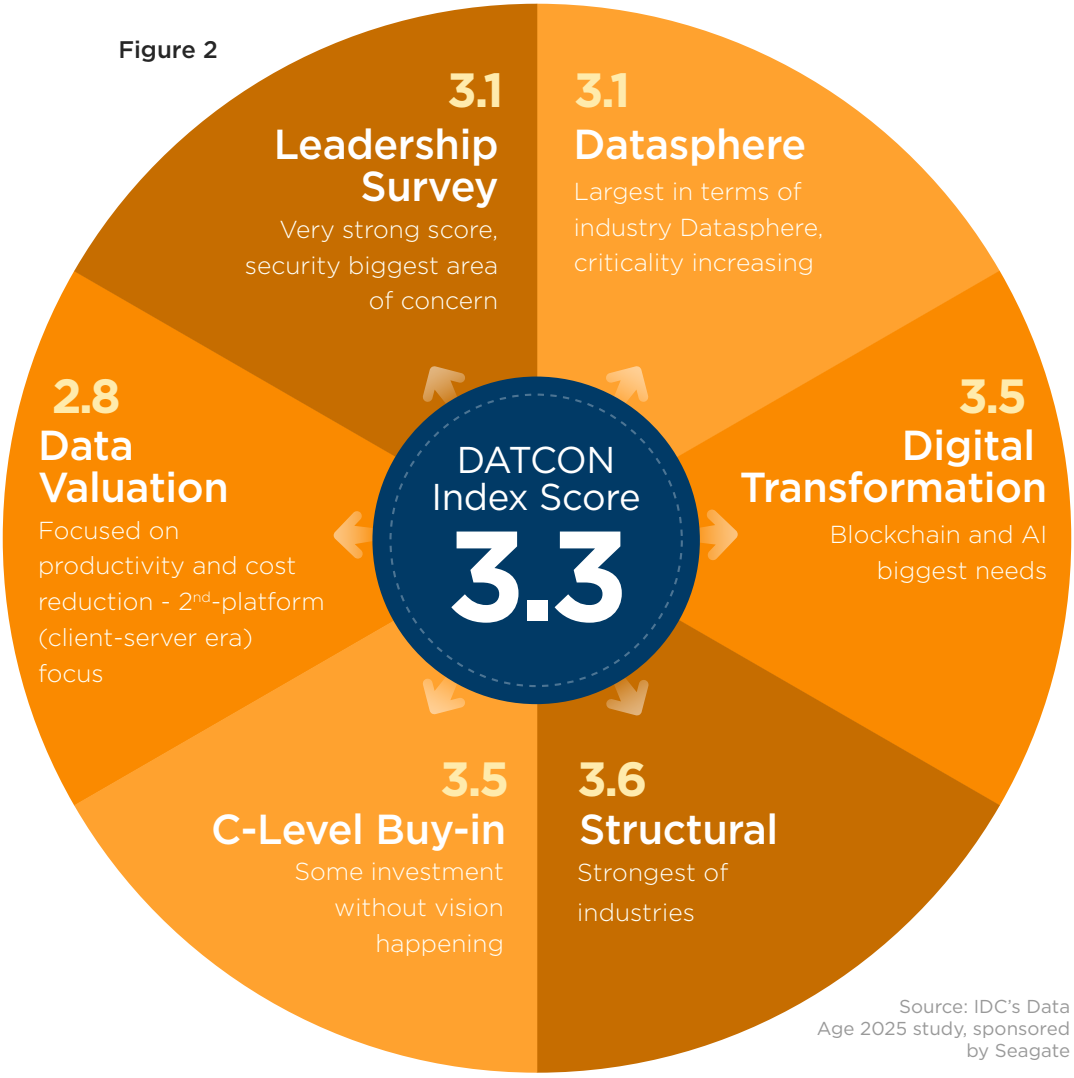


Chapter 1

Manufacturing Survey Data

While the manufacturing industry maintains a high level of investment, it is focused primarily on technologies that extend the reach outside of its traditional manufacturing walls. Blockchain, while not a top investment priority of those manufacturers surveyed in this study, will be an important technology for manufacturers to guarantee the authenticity, origin, and traceability of every part used in a given product. Parts come from various geographies, and using blockchain can help prevent fraudulent parts from being substituted in the final build process of products. Manufacturing had one of the highest DATCON scores across the industries studied, with only one assessment vector scoring below 3.0 (Figure 2).

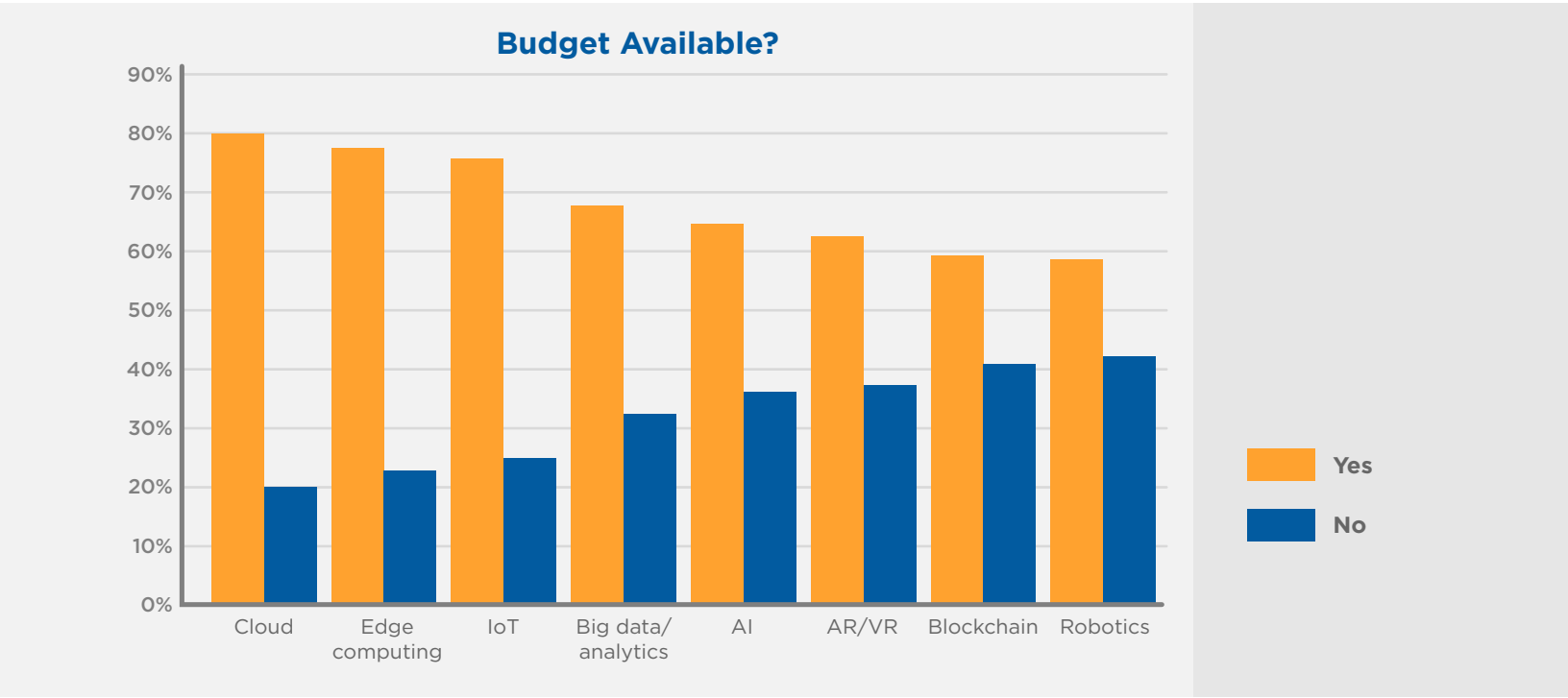
Figure 2



Source: IDC's Data Age 2025 study, sponsored by Seagate

The top three investment priorities for the manufacturing companies surveyed were the cloud, edge computing and IoT. The lower three manufacturing investment priorities are augmented reality/virtual reality (AR/VR), blockchain, and robotics, which is not surprising, given the industry's long history of deploying robots in the manufacturing process (Figure 3).

Figure 3 - Manufacturing leading and lagging investment priorities



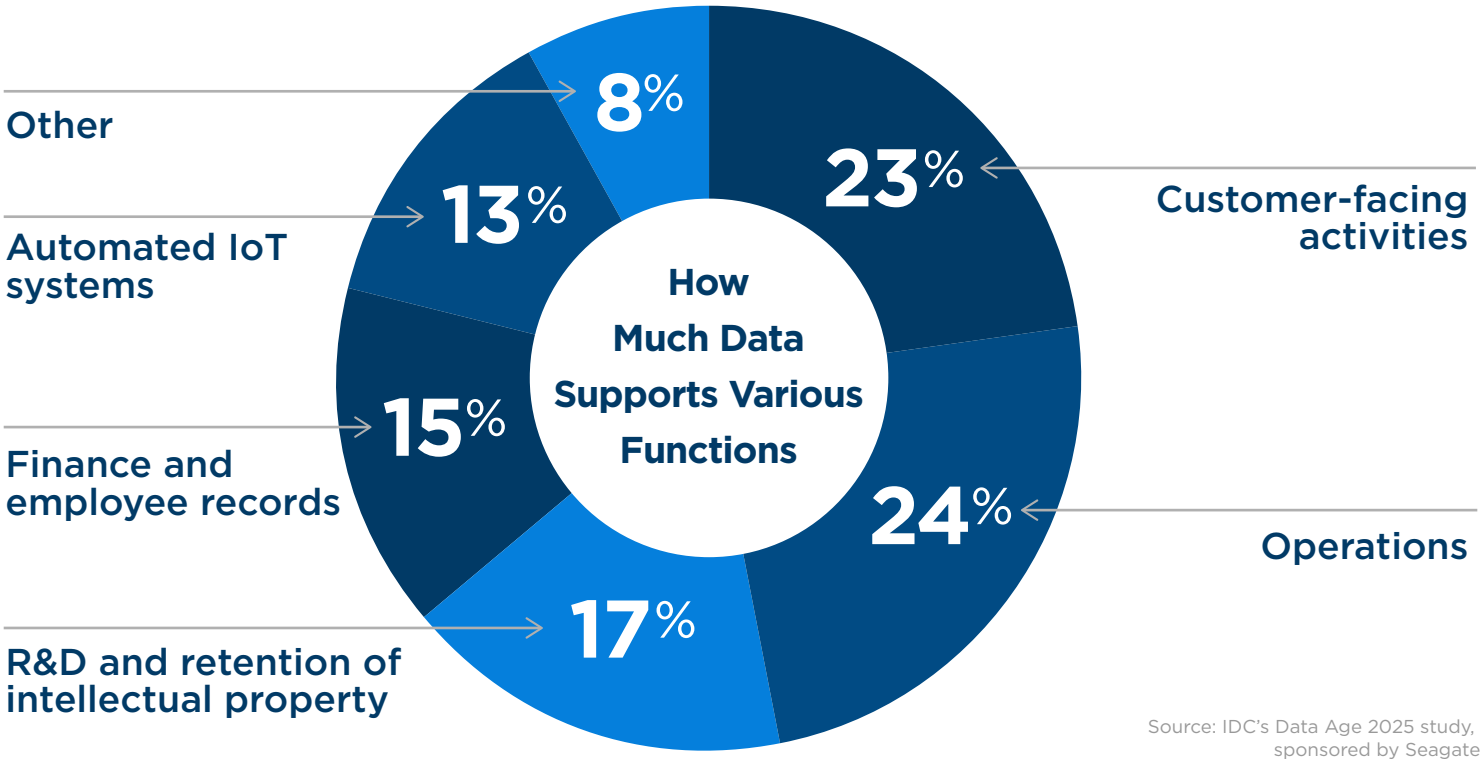
Source: IDC's Data Age 2025 study, sponsored by Seagate

Embedding sensors into normal everyday products are enabling new ways to understand how customers use products. For example, with connected embedded sensors, washing machines can notify the manufacturer of an impending failure; the manufacturer can then notify the customer or even send a replacement part if still under warranty — before a failure occurs. This new type of customer-facing activity is all enabled by real-time monitoring of embedded sensor data.

Embedding sensors into normal everyday products are enabling new ways to understand how customers use products.

As the manufacturing industry begins to collect and leverage data from outside the traditional factory walls (via its investment in edge-related technologies) and begins to interact with its product users more directly and intimately, its mix of data supporting customer-facing activities will increase from today's 23% (Figure 4).

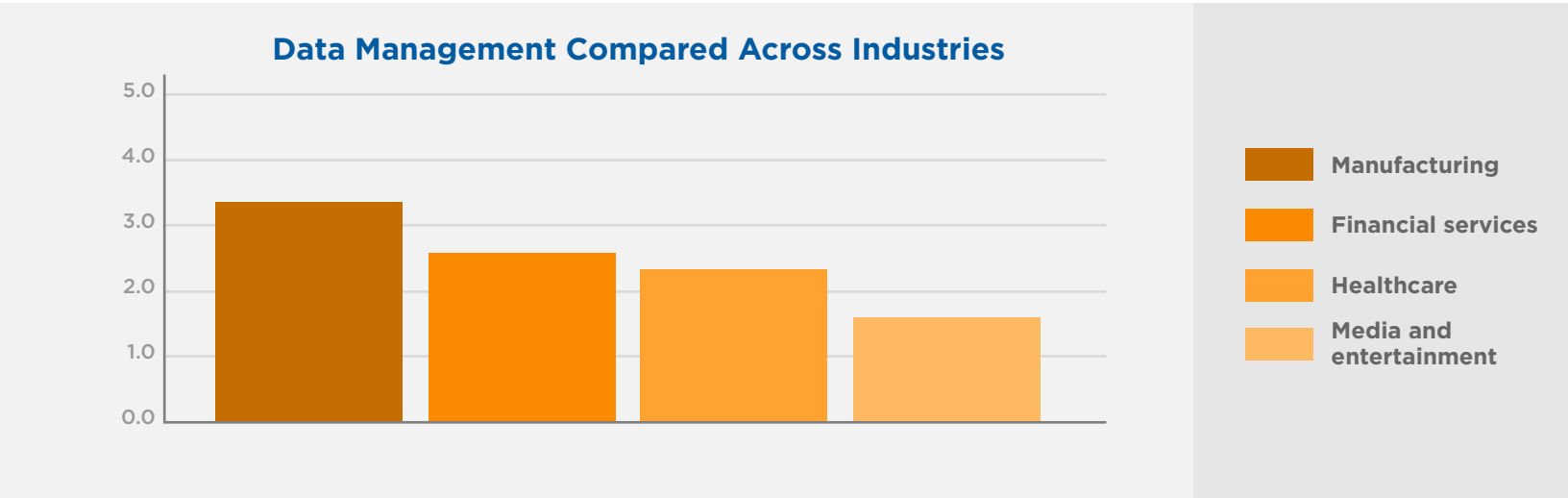
Figure 4 - Functions that support data



Source: IDC's Data Age 2025 study, sponsored by Seagate

Commensurate with their well-established manufacturing process control, surveyed manufacturers believed they were also advanced in their data-management skills (Figure 5).

Figure 5 - Data management (self-scored)



Source: IDC's Data Age 2025 study, sponsored by Seagate

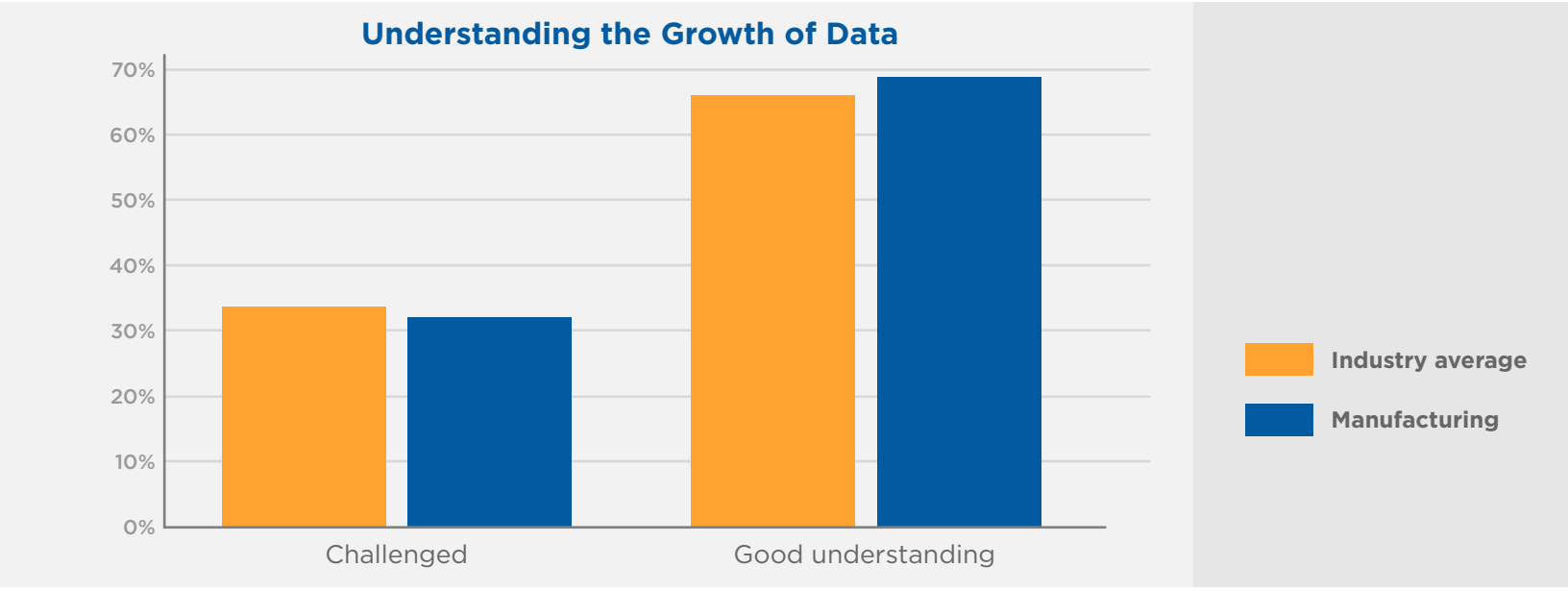
We expect manufacturers might face challenges as new types of data in "uncontrolled" environments (e.g., homeowners' basements, garages, and laundry rooms) begin to emerge.

It's not that the problem of disparate data sets doesn't exist today; rather, they could expand aggressively in the future. Note the following quote from a leading engine manufacturer:

> We are beginning to understand the value of data mining and being able to bring together disparate data and systems that create that data. We don't understand well enough how to do this in an efficient, cost-effective way.
> Right now, each system primarily creates their own data [and] manages their own data environment.
>
> *– CISO/CFO, Leading Manufacturing Firm*

Nevertheless, manufacturers on average seem to have an acceptable grasp on the size and growth of data in their own Dataspheres, according to our survey (Figure 6).

Figure 6 - Managing data



Source: IDC's Data Age 2025 study, sponsored by Seagate

Based on the manufacturing firms surveyed, the manufacturing industry is undoubtedly on solid footing in managing its own Datasphere and all the dynamics therein.

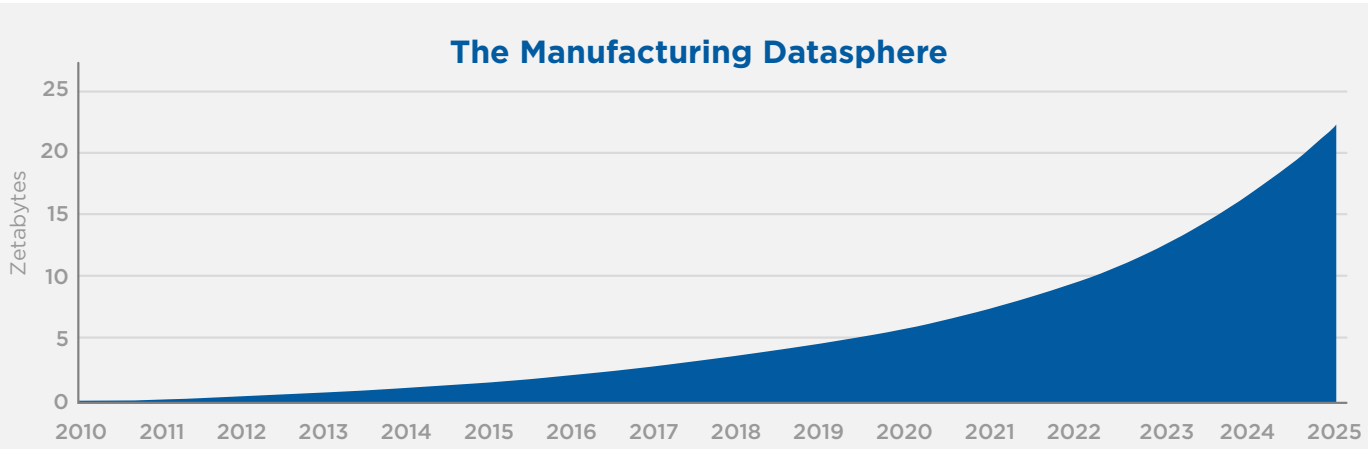
> In the last three years, the data generated by our plants has multiplied over 100 times. New sensors, processes, and more ubiquitous connectivity has allowed our engineers to embed sensors into anything and everything. We are still struggling with how to get the data out of the siloes, but we are on the verge of a major transformation in how we use the data.
>
> *– Director of Process Engineering, Specialty Chemical Manufacturer*

Chapter 2

Revelations on the Manufacturing Datasphere

The manufacturing Datasphere might not be one of the fastest-growing industry Dataspheres that IDC evaluated, but it is certainly the largest. In fact, it is twice as large as the other industries analyzed in this DATCON study (Figure 7).

Figure 7 - Data growth in the manufacturing industry



Source: IDC's Data Age 2025 study, sponsored by Seagate

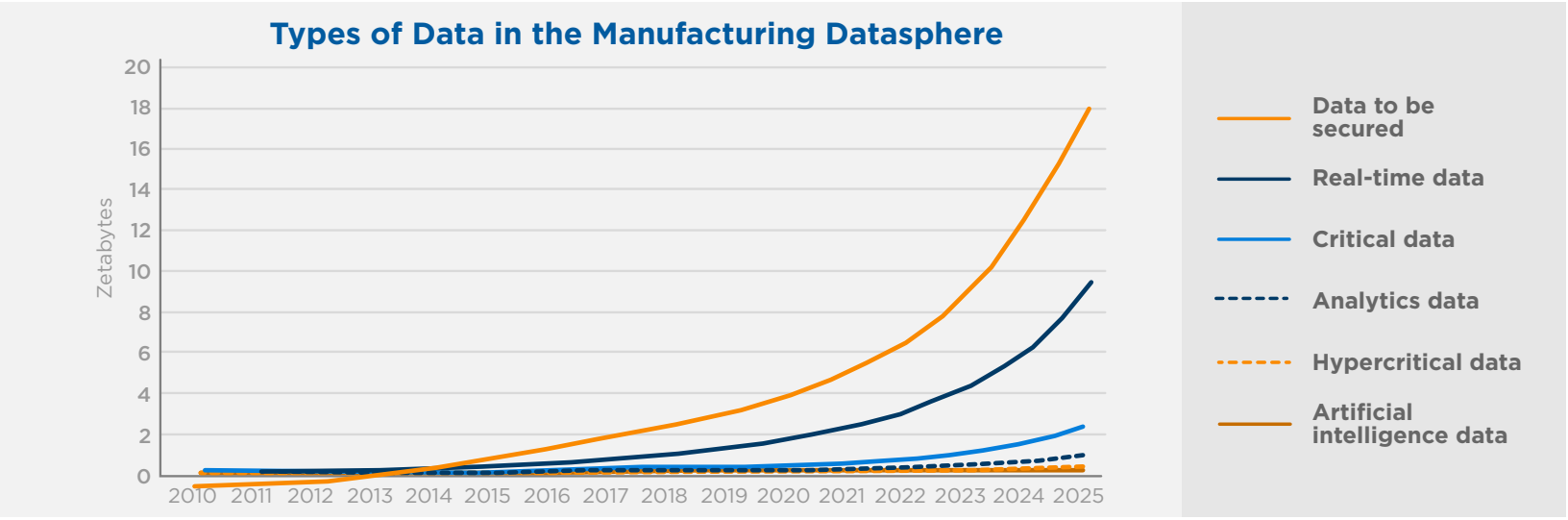
It should be no surprise that the manufacturing Datasphere is one of the largest industry Dataspheres, given its propensity to be always on — in many cases, 365 days a year. One must also realize that manufacturers began running their businesses on computers in the late 1950s and accelerated through the 1970s to today. This means that manufacturing companies have been collecting data for almost 70 years.

Noteworthy, however, is the amount of real-time data that exists with the manufacturing Datasphere. While factories have leveraged real-time data in process control for years, companies are increasing the capture and use of real-time data to include data from IoT and actual product users, tracking everything from engine location to performance to bearing fatigue. Predictive maintenance and asset performance management are becoming massive data engines that are driving adoption of data management and analytics strategies focused on operational excellence.

On the customer and product side, connected products are providing the opportunity for manufacturers to take product performance data directly back to product development for continuous improvement. Those same connected products also open the opportunity to generate new data-monetization revenue streams for service, prescriptive maintenance, and outcome-based business models.

Figure 8 illustrates the growth trajectories of various types of data that are part of the manufacturing Datasphere.

Figure 8 - Critical data growth trends in manufacturing



Source: IDC's Data Age 2025 study, sponsored by Seagate

Of course, not all data grows at the same rate. The table below provides further insight into the characteristics of the data in Figure 8 above.

	2018–2025 CAGR	% of **2018** Manufacturing Datasphere	% of **2025** Manufacturing Datasphere
Data to be secured	30%	80%	82%
Real-Time data	36%	32%	43%
Critical data	37%	7%	10%
Analytics data	51%	1%	3%
Hypercritical data	51%	0%	1%
Artificial intelligence data	63%	0%	0%

Source: IDC's Data Age 2025 study, sponsored by Seagate

New types of data growth abound within the manufacturing industry. For example, a typical hot press in a molding line at a ceramics company had three sensors 10 years ago: temperature, pressure, and time. Today, that same press has 12 temperature sensors, eight pressure sensors, four positioning sensors for mold alignment, and a radio-frequency identification (RFID) tag on the mold with 32 characters.

Hence, a single press has gone from two simple sensors in a time-based data collection of one scan every 15 seconds to 25 sensors with data collected every second. That new data is now used to build a complete production profile for the pressed product. In the legacy system, the data was collected through a custom app and dumped into a spreadsheet. Today, the data that is 20 times as great is collected at sub-second intervals into an off-the-shelf data

historian in the cloud. Engineers now have real-time access to that production data for process optimization and quality control. This ceramic company actually attaches the production profile to the product as it is shipped to automotive customers.

This is happening in all aspects of manufacturing operations. The Internet of Things allows manufacturers to get large volumes of data from their own products. Based on the previous example, what if the press manufacturer could gain access to the data above? The manufacturer could monitor the performance of the press and notify the ceramic company of its asset's performance and even offer prescriptive service. The volumes of data just from the production process are increasing exponentially. The Internet of Things and the drive for sensor proliferation are providing companies with the opportunity to gain insights never before imagined.

Another data-intensive manufacturing use case is the use of digital twins, or virtual representations. Simply put, this is the creation of a digital replica of a physical product. Digital twins can be used to manage multiple aspects of a manufacturing business, including highly complex, customized products and connected assets, such as manufacturing plants and facilities and the assets within them. Data and processes from multi-tier supply chains, service plans and execution, and the operating environment perpetually feed digital twins to ensure the most up-to-date view of the past, current, and future performance and condition of products, assets, facilities, and plants.

Digital twins can help manufacturers deal with the increasing complexity of product design in an era of regulations that continually change for safety and eco-friendliness. Manufacturers can test design and performance against customer preferences and feedback while maintaining quality and product life to improve customer experiences. Massive amounts of data, structured and unstructured, are leveraged in creating a digital twin and can serve as the container of information about product and asset quality, usage, and overall performance. Thus, various roles throughout the organization can view the information they need to do their jobs today and improve their performance tomorrow.

Manufacturers can test design and performance against customer preferences and feedback while maintaining quality and product life to improve customer experiences.

Chapter 3

Improvements for the Manufacturing Industry

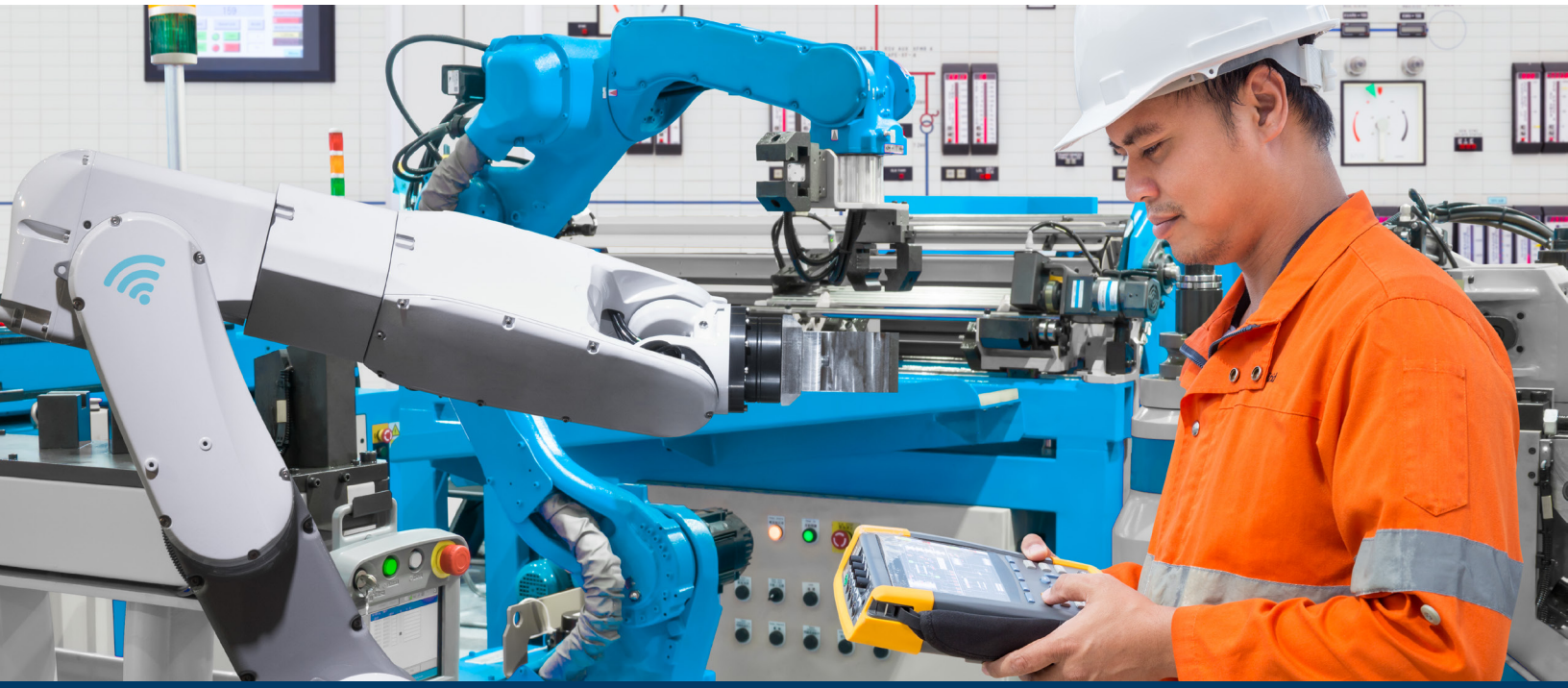
The most important thing manufacturers can do to improve their DATCON scores is to consolidate their data strategies into one cohesive strategy that encompasses the following:

Cloud investment and integration.

According to our survey of more than 2,200 companies worldwide, the number-one investment priority for the manufacturing industry is the cloud. Breaking down, or at least bridging, data siloes is critical in the context of digital transformation. Every industry suffers from this problem, and the manufacturing industry is no different, even in an advanced state. Cloud investment should remain a priority; this will bring new levels of data accessibility that, in turn, will help feed initiatives and processes that leverage new artificial intelligence (AI) and real-time engagements.

Data governance and management.

New types of data from multiple sources (sometimes personal and sensitive) are available to manufacturers and must be managed in a way that informs new use cases such as digital twins. The process, however, must begin by guaranteeing the quality and integrity of the new data and source, which is the essence of data governance. The integrity of the data must also be managed throughout its life to ensure that the results and outcome of any data-intensive initiative are valid.



New data and data sources will drive new requirements.

Sensors being integrated into connected products (e.g., white goods, engines) give manufacturers access to new, real-time data that can feed their operations and business processes. This is key to digital transformation, one of the metrics scored in the DATCON analysis. Manufacturers must not only manage this new data properly, but also integrate it with third-platform technologies to transform their decision-making.

This integration includes:

Secure data access

Securing the access to and privacy of data while maintaining accessibility to other parts of the organization

Analysis & reporting requirements

Applying analytics and establishing new reporting metrics to chart improvements in efficiency, quality, and cost

Integration of operational data & business processes

Creating new feedback loops that integrate operational data and analytics to inform, refine, and improve business processes

The goal all manufacturing companies should have when considering a metric like a DATCON score is to understand what that DATCON score represents: the ability for all roles in the company to have access to appropriate data, at the right time, in a secure environment. In the end, though, it means giving people access to the information needed from across the enterprise to innovate in ways that data siloes could never support.

Chapter 4

Methodology

The DATCON index is an indication of how well a particular industry is prepared to manage and capitalize on the data that is forecast to grow within that industry. Any given company within a particular industry may be above or below the calculated DATCON index for the industry.

The DATCON index is a calculated score that is synthesized across six vectors and numerous metrics that emerge from surveys, research, industry experts, and other sophisticated modeling techniques.

The six assessment vectors are:

1. Industry Datasphere

This vector score is derived by analyzing the growth trajectory of multiple types of data within IDC's Global Datasphere calculation for each industry. These types include critical and hypercritical data, data that requires various levels of security, data that is leveraged in big data analytics, data that is leveraged in artificial intelligence applications, and real-time data.

The Datasphere is the amount of new data that is captured, created, replicated, and consumed in any given year.

2. Digital transformation and the third platform

This vector score is derived by assessing an industry's activity, initiatives, corporate sponsorships, investment, and other insights relative to a set of IDC's third-platform and innovation accelerators. These innovations include the IoT, blockchain, big data, artificial intelligence, and digital transformation progress.

Digital transformation is the application of third-platform and related technologies to fundamentally improve all aspects of society. For business, this means transforming decision-making with technology.

3. Structural score

This vector score combines various metrics related to an industry's structure (e.g., investment in edge IT, IT spend as a percent of an industry's gross output, and leader/laggard condition).

4. C-level buy-in

This vector scores the involvement of a company's C-suite in sponsoring, leading, and budgeting for the various technologies across multiple metrics in the DATCON construct.

5. Data valuation competency

This vector assesses the skills necessary to understand the value of data, as well as to monetize it or treat it as an asset.

6. Leadership (self-scored)

This vector assesses a company's perspective on its own competency in data management, data security, data leadership and vision, and availability of skilled data workers. It also evaluates how a company sees itself compared to its peers.

IDC surveyed more than 2,400 companies worldwide across various industries to gather insight on current and future plans to invest in technologies important to digital transformation. Each metric within each assessment vector is weighted relative to its importance in achieving a high level of competence.

Each assessment vector has also been weighted relative to its importance in achieving an optimized data-readiness state. The aggregate score becomes the DATCON level for the respective industry. All scores were informed by IDC proprietary models, primary surveys (as described above), expert insight, and direct interviews with various Fortune 1000 companies.

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