



# The Path Towards Data-driven and **Intelligent Operations**

**Redefining Digital Transformation in Modern Manufacturing Towards Autonomous Operations: Welcome to the Era of Industrial DataOps and Role-based AI Copilots**

Since the beginning of the Industry 4.0 era, data has emerged as businesses' most valuable strategic asset. However, the digital revolution goes way beyond the data; it is all about data contextualization—turning raw, unstructured data into knowledgeable, actionable insights. Industrial operations, ranging from manufacturing floors to oil and gas operations, increasingly depend on accurately analyzing contextualized data to drive operational excellence.

*By Sebastián Trolli, Research Manager & Global Head of Industrial Automation*

FROST & SULLIVAN EXECUTIVE BRIEF



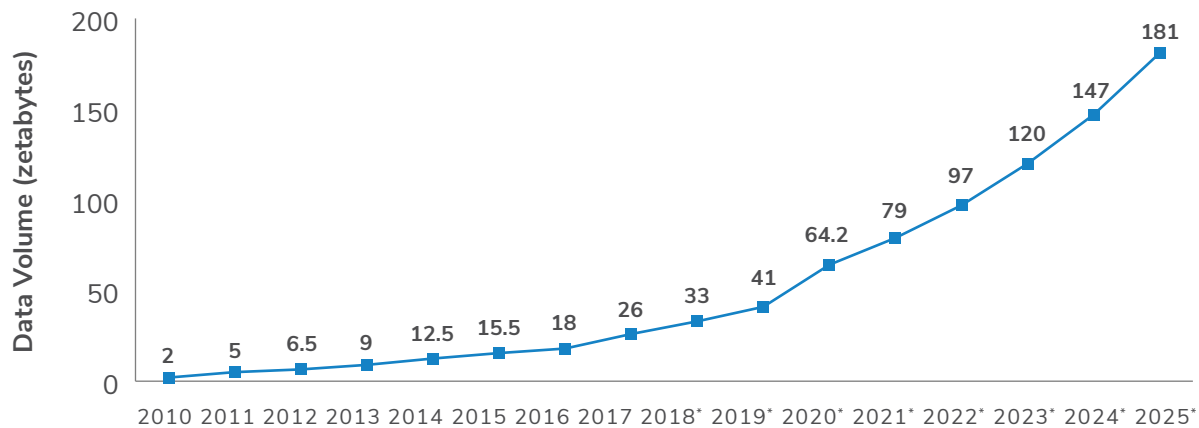
# The Strategic Imperative of Data in Industrial Operations



## THE INDUSTRIAL DATA CHALLENGE

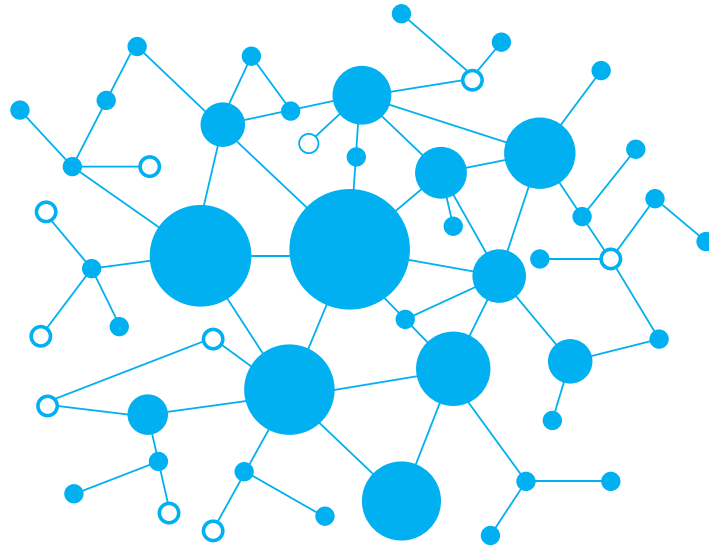
Today's industrial landscape is characterized by exponential data generation, with estimates indicating the current creation of roughly 328 million terabytes daily<sup>1</sup> and projections of 181 zettabytes annually by 2025.<sup>2</sup>

Volume of Data Created, Captured, Copied, and Consumed, Global, 2010-2025



This fast-paced environment presents unique opportunities and challenges for industrial operations. Traditional information technologies (IT) data management techniques are not well-suited to handle the requirements of operational technologies (OT) time-series data. The latter is characterized by its high velocity, massive volume, and unstructured nature, compounded by the complexity of multiple independently operating industrial sites that use unique models. Engineering technologies (ET) are trying to reign in these integrations and maintain interdisciplinary collaboration. Additionally, the variety of communication protocols flowing across industrial devices, assets, and systems creates silos that make it challenging to analyze and visualize data within the appropriate context.

Are you struggling to make sense of the massive amount of data you are collecting? Do you feel overwhelmed? If that is the case, you need to start thinking of an integral approach to data management, orchestration, and utilization across OT, ET, and IT domains, which will help you stay ahead of your competition.



### THE IMPORTANCE OF DIGITAL MATURITY

Digital maturity represents a transformational path for every company, from basic digitization and automation to digital transformation, augmented decision-making, and autonomous operations. It is marked by an organization’s ability to integrate and contextualize data across all levels of operation, from enterprise (IT and ET) to site (OT) visibility. This journey, built from the principles and foundations of DataOps, such as the Data, Information, Knowledge, and Wisdom (DKIW) pyramid model and acatech’s (Germany’s National Academy of Science and Engineering) Industrie 4.0 Maturity Index, requires a structured approach to data management, ensuring that data is not just accessible but meaningful.

In an environment where the pace of change is relentless, industry leaders’ ability to adapt quickly and translate data into operational knowledge (and ultimately wisdom) sets them apart. The digital maturity journey is not a destination but a continuous path of evolution that can benefit even the most advanced companies.



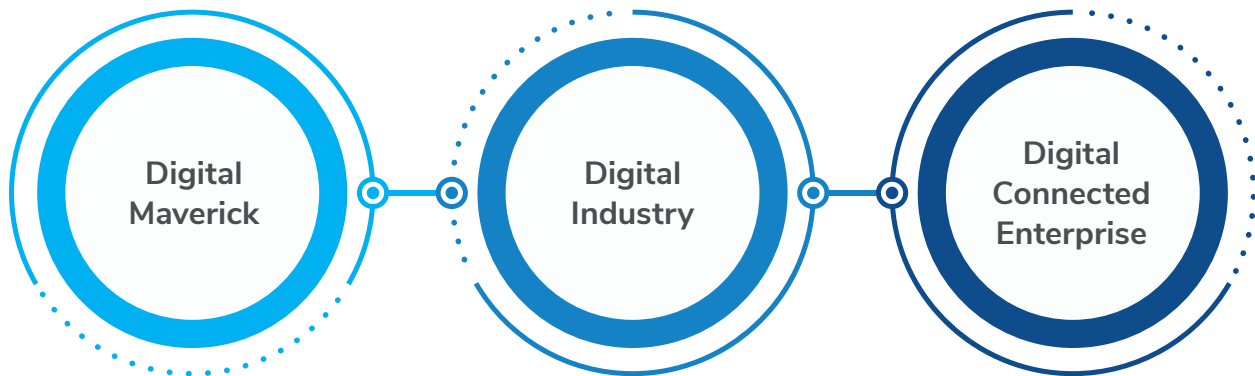


# The Industrial Digital Maturity Framework: Is Your Digital Transformation Journey Moving Too Slowly?

As industries delve deeper into digital innovation, a pressing question remains: Is your digital transformation journey keeping pace, or is it languishing?

Frost & Sullivan's three-pronged, enterprise-wide Industrial Digital Maturity Framework presents a structured pathway for enterprises to properly navigate the digital transformation journey. This powerful framework is built around three components that are critical to the success of the whole. These components must be balanced and coordinated for an enterprise-wide transformation to be successful and must be supported by a corporate change management program driven by a governance model that reflects a top-down/bottom-up buy-in approach.

Establishing them, leveraging their interdependence, and embracing their collaborative nature will speed up your journey with greater ease and efficiency.



## THE DIGITAL MAVERICK

At the core of the transformation journey lies the Digital Maverick, a persona embodying the knowledge, innovative spirit, and drive necessary to navigate and lead digital change. These visionaries play critical roles at both corporate and site levels, integrating advanced capabilities and steering initiatives that break new ground in industrial operations. Their efforts lay the groundwork for a digital ecosystem that thrives on agility and innovation. This persona-driven approach ensures that digital initiatives are aligned with strategic business objectives while tailoring the initiatives to the unique needs of each site.



## THE DIGITAL INDUSTRY

The transition from application-centric to platform-centric technology stacks shows a notable evolution in the Digital Industry landscape. This shift facilitates taking the first steps of the journey from digitization to the zenith of autonomous operations. It empowers companies to redesign their operational frameworks and take advantage of a connected, intelligent infrastructure leveraged by the latest industrial DataOps and industrial AI advancements. The Digital Industry's transformation underscores the criticality of adaptable, scalable technology ecosystems capable of driving forward a progressive digital maturity of modern industrial enterprises.



## THE DIGITAL CONNECTED ENTERPRISE

The Digital Connected Enterprise concept brings a holistic vision to fruition, where integration and collaboration across all levels of the organization are paramount. This model emphasizes a data-driven value proposition that permeates from enterprise to site level, championing the interaction of people, processes, and technologies and the pursuit of a robust IT/ET/OT integration strategy to facilitate connectivity, data accessibility, and interoperability across all domains.

Industrial DataOps is the critical technology enabler for the Industrial Digital Maturity Framework. It aggregates, curates, normalizes, contextualizes, standardizes, and securely distributes data across the enterprise down to sites and vice versa, helping bridge the IT/ET/OT gap. However, simply using industrial DataOps is not enough. Industrial vendors should also provide specific applications and use cases to enable end users to achieve maximum efficiency and profitability in their digital transformation journey.





Digital transformation is more than just a technology transformation; it is all about redefining an organization’s strategy and cultural mindset, empowering employees to embrace change, and utilizing technology to accelerate the creation of more value for clients and stakeholders. Technology by itself will not accomplish much without the people and processes around to support it. Do not let technology lead the transformation—let the transformation guide technology adoption and implementation.

# The Industrial Market and the Rise of DataOps—Are You Maximizing the Value of Your Industrial Data?

## A Sneak Peek at the Industrial Market

The industrial market is currently facing a complex scenario dominated by challenges such as global economic fluctuations, geopolitical tensions, and supply chain vulnerabilities. However, the recent rise of industrial DataOps and industrial AI as ground-breaking technologies and top growth opportunities highlight the sector’s overall fast-paced growth and move toward data-driven, smart manufacturing processes.

### Frost & Sullivan’s Top 10 Strategic Imperatives for the Industrial Market, Global, 2024<sup>3</sup>



Economic Landscape



Geopolitical Dynamics



Supply Chain Disruption



Labor Market and Workforce



Regulatory Environment



Sustainability & Decarbonization



Collaborative Ecosystems



Smart Manufacturing



IT/ET/OT Integration



Technology Democratization



To succeed in this landscape, companies must take assertive steps to integrate their IT, ET, and OT domains, adopt sustainable practices, and pursue digital transformation strategies. The democratization of technology is essential for manufacturers of all sizes to stay competitive. Companies that take bold action and leverage these imperatives and growth opportunities will stand out above the rest.

The industrial realm is witnessing an undeniable growth in demand for solutions that streamline data operations. The need for a data-to-value conversion, which is crucial to forward-thinking companies' decision-making processes, drives demand and leads to a more digitalized, interconnected, science-based, flexible, and secure manufacturing environment.

## The Rise of Industrial DataOps

Industrial DataOps has emerged as the right approach to fulfill this requirement. Its growth environment is characterized by a surge in data literacy, high demand for seamless data operationalization, and increasing adoption of cloud-based solutions and generative AI-powered analytics. These factors foster numerous collaborations and partnerships among vendors with complementary portfolios.

### Critical Elements of Industrial DataOps

- **Data Orchestration:** This process integrates data across multiple sources, ensuring accessibility and flow of information.
- **Data Contextualization:** This process enriches data and links it with operational insights and real-world applications, transforming raw data into actionable intelligence and maximizing its value.
- **Industrial Knowledge Graphs:** These business ontology-based graphs represent the network of industrial entities. These elements are the main ones responsible for breaking data silos.
- **Large Language Models (LLMs), Generative AI, and Copilots:** The engines behind Industrial AI, leveraged by Industrial DataOps platforms. These technologies offer sophisticated predictive and prescriptive analytical capabilities that can anticipate operational trends and events. AI copilots provide an intuitive interface, making these technologies accessible to decision-makers at all levels.
- **MLOps:** These are procedures and best practices aimed at streamlining the deployment of machine learning (ML) models, ensuring their efficiency and reliability over time.
- **Unified Namespace (UNS):** This software layer, or event-driven architecture, acts as a centralized repository and “single source of truth” for operational and enterprise data by integrating consistent naming conventions across both domains.



The adoption of a comprehensive DataOps strategy presents a multitude of growth opportunities for industrial organizations. With it, companies can optimize production, operate sustainably, reduce costs and downtimes, improve compliance in regulatory environments, and meet the ever-evolving customer demands.

## Call to Action—Why SymphonyAI Should Be Your Partner of Choice

Digital transformation has become a must-have requirement for surviving in today's industrial landscape. The challenging conditions in the industrial market have made technology investment and digitalization a top priority among industrial organizations.

In that regard, Frost & Sullivan sees that the industrial ecosystem is finally “crossing the chasm,” meaning that end-user technology adoption is transitioning from an early to a mainstream stage. Despite their digital maturity difference, the innovators, early adopters, early majority, and late majority have all started to embrace the journey. Those who resist embracing digital transformation are suffering dire consequences, such as losing their competitiveness and being forced to abandon the market.

As data has become the most valuable, transformational, and strategic asset, leveraging it to create knowledge and actionable insights to optimize enterprise-wide businesses and operations using an industrial DataOps platform will determine the success of industrial organizations.

### What to Look for in a Technology Vendor

Industrial companies need a leading extensible, future-proofed industrial DataOps platform tech stack that provides and delivers:

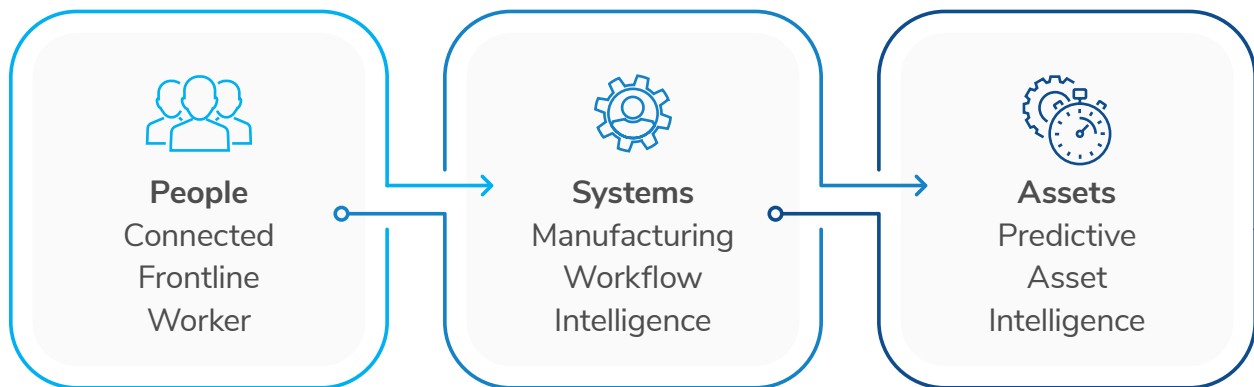
- Quick time-to-value
- Fast, flexible, scalable, and secure deployment
- Seamless connectivity to all types of industrial machines, devices, and assets
- Full portfolio of pre-built, industrial use case applications across functions and personas
- Ability to build custom applications
- Easy-to-use and domain expertise for manufacturers
- Hybrid deployment (on-premises and/or cloud)





## How SymphonyAI Industrial Helps Industries Drive the Digital Transformation Journey

Choosing the right technology partner is crucial to reaching digital maturity. With its comprehensive suite of AI-driven solutions, the SymphonyAI organization is a trailblazer in guiding companies through their digital transformation journeys. SymphonyAI Industrial, a division of the SymphonyAI Group, is a testament to this leadership and provides state-of-the-art solutions tailored to the unique challenges of smart manufacturing and digital operations. It easily connects people, assets, and systems, ensuring high-speed automation and reliable execution.



### Global Footprint and Proven Success

SymphonyAI Industrial has a broad footprint, with over 3,000 employees spread across 33 countries and serving more than 1,300 users worldwide. Headquartered in Palo Alto, California, and supported by offices in key industrial hubs around the world (including Seattle, the US East Coast, Bogotá, the UK, Belgium, Kyiv, Dubai, Mumbai, and Bengaluru), this global presence aligns with its deep-rooted expertise across multiple verticals, including oil and gas, energy, chemicals, food and beverage, and pharmaceuticals. Recognition from leading industry analyst firms, including Frost & Sullivan’s 2023 Global Technology Innovation Leadership Award for Industrial AI Solutions, underlines SymphonyAI Industrial’s standing as a leading industrial vendor.

### Solution Spotlight: IRIS Foundry DataOps Industrial Platform

The IRIS Foundry DataOps Industrial Platform is unique in its robust suite of features, which were specifically designed to address the industry’s most critical challenges.

This platform stands out for its ability to provide sophisticated data orchestration, real-time bidirectional data flows, and transformation pipelines across diverse systems and formats, ranging from MQTT and OPC UA to Modbus and ODBC, enabling seamless data integration and processing. Its data contextualization further empowers organizations by organizing and enriching data with relevant metadata, facilitating deeper insights and more informed decision-making.



One of the most revolutionary aspects of the platform is the introduction of the first industrial-tailored LLM, a testament to SymphonyAI Industrial's commitment to pushing the boundaries of industrial AI. This LLM, combined with features like anomaly detection models and a comprehensive KPI library, highlights the platform's unparalleled capability to convert data into actionable insights and drive operational excellence across the board.

Moreover, the platform's deployment flexibility, whether on-premises or in a public or private cloud, ensures it can scale and adapt to the unique requirements of any enterprise.

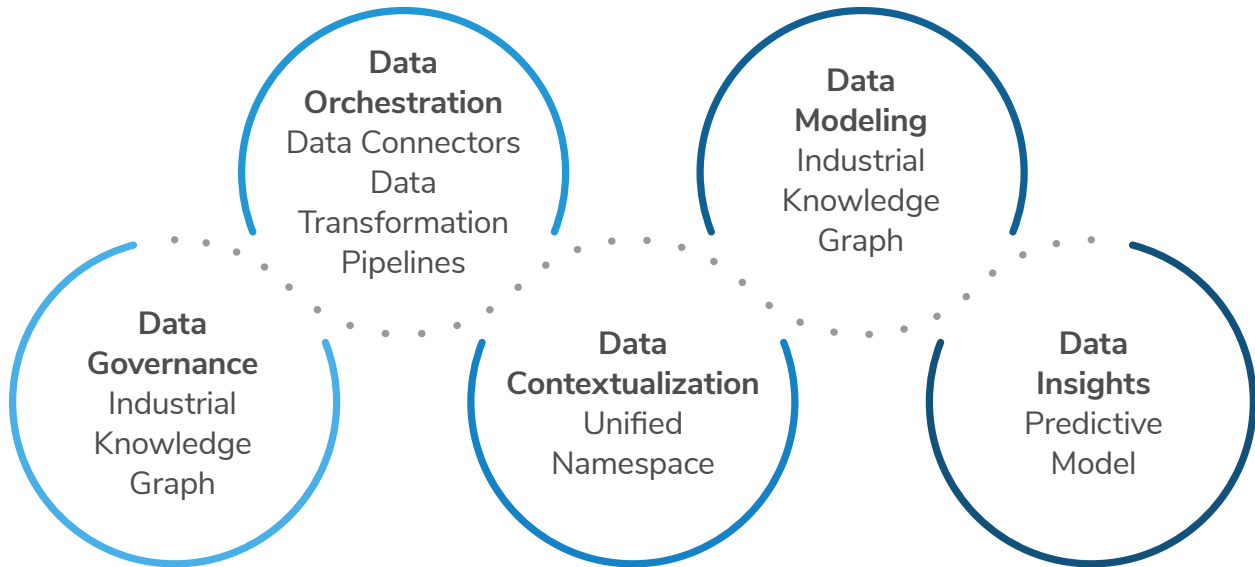
### **A few additional critical features include:**

- **P&ID Ingestion and Data Contextualization:** Automating the interpretation of piping and instrumentation diagrams to map assets and sensors, IRIS Foundry DataOps Industrial Platform utilizes templates and hierarchical structures to create a unified namespace (UNS) enriched with contextual metadata, enhancing analysis and storage capabilities.
- **Data Orchestration and Governance:** The platform ensures data integrity, security, and compliance across the operational spectrum with prebuilt industrial connectors and comprehensive data governance frameworks. It guarantees secure and efficient data ecosystem management, upholding the highest standards of data integrity and access control. This ensures that sensitive information is protected against unauthorized access and data breaches. The framework supports ethical data use and reinforces a culture of accountability and transparency within the organization.
- **Role-based Copilots:** The platform introduces AI-driven assistance tailored to specific industrial roles, enhancing decision-making and operational efficiency. Process and production engineers can forecast equipment performance, maintenance and reliability teams can receive recommended actions on alerts, and connected frontline workers can troubleshoot issues in the field.
- **Advanced Analytics and AI:** By integrating predictive and generative AI engines, the IRIS Foundry DataOps Industrial Platform enables predictive maintenance, anomaly detection, and operational efficiency improvements.
- **Anomaly Detection and Asset Health Calculations:** The platform empowers organizations with predictive insights, which enhances maintenance and operational decisions with calculations available out of the box that can be directly applied or tailored to a site's unique needs.

Deep industrial domain expertise is embedded within these features, making the IRIS Foundry DataOps Industrial Platform a comprehensive guide to modern industrial operations.



### End-to-End Industrial Data Operations



### Enterprise-wide Value-led Proposition

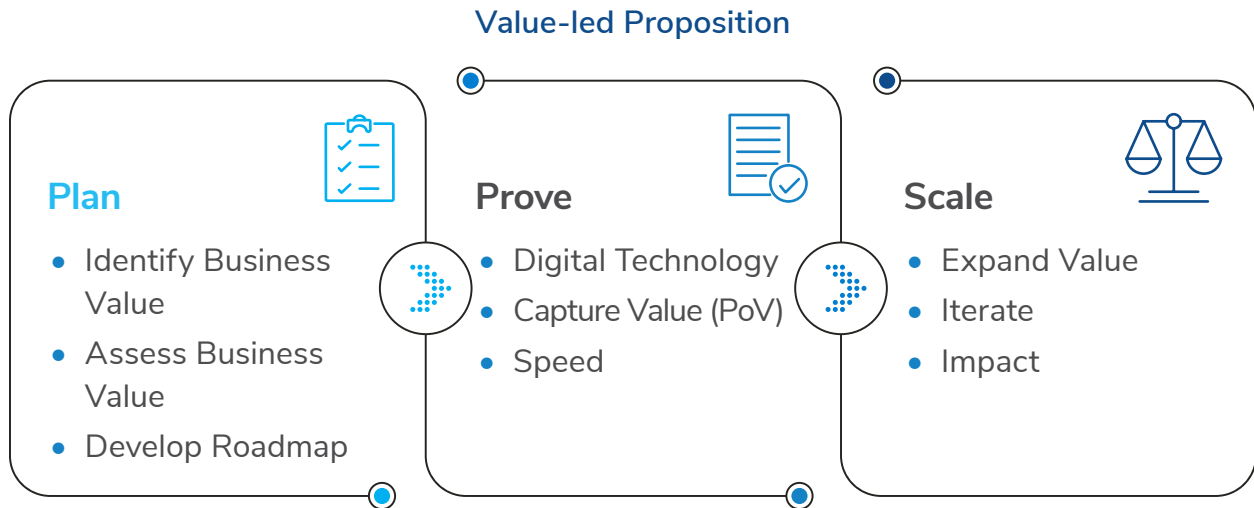
SymphonyAI does not just offer technology; it offers a transformation roadmap that is characterized by speed, ease of implementation, hybrid deployment flexibility, and scalability. This value proposition is made tangible through the IRIS Foundry’s hybrid deployment capabilities, ensuring that the platform can operate across cloud and on-premises environments equally efficiently. The platform’s extensibility, facilitated through comprehensive APIs and its proprietary industrial LLM, ensures that it can cater to the unique needs of diverse industrial operations, thus driving speed and impact through both existing and custom applications.





**SymphonyAI's value proposition will allow an industrial organization to:**

- Achieve a rapid return on investment
- Get the most significant actionable insights from data
- Create a top-down, bottom-up, data-driven enterprise





### Leading to Tangible Business Value

With proven use cases across industries like mining, oil and gas, metals, glass, and cement, the following metrics show the total economic value impact of the IRIS Foundry DataOps Industrial Platform:

#### Total Economic Value Impact

An industrial data foundation that unlocks predictive and generative AI at scale



#### METRICS



ROI  
**330%**



Time to first  
value  
**<12  
weeks**



Payback  
**<6  
months**



#### BUSINESS IMPACT



**4%**  
Increase  
in process  
throughput



**5%**  
Increase  
in energy  
efficiency



**37%**  
Efficiency  
gain of  
knowledge  
workers



**25%**  
Cost  
reduction of  
maintenance



**10%**  
Reduction  
of downtime  
events





**These metrics say that:**

- Revenue gains of more than \$5 million per 1% gain in throughput (such as for mining and grinding mill optimization)
- Savings of \$1.5 million per every avoided outage (such as for chemical manufacturer asset performance management)
- Savings of more than \$1 million per plant (such as for steel manufacturer furnace optimization)
- Revenue gains of \$1 to \$3 million per plant (such as for glass manufacturer furnace optimization)
- Revenue gains of \$0.25 million per Vertical Roller Mill (such as for cement manufacturer roller mill optimization)

In the quest for a technology vendor that embodies the promise of best-in-class technology and provides deep industry experience, domain knowledge, and a track record of success, SymphonyAI emerges as the undisputed choice. With its global footprint, the IRIS Foundry DataOps Industrial Platform, and an unwavering commitment to delivering value at every step of the digital transformation journey, SymphonyAI is the partner industries need to thrive in the digital era.

Learn more about SymphonyAI's solutions for Industrial at:

<https://www.symphonyai.com/industrial/>





# The Last Word: A Forward Look to Industrial DataOps

The message is clear for industrial organizations and manufacturers: the time to adopt and adapt to industrial DataOps is now. This strategic pivot is more than mere technological adoption; it is a radical cultural and mindset shift toward valuing data as a strategic asset, promoting cross-functional collaboration, and cultivating an environment of continuous innovation—the three pillars of the journey toward digital maturity.

The advent of technologies like quantum computing, with its promise to exponentially increase data processing capabilities, alongside innovations on several fronts (such as cybersecurity, cloud computing, edge computing, software-defined automation, and serverless platforms), will elevate the capabilities of industrial DataOps and industrial AI to new heights.

As industries evolve, so must the strategies and technologies that drive them. The promise of a data-driven, intelligent, and autonomous operational future is not a distant dream, it is within your reach. It is time to seize it.

## Sebastián Trolli

Research Manager, Global Head of Industrial Automation & Software

[Sebastian.trolli@frost.com](mailto:Sebastian.trolli@frost.com)

## Endnotes

<sup>1</sup> Duarte, F. (December 13, 2023). Amount of data created daily. Exploding Topics. Retrieved April 3, 2024, from <https://explodingtopics.com/blog/data-generated-per-day>

<sup>2</sup> Statista. (June 7, 2021). Volume of data/information created, captured, copied, and consumed worldwide from 2010 to 2020, with forecasts from 2021 to 2025 (in zettabytes) [Graph]. Statista. Retrieved April 3, 2024, from <https://www.statista.com/statistics/871513/worldwide-data-created/>

<sup>3</sup> Frost & Sullivan. (February 2024). Top 15 Growth Opportunities in Industrial Automation, 2024 – Report Code K9F9

## YOUR TRANSFORMATIONAL GROWTH JOURNEY STARTS HERE

Frost & Sullivan's Growth Pipeline Engine, transformational strategies and best-practice models drive the generation, evaluation, and implementation of powerful growth opportunities.

Is your company prepared to survive and thrive through the coming transformation?

Join the journey. 