Driving Digital Transformation in Manufacturing:
Lessons from Digital Leaders

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IDC ANALYZE THE FUTURE

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Executive Summary

In 2019, IDC completed a global research study, sponsored by NetApp, to understand the characteristics of the most-mature manufacturing organizations in the way they manage data and digital technologies, and to draw lessons about how manufacturers can expand their use of digital technologies to drive better business outcomes.

Organizations were characterized into one of five categories, from most (stage 5) to least (stage 1) mature:

5. Data Thrivers
4. Data Synergizers
3. Data Responders
2. Data Survivors
1. Data Resisters

We found that the level of digital maturity reported had, not surprisingly, increased since our previous survey sponsored by NetApp in 2017.

Successful digital transformation (DX) relies on intelligent use of data, and the most sophisticated manufacturing organizations are already using it to transform their operations.

Manufacturing Data Thrivers are switching from being opinion-driven to data-driven. They:

- Leverage data in their core technologies to make better manufacturing decisions.
- Gain improved operational efficiencies and enable faster product innovation by bringing goods to market quicker.
- Achieve advanced (real-time) insights from data for organizational transformation and competitive differentiation.
- Use Internet of Things (IoT) to improve their products' reliability and the customer experience – making IoT and IT/OT (Operational Technology) integration two of their hallmarks.
- Use cloud more effectively and strategically for improving staff productivity, security, and agility, utilizing on-premises and public cloud services for applications and data, including greater use of SaaS applications than peers.
- Look to hybrid cloud for greater end-to-end control over their environments.
- Are at the forefront of using artificial intelligence and deep learning to transform their manufacturing operations.

The Shift from Opinion-Driven to Data-Driven

Digital technologies are transforming manufacturing.

Using digital information, manufacturers are improving operational efficiency, driving faster product innovation, and gaining insights for competitive differentiation. The industry is on the verge of radically transforming how products are designed, built, and delivered.

Mature organizations manage their operational information to become data-driven, integrating disparate IT and OT systems to gain unprecedented real-time insights. They add security to workflow to safeguard against competitive IP theft, and they add intelligence to end products to improve usability and supply chain optimization.

The trickle-down effect is to make performance consistent across assembly lines and plants as well as improve their suppliers' workflows. Mature manufacturing organizations also gather crucial product data that accelerates new product development and improves quality.

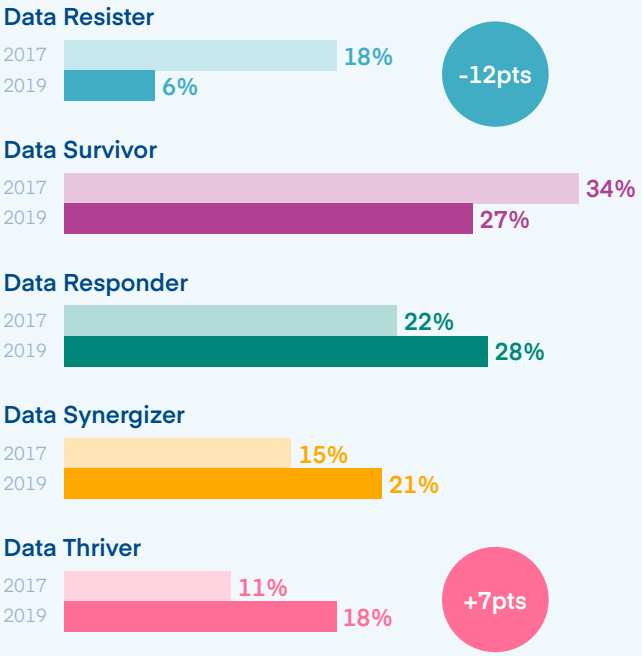
This shift requires data that is secure, clean, high quality, and available in real time. Top data challenges for Data Thrivers include ensuring that data rules meet corporate governance requirements and gaining timely insights from data.

Manufacturing organizations at any stage in their data journey can look to Thrivers and implement similar practices as their transformations progress.

> "Through our analytics we are figuring out that certain segments might be a little more seasonal or more in demand. [Based on this data], we added a production line, and we really rode that wave last year, very, very well."
>
> **Senior Director, IT,**
> **Fortune 500 Electrical Goods Manufacturing Firm**

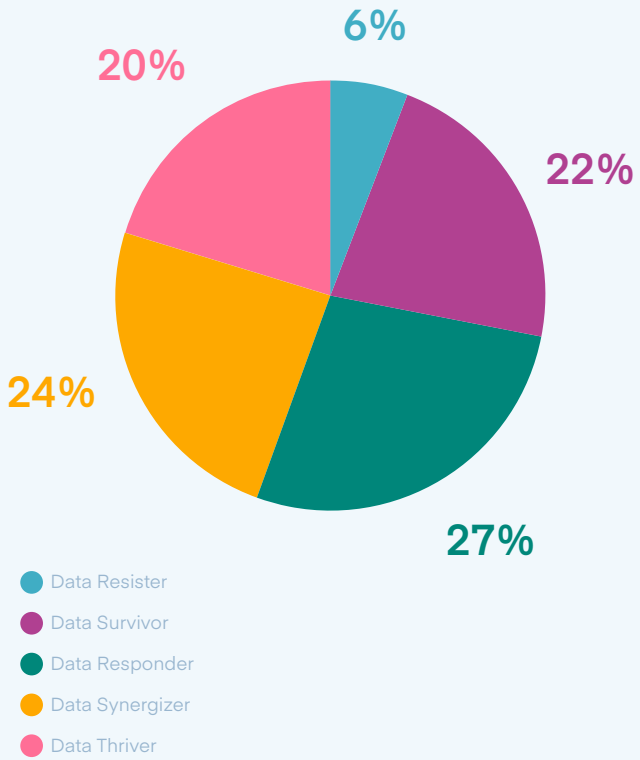
Manufacturing Organizations' DX Maturity Is Increasing

DX Maturity Self-Assessment
(All Industries)



Across all industries, respondents' DX self-assessment improved significantly from the previous survey. Data Thrivers experienced the highest growth rate since the 2017 study, rising from 11% to 18%, while Data Resisters dropped from 18% to 6%.

DX Maturity Self-Assessment
(Manufacturing)



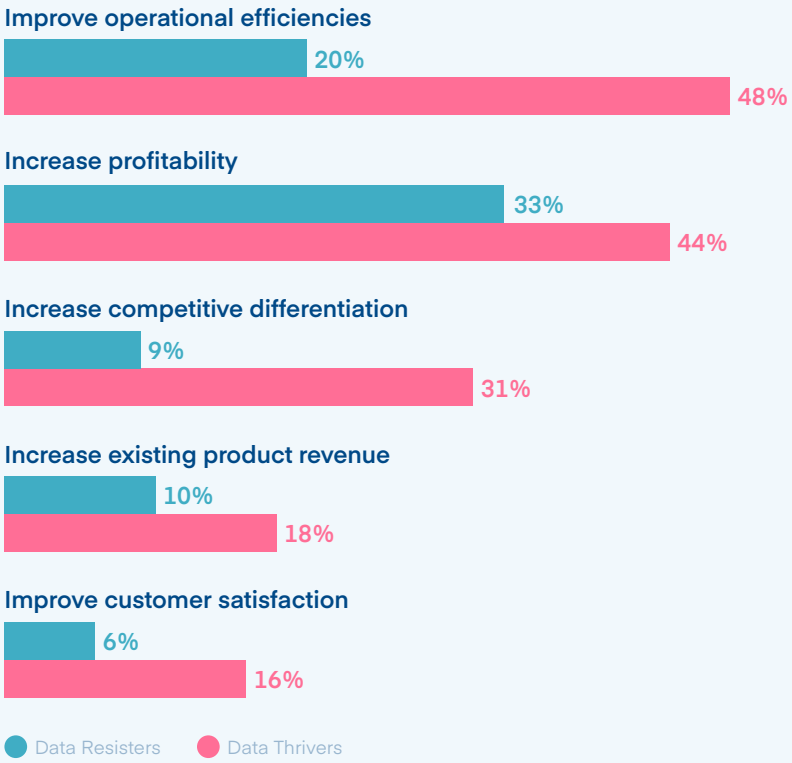
In this year's study, the maturity mix for manufacturing companies tracked ahead of the total sample, indicating more maturity as an industry.

"I'd say we can easily secure ourselves out of business if we are not able to gain insights from the data we collect."

IT Director, Tools Manufacturing Company

Manufacturers Say Efficiency and Profitability Are Most Important DX Objectives, Thrivers Cite Differentiation

Top DX Investment Objectives (Manufacturing)



Both manufacturing organizations *in general* and Manufacturing **Data Thrivers** cite improving operational efficiencies and increasing profitability as their top DX investment objectives.

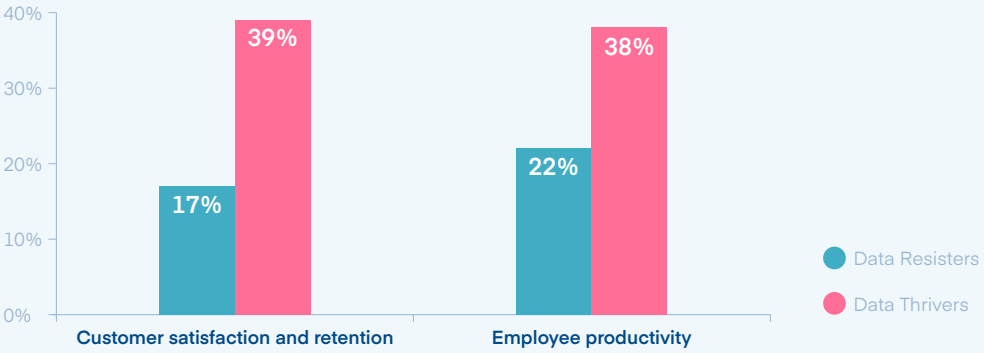
However, Manufacturing **Data Thrivers** also stand out with their focus on increasing competitive differentiation. Manufacturing has never been more competitive; keeping on top of customer needs allows organizations to differentiate themselves from peers.

> We're working towards the goal that very soon [vehicle performance data] will actually provide real-time prognostic information so we can make a better truck with that information."

Senior Director, IT, Heavy Automotive Manufacturing Firm

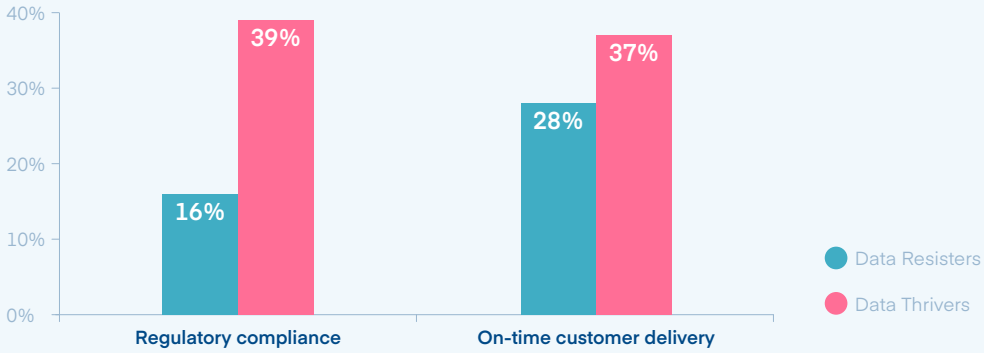
Manufacturing Thrivers' Performance Metrics: Customer Satisfaction/Retention and Employee Productivity

Business Priorities



Manufacturing **Data Thrivers** top business priorities are customer satisfaction and retention and employee productivity.

Self-Reported Business Outcome Improvement, Past 3 Years



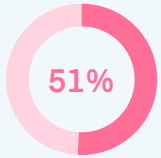
Manufacturing **Data Thrivers** report having the best business outcome improvements in regulatory compliance and on-time customer delivery in the past three years. Having the right technologies helps Manufacturing **Thrivers** both improve their current competitive positions and future-readiness as well as contribute to the goals of increased compliance and customer satisfaction.

Looking to the next three years, Manufacturing **Data Thrivers** will mostly be focusing on product innovation and organizational transformation as the key metrics for measuring business performance.

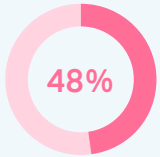
Manufacturing Thrivers' Top Data Challenges Include Compliance and Data Analysis

Data Challenges (Manufacturing)

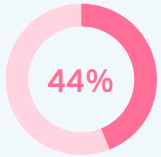
Data Thrivers



Ensuring that data rules meet corporate governance standards

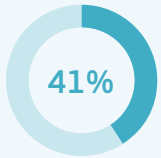


Garnering insights – ability to analyze data

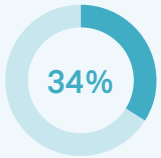


Garnering insights – ability to analyze data in real time

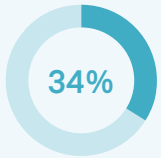
Data Resisters



Fast and easy integration – minimal effort to integrate data from different sources



Control – ensuring that data access is aligned to roles regardless of location (Premises)



Speed of accessibility – being able to get the data quickly through

Manufacturing **Data Thrivers** are most focused on compliance – ensuring that data rules meet corporate governance standards. They are also focused on garnering insights, be they in real-time or quickly enough so that the time to value is not lost. In contrast, **Data Resisters** are hung up on data integration, control, and accessibility, which are table stakes for any organization seeking data-driven business outcomes.

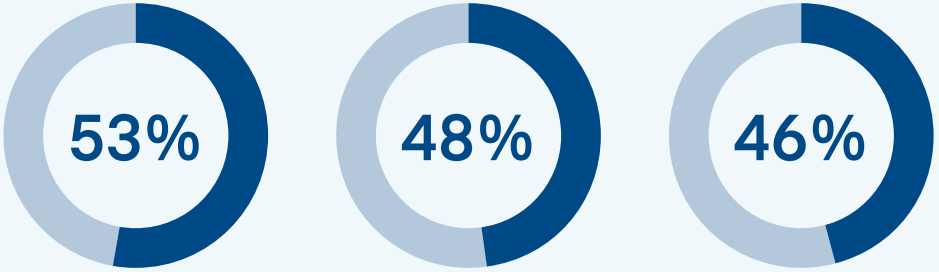
The push for better compliance (i.e., ensuring that data rules meet corporate governance standards) and insights reflects that **Thrivers** not only want to analyze data in real time but also seek to ensure that they meet or exceed internal and external policies and standards for handling the data.

> "We do a yearly corporate audit where we go through some best practices from our corporate offices. We also hire a firm to perform vulnerability and penetration testing."

Senior Director, IT, Fortune 500 Electrical Goods Manufacturing Firm

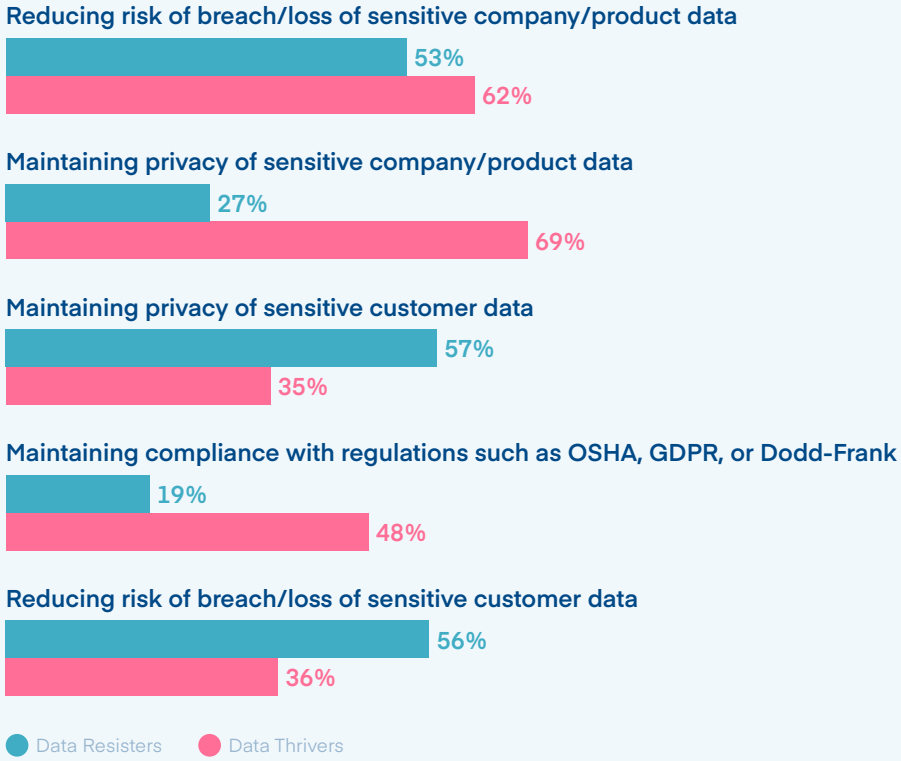
Challenges for Data Privacy, Security, and Compliance

Manufacturing Data Privacy, Security, and Compliance Drivers



For manufacturing organizations across the board, data privacy, security, and compliance are driven by concerns about data and IP theft – specifically reducing risk of breach or loss of sensitive company and product data. The second-most important driver is maintaining privacy of sensitive company and product data followed by privacy of sensitive customer data.

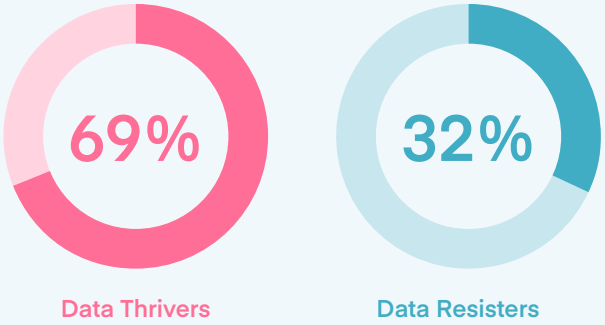
Data Privacy, Security, and Compliance Challenges



Manufacturing **Data Thrivers** are more concerned with maintaining privacy of sensitive company/product data while **Data Resisters** are concerned about customer data, especially maintaining privacy and reducing risk of breach/loss of sensitive customer data.

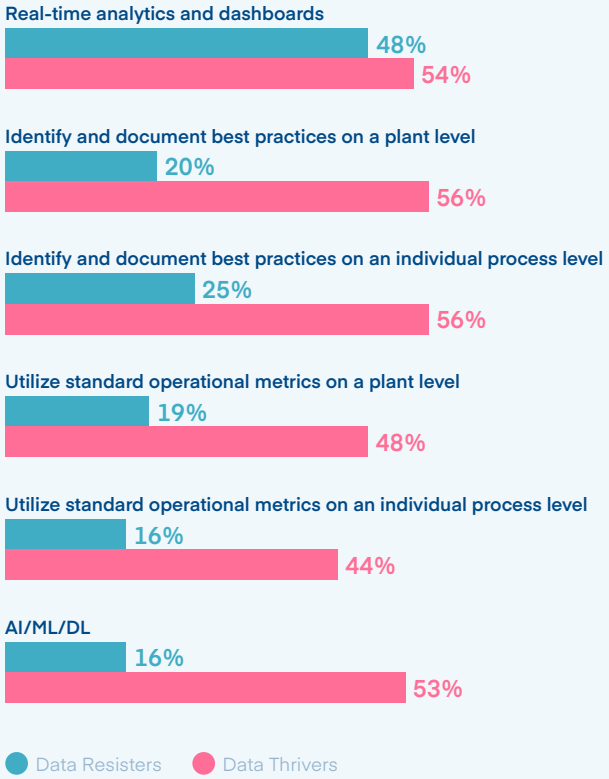
Manufacturing Thrivers Use a Variety of Techniques, Including AI, to Compare Operations Data

Ability to Compare/Contrast Operational Performance Across Plants



Comparing and contrasting operational performance across plants is critical for global manufacturers. It gives manufacturers the ability to have consistent operational efficiency and product quality across their operations. **Data Thrivers** are more than 2x as likely to possess this ability when compared to **Data Resisters**, providing a clear advantage.

Strategies to Compare Performance Across Plants



Manufacturing organizations employ a variety of techniques to compare data across plants. **Data Thrivers** deploy techniques that include real-time analytics and dashboards, utilizing standard operational metrics across all plants, AI, ML, and DL, and identifying and documenting best practices on a plant level as well as an individual process level.

> "We want to eliminate the 3 Ds: dull, dirty, and dangerous jobs. By enabling automation, we are able to collect data on any number of quality-detecting metrics from a surface profilometer, such as imperfections in surfaces, scales, and sensors. We put wireless vibration sensors on our motors in various locations to detect if they're running right or if they're going to fail."
>
> **IT Director, Construction Materials Manufacturing Firm**

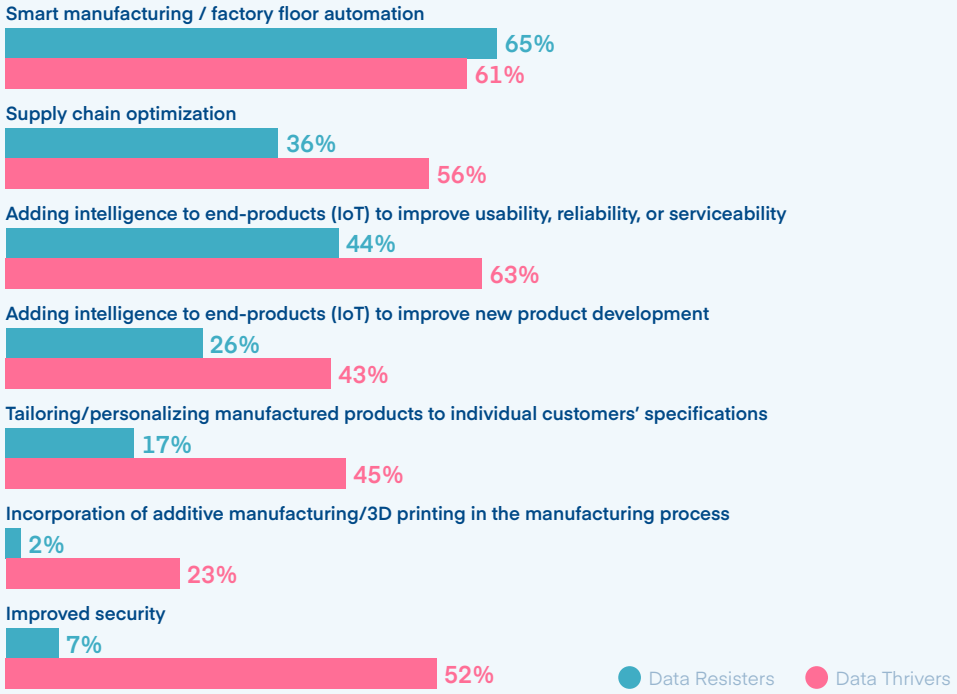
Manufacturing Thrivers Use AI, ML, and IoT to Improve Business Outcomes

Manufacturers' Top Drivers of AI, ML, and DL

Top drivers of AI, ML, and DL in manufacturing are realizing operational insights and improvements, reducing operational costs, making better business decisions, and enabling new revenue streams. Applications include call center automation, product configuration, and security. One challenge mentioned is attracting AI/ML/DL and analytics talent into manufacturing. The perception is that the vanguard is in other industries like financial services or consumer insights.

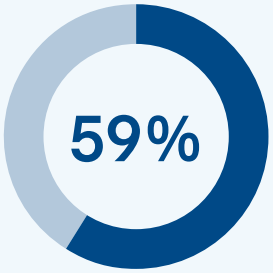
> "We are trying to automate plant comparisons as much as possible. We are investing in artificial intelligence-based reporting systems and shifting to rules-based dashboards for reporting."
>
> **Senior Director, IT, Heavy Automotive Manufacturing Firm**

AI, ML, DL Use Cases

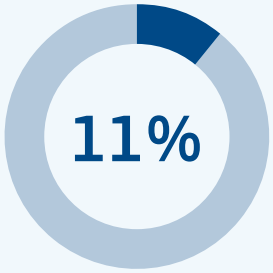


For **Data Thrivers**, the top use case of AI, ML, and DL is adding intelligence to end products (IoT) to improve usability, reliability, or serviceability. This is followed by smart manufacturing (factory floor automation) and security (preventing IP theft or leak of sensitive information). **Data Resisters** are more focused on smart manufacturing but not much else, indicating that their AI initiatives are still in the initial stages.

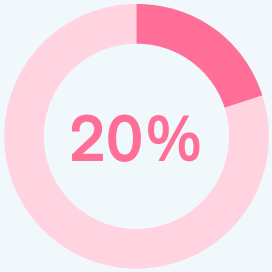
Manufacturing Thrivers Are More Likely to Do Real-Time IT/OT Integration as Part of IT/OT Integration Initiative



Manufacturers have an IT/OT integration initiative



Manufacturers have fully integrated IT/ OT organizations



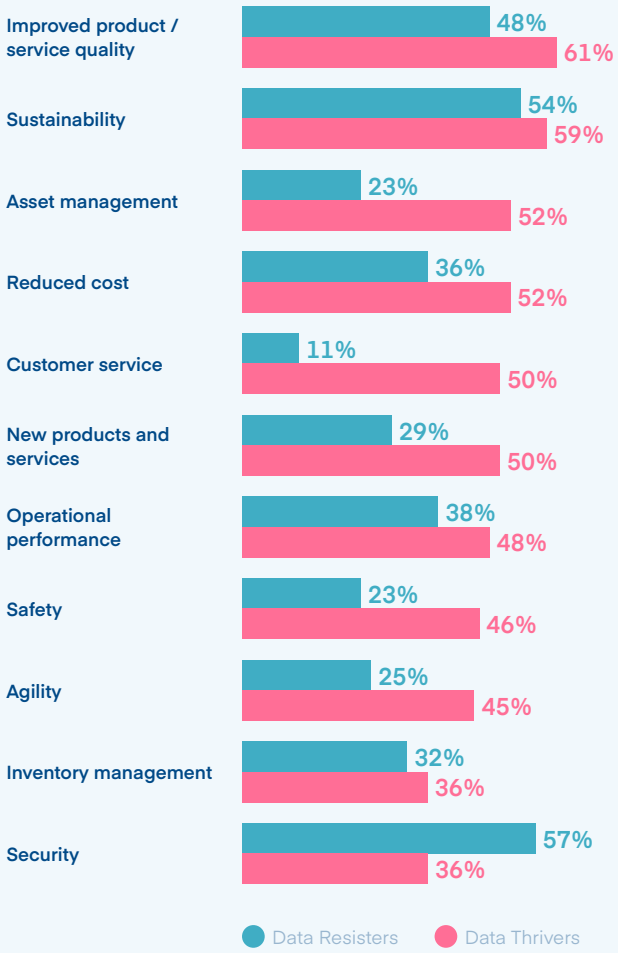
Data Thrivers have fully integrated IT/OT organizations

Many manufacturing organizations have an initiative to converge or integrate their IT (Information Technology) and OT (Operational Technology) systems and organizations. In such organizations, IT is seen as the enabler for OT. Most work closely together, with OT driving the need. Key stakeholders from line of business and IT drive this transformation. In fully integrated IT/OT organizations, the combined organization is led by a single executive.

The primary approach to IT/OT integration for manufacturing organizations in general is batch integration. Thrivers are more likely than other digital maturity levels to do real-time integration.

Manufacturing Thrivers' IT/OT Integration Goals and Barriers

Goals for IT/OT Integration



Goals for IT/OT Integration

The top goals for Manufacturing Data Thrivers are improved product/service quality, sustainability, asset management, and reduced cost. While security is the top driver behind this push for convergence, there are reasons beyond security. Many benefits are achievable through an effective IT/OT integration program, and the ones Thrivers experience contribute to their overall success. One area where Thrivers are over 4x more likely to have a focus is customer service. The needs of customers should be the top priority for any manufacturer looking to differentiate themselves.

Barriers to IT/OT Integration

Data Thrivers in manufacturing cite:

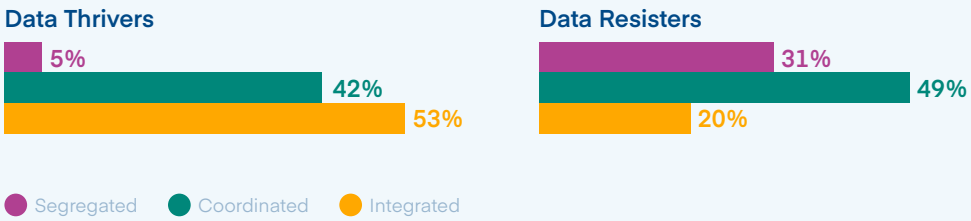
- Concerns about security and technology issues (e.g., compatibility issues between legacy IT and OT applications)
- Lack of integration expertise

Data Resisters cite:

- Lack of familiarity with the concept of IT/OT integration and/or integration expertise
- Decision making/organizational complexity

Source: Data-Driven Transformation Study, Sponsored by NetApp, April 2019

IT and OT Systems Are Converging; Manufacturing Thrivers Are More Likely to Utilize an Integrated Governance Model



Segregated:
Each plant makes independent investment decisions about technology for its operational requirements (control and execution systems).

Coordinated:
Each plant makes independent investment decisions about technology for control systems, but decisions related to execution are shared across multiple plants through a shared services organization. Collaboration between IT and operations teams occurs on a project basis as required.

Integrated:
Control systems and execution systems investment decisions are made through a shared services organization. Ongoing business as usual collaboration exists between IT and operational technology. Decision making about investment and priorities for operations is undertaken as a single unit.

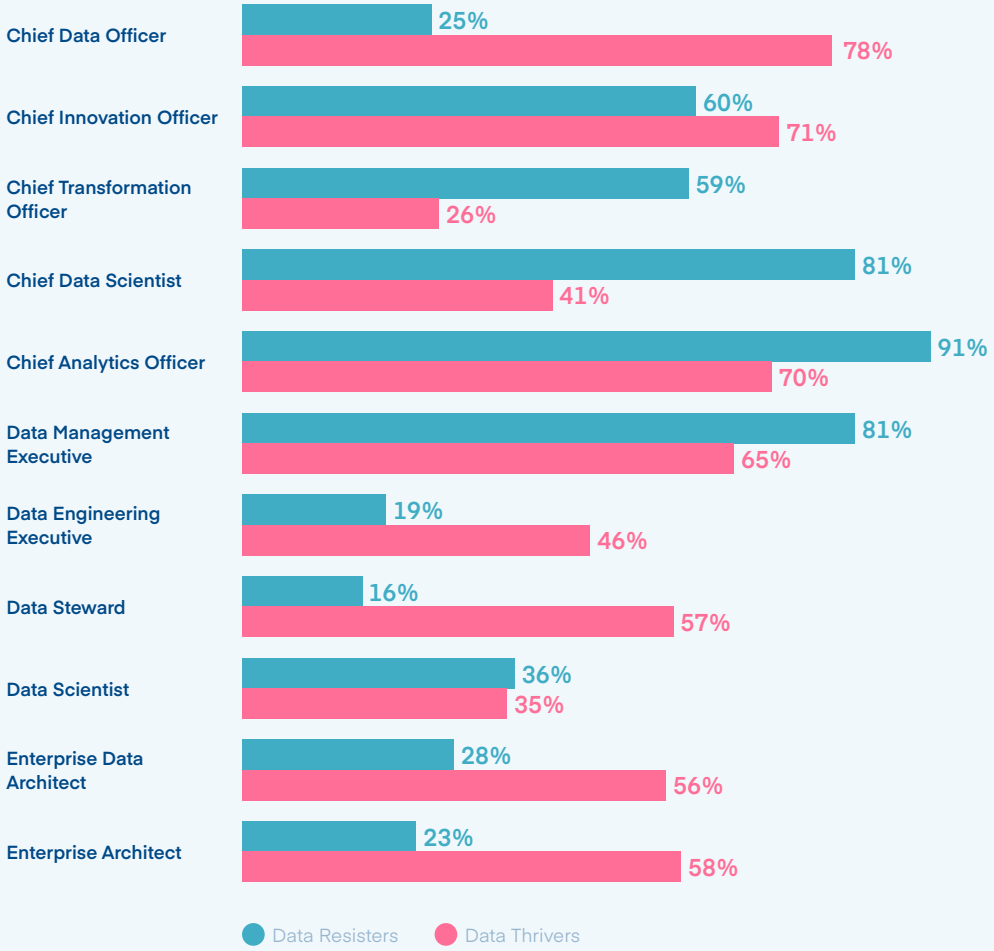
The IT and OT worlds are converging within manufacturing. Decisions can no longer be made in isolation. Collaboration between IT and OT will result in the most effective technology landscape, one that allows a company to become data-driven. Manufacturing Data Thrivers are far more likely to utilize an integrated IT-OT governance model, which allows for the best system decisions to be made. Resisters are starting to move away from the segregated approach, however, there is still a lot of ground to make up when compared to Thrivers.

“We do an annual or biennial corporate audit where we review best practices from our corporate offices. We also hire an external auditing firm to perform vulnerability and penetration testing.”

Senior Director, IT, Fortune 500 Electrical Goods Manufacturing Firm

Data Roles and Ownership in Manufacturing

Roles in the Organization



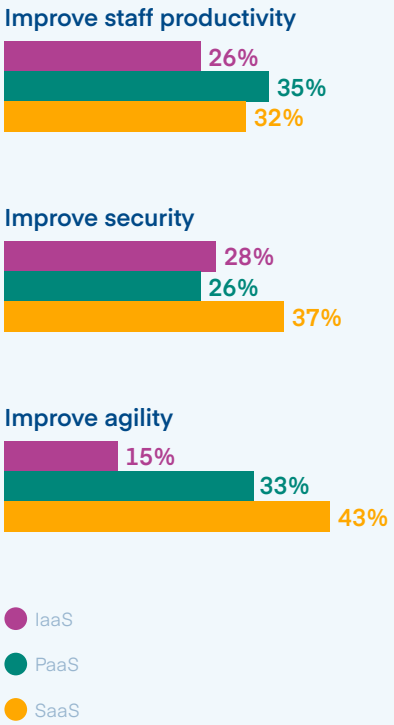
Manufacturing Data Thrivers are likely to have Chief Data Officer and Chief Innovation Officer roles. They consider the role of Chief Data Officer as having significant influence on data strategy and policy.

Resisters are more likely to have Chief Analytics Officers, Chief Data Scientists, and Data Management Executives, but they consider the role of Chief Transformation Officer to be most influential.

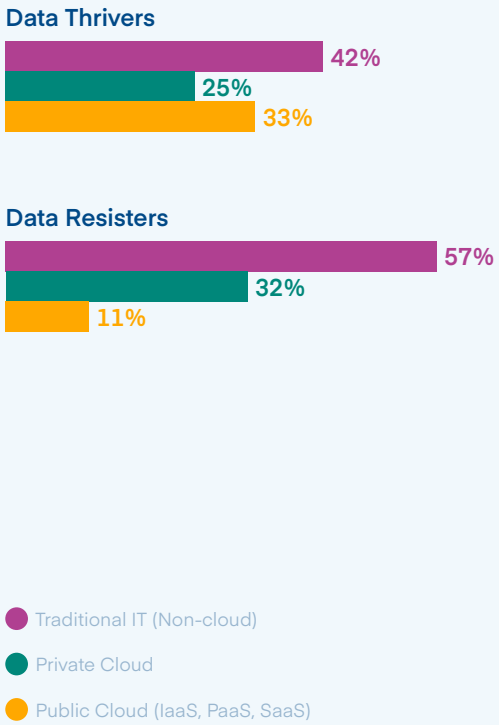
Thrivers stand apart from their peers by promoting the roles of Data Stewards, Enterprise Data Architects, and Enterprise Architects in addition to the roles above.

Data Thrivers Have Higher Cloud Adoption Among Manufacturing Organizations

Manufacturing Thrivers' Top Factors Driving Cloud Adoption



Data Thrivers have a higher percentage of infrastructure in public cloud



Manufacturing organizations are beginning to embrace cloud as the industry is starting to acknowledge the benefits realized by forward-thinking organizations. They are growing less apprehensive about moving certain workloads to the cloud, as there will be a mix of on-premise and cloud solutions. Top factors driving cloud adoption amongst Manufacturing Thrivers are improving staff productivity, security, and agility.

Conclusion:
Use Data to Improve Manufacturing Outcomes

Manufacturing is a complex world of high-speed decision-making, constant change, and pressure to keep up with new product development — and it won't change anytime soon. Survival thus depends on becoming data-driven. Manufacturers recognize that the vast amounts of data generated from products and operations can be turned into actionable insight and competitive advantage.

A closed-loop process maximizes data's usefulness in decision making at the organization, business unit, and plant levels. Manufacturing Thrivers use various techniques including artificial intelligence to compare operations data with that from the IoT to improve business outcomes. IT and OT systems are converging, and Manufacturing Thrivers are more likely to utilize an integrated governance model. In this model, investment decisions about control systems and execution systems are made through a shared services organization, ongoing collaboration exists between IT and operational technology, and decision making about operations investment and priorities is undertaken as a single unit.

Manufacturing Thrivers also stand out for their focus on increasing competitive differentiation, a path that has never been more critical to success than it is today.

Successful manufacturing organizations are becoming data-driven and identifying ways to leverage digital solutions to improve operational efficiencies and increase profitability. Forward thinkers are beginning to capitalize on the benefits that digital transformation promises around product innovation, faster time to market, and increased customer satisfaction. However, they must do so in a way that maintains their data security, increases end-to-end insights, and improves data governance standards.

It's a brave new world, and we are only at the first step.

Appendix:
Study Methodology

The findings in this study were developed in part from a series of focus groups IDC conducted in January 2019 with information technology and data executives in healthcare, manufacturing, and financial services. The healthcare and manufacturing groups were conducted in Chicago while the financial services group was held in New York.

These groups were followed by a global survey of 900 information technology and data executives in the U.S., U.K., Germany, France, China, Japan, and Australia. Typical respondent titles include CIO, VP of Data Management, Chief Data Scientist, and Data Architect. Of the total survey sample, 300 completes came from manufacturing organizations. **The data provided in this InfoBrief comes from those 300 completes.** The global study was conducted in April/May 2019.

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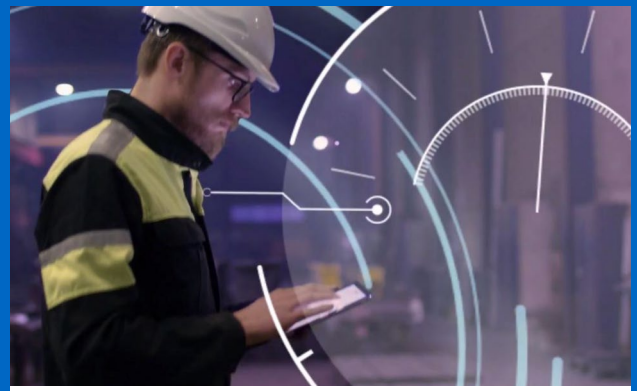
Get Executive Insights from IDC, The Wall Street Journal, and NetApp



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