LNS Research

RESEARCH SPOTLIGHT

Advanced Industrial Analytics:

4 Proven Strategies to Scale Transformation During Uncertain Times

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Where Manufacturing Meets IT

Introduction

Since the COVID-19 pandemic, the global manufacturing industry has been impacted by not one or two, but many simultaneous and intertwined challenges, including: managing rapid supply-demand fluctuations, the skilled worker shortage, operationalizing sustainability and ESG goals, and the recent socio-economic issues leading to a looming recession.

Amidst these challenges, many manufacturers are considering slowing down or pausing medium to long-term transformational programs to focus on short-term wins. However, LNS Research's recent research on Analytics That Matter reveals that the Leaders (the top 14% of companies) are showing no signs of slowing down. These Leaders are in fact doubling down on existing investments to accelerate transformation programs and are building on competitive advantages to further leap ahead of the competition.

At the heart of these transformation programs lies a strong foundation of making informed decisions based on data and advanced analytics. One recent LNS Research survey that studied the economic impact of technology investments showed that industrial analytics were the most likely to provide quick wins to manufacturing companies. While manufacturers have been doing data analysis (SPC, root cause

> **While manufacturers have been doing data analysis** since computers were first deployed across manufacturing, many of the challenges experienced 30+ years ago have persisted, including data access, data quality, in-context delivery of intelligence, and usability of solutions...
>
> – Vivek Murugesan
> *Senior Research Associate*

Software projects with the quickest impact

N = number of respondents from economic uncertainty

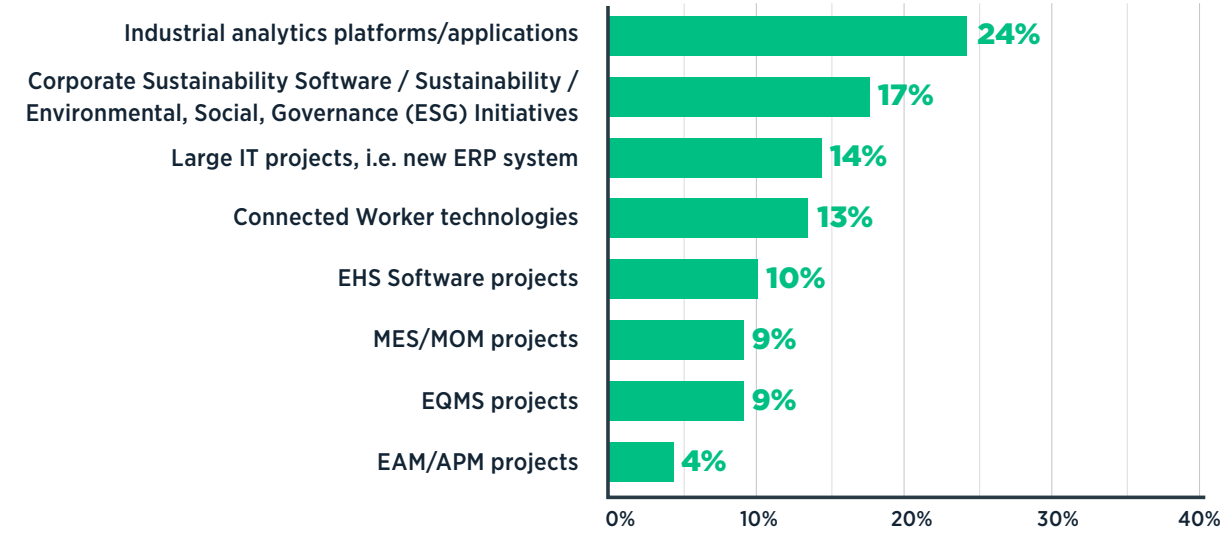

FIGURE 1 - LNS Research Survey Responses on Quickest Impact from Software Projects

analysis, etc.) since computers were first deployed across manufacturing, many of the challenges experienced 30+ years ago have persisted, including data access, data quality, in-context delivery of intelligence, and usability of solutions in the context of the work being done.

In this first Research Spotlight of the Analytics That Matter biennial research series, jointly conducted by LNS Research and MESA in 2022, we will be defining the emerging space of Advanced Industrial Analytics – what it includes and what it doesn't – and how the Leaders are avoiding these traditional challenges and leapfrogging the competition in these uncertain economic conditions. In additional, upcoming reports, we will dive into more detail into specific topics, including the benefits of an industrial data hub architecture, common pitfalls in deploying Advanced Industrial Analytics, and how to avoid these common mistakes.

So, what do we mean by Advanced Industrial Analytics?

Today's industrial companies are using analytics in many forms: spreadsheets, control systems, monitoring dashboards, and an increasing number of ML/AI platforms, not to mention homegrown systems. However, many of them do not meet LNS Research's definition of Advanced Industrial Analytics. To start, any Advanced Industrial Analytics application needs to:

- **Address multiple industrial use cases out of the box:** There are many generic IT and data focused analytics platforms in the marketplace, and with the right team and resources they can deliver value to manufacturers. But many manufacturers lack these resources and expertise but still want quick time to value. Advanced Industrial Analytics need to be tailored to the industrial market and have pre-built use cases out of the box to speed time to value. Further, manufacturers don't want to have to deploy a new vendor every time they want to pursue a new use case, so vendors in this space need to span a broad set of use cases in the space.

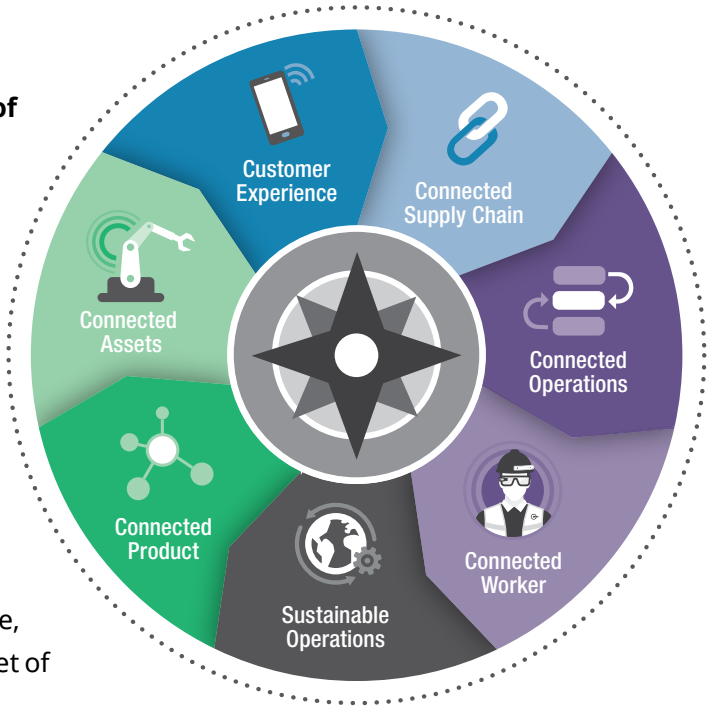

FIGURE 2 - Industrial Transformation Use Case Navigator

- **Be digitally native and create value from a modern operational architecture:** Traditional analytics were mostly built on client-server architectures within the constraints of an ISA-95 framework, where data flow was hierarchical in nature, thereby creating gaps and data silos. In today's Industry 4.0 world, companies are flattening this architecture by enabling machine connectivity and data transfer between IT and OT with many-to-many architectures. Some of the leading manufacturers have invested heavily in building a common data model or data schema to bring together data from the shop floor and the enterprise systems that can feed analytics in the cloud, edge, or in on-premise systems. Further, many IX Platform providers now offer IIoT, AR/VR, No-Code Dev, AI/ML, Cloud, and Edge capabilities as a service. Advanced Industrial Analytics vendors are architected to maximally take advantage of all these capabilities.

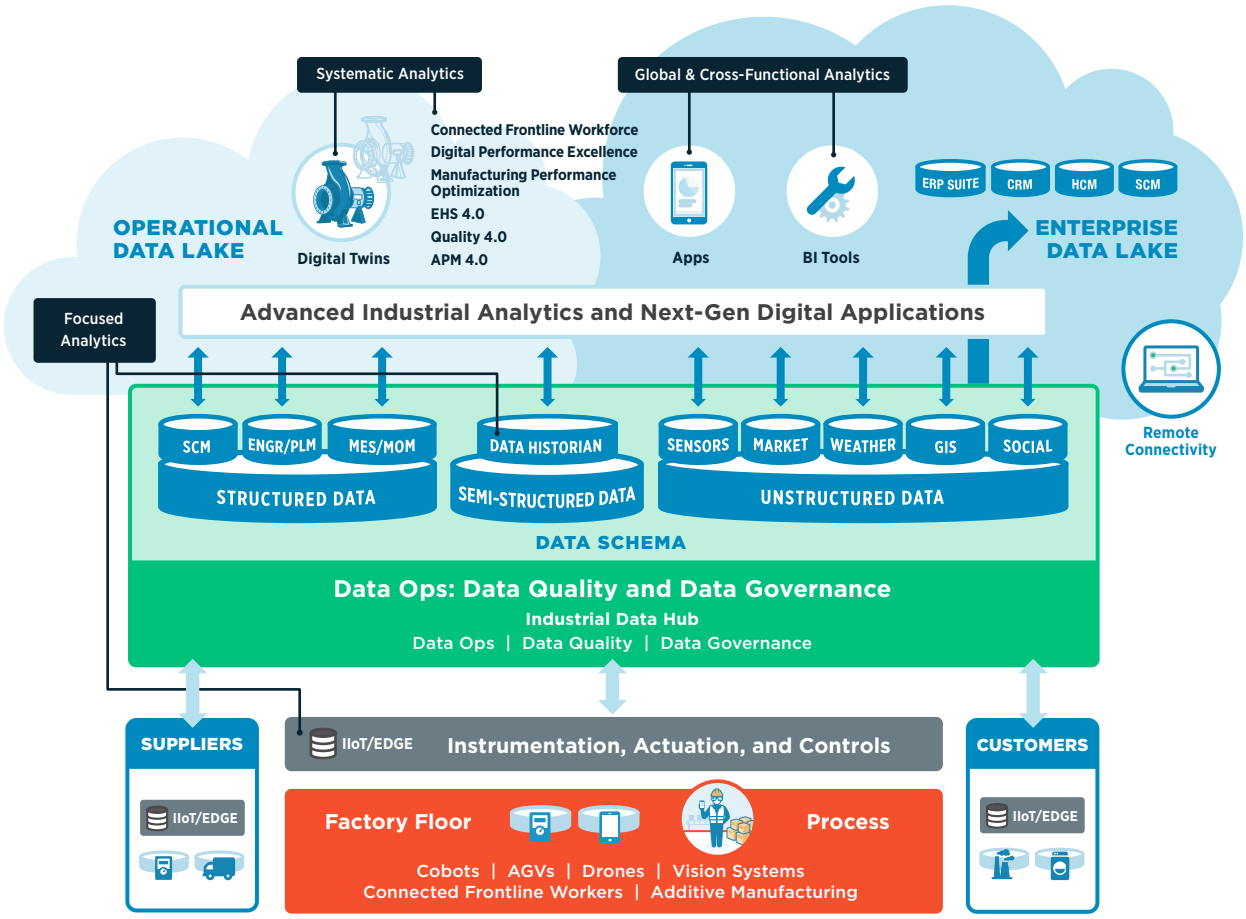

FIGURE 3 - Industry 4.0 Operational Architecture

- **Target specific layers and roles:** Use cases for Advanced Industrial Analytics extend across multiple layers in the organization, as shown in Figures 3 and 4, including global/cross-functional, systematic, and focused. Given the architectural constraints described previously, traditional analytics have mainly been targeted at transactional data at the global/cross-functional level or at process data at the unit level. Advanced Industrial Analytics can now target multiple levels and roles by fully taking advantage of the architecture and also working with a diverse set of data types.

LAYER	PREFERRED ARCHITECTURE	USE CASES	TARGET USERS
Global/Cross-Functional	Cloud	Multi-plant Supply Chain Enterprise Performance Management Customer Experience	Division Corporate Supply Chain Value Chain
Systematic	Potential mix of Edge and Cloud	Multiple assets and processes in a plant, e.g., pumps, valves, heat transfer, etc. Discrete asset classes, e.g., robots, presses, cnc	Operations Maintenance Reliability EHS
Focused	Edge Saas optional	Unit/Equipment/Line Performance Continuous Improvement, e.g., Lean Sigma	Process Engineer Reliability Engineer

FIGURE 4 - Analytics Across Multiple Layers in the Organization

- **Analyze large heterogeneous data sets:** While several traditional analytics only cover structured and (in some cases) semi-structured data from existing databases and historians, one of the biggest differentiators of Advanced Industrial Analytics is the inclusion of unstructured data. This means newer types of data, such as image files, logs, and video, are introduced into the data model enabling more complex algorithms. Some of the advanced use cases enabled by these data types include vision systems for automated quality inspection, natural language processing, etc.

- **Leverage sophisticated mathematical models:** In terms of sophistication of the analytics, Advanced Industrial Analytics goes beyond traditional statistical, rules-based, or first principles-based analysis and blends this with machine learning/artificial intelligence models, ranging from descriptive to prescriptive, and prognostic. Some of the more advanced companies are taking it a step further by including these models as part of a self-learning system by closing the loop on the insights from analytics. This includes not just developing predictions and prescriptions, but also going back to check if they were accurate and using that information to improve the model for future analyses.

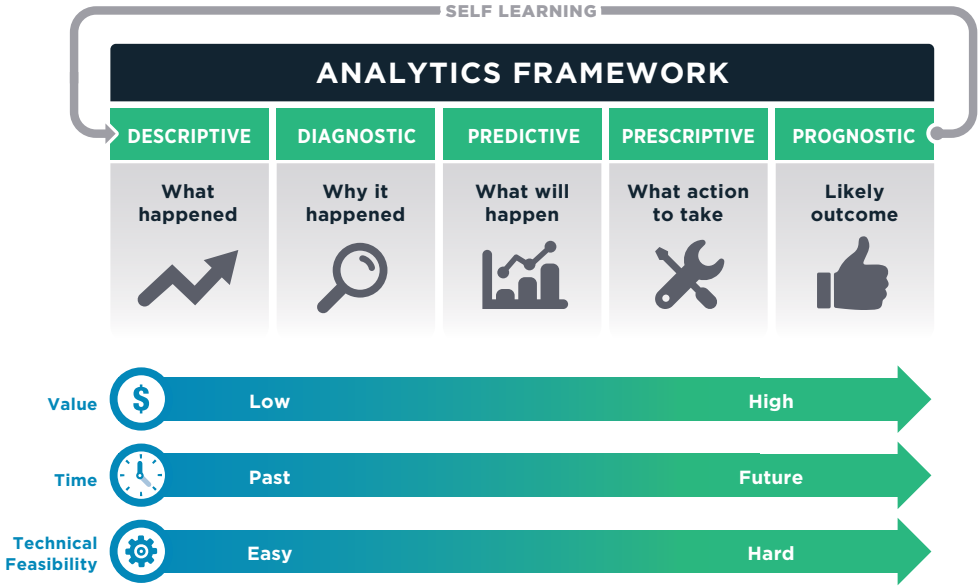

FIGURE 5 - Advanced Industrial Analytics - Levels of Sophistication

Current State of Advanced Industrial Analytics: On the Cusp of Broad-Based Adoption

Now that we've defined Advanced Industrial Analytics, let's see how widely it's been adopted by manufacturers across the globe. LNS' research data from the Analytics That Matter study in 2022 shows that adoption rates for Advanced Industrial Analytics has just crossed the proverbial chasm and is at 33% (fully implemented beyond pilots). But, when comparing this number to two years prior, we see that there has not been much progress, which is a surprising finding.

Adoption of Advanced Industrial Analytics

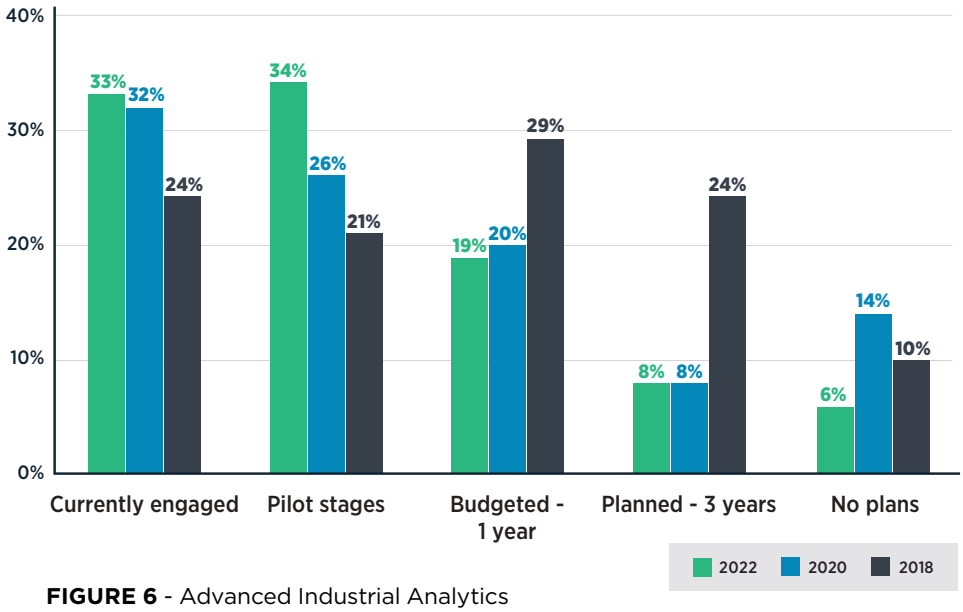

FIGURE 6 - Advanced Industrial Analytics Adoption Rate – Comparison Across Three Studies

However, that does not mean that there hasn't been much progress in the industry since 2020. The market is clearly progressing in several dimensions. First, the percentage of companies with "no plans" or "planning in the next 3 years" has dropped dramatically as skeptics have left the market or been convinced. Second, as we will show in the next section, companies that have currently adopted Advanced Industrial Analytics have broadened adoption across use cases and plants, while also dramatically increasing the sophistication of these implementations – most notably deploying prescriptive and prognostic analytics to create a self-learning system.

Finally, the big question remaining is this: Will companies see pilot projects and win budget through to fully implemented solutions, green-lighting pilots, and proofs-of-concept? Looking at the near future, over the next two years, it is still an open question of whether Advanced Industrial Analytics will become something like ERP, a ubiquitous must-have for every manufacturer, or will it stagnate like MES, which plateaued at around 20-25% adoption and has become more of a unique solution for a subset of plants with more mature teams and complex operations?

Although there is no clear answer, LNS Research remains bullish on the space. Much depends on the continued innovation of the vendor community to make deployment easier and time to value quicker, especially with limited resources. But much also depends on the industrial companies themselves making smart architectural decisions.

Almost every week, LNS Research is briefed by another new industrial analytics platform coming out of stealth mode, and established industrial software vendors are doing acquisitions and partnerships to add more analytics solution to their portfolio. It will (and already has) become too easy for industrial companies to start piloting many solutions in this space; we've seen some companies run 10+ pilots at the same time but solution sustainment, interoperability, and cost can quickly become a problem. For most, a one-to-one mapping of vendors to use cases will be too inefficient and lacking scale; most companies will find it best to choose one or two primary Advanced Industrial Analytics providers, with additional vendors being reserved for special needs and use cases.

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– Vivek Murugesan
Senior Research Associate

Industry Dramatically Impacts the Competitive Landscape

While overall adoption rates remained pretty flat, a closer look at the numbers shows that each industry had its own story.

- **Consumer-facing industries had the highest adoption numbers in fully engaging analytics programs.** Having direct access to a rich stream of consumer data from social media, online marketplaces, etc., has certainly acted as a competitive advantage for these companies in terms of analytics. Additionally, these consumer-facing companies also have experienced a lot of pressure from the C-suite to achieve sustainability, ESG, and overall transformation goals, which has led to more investment in analytics.

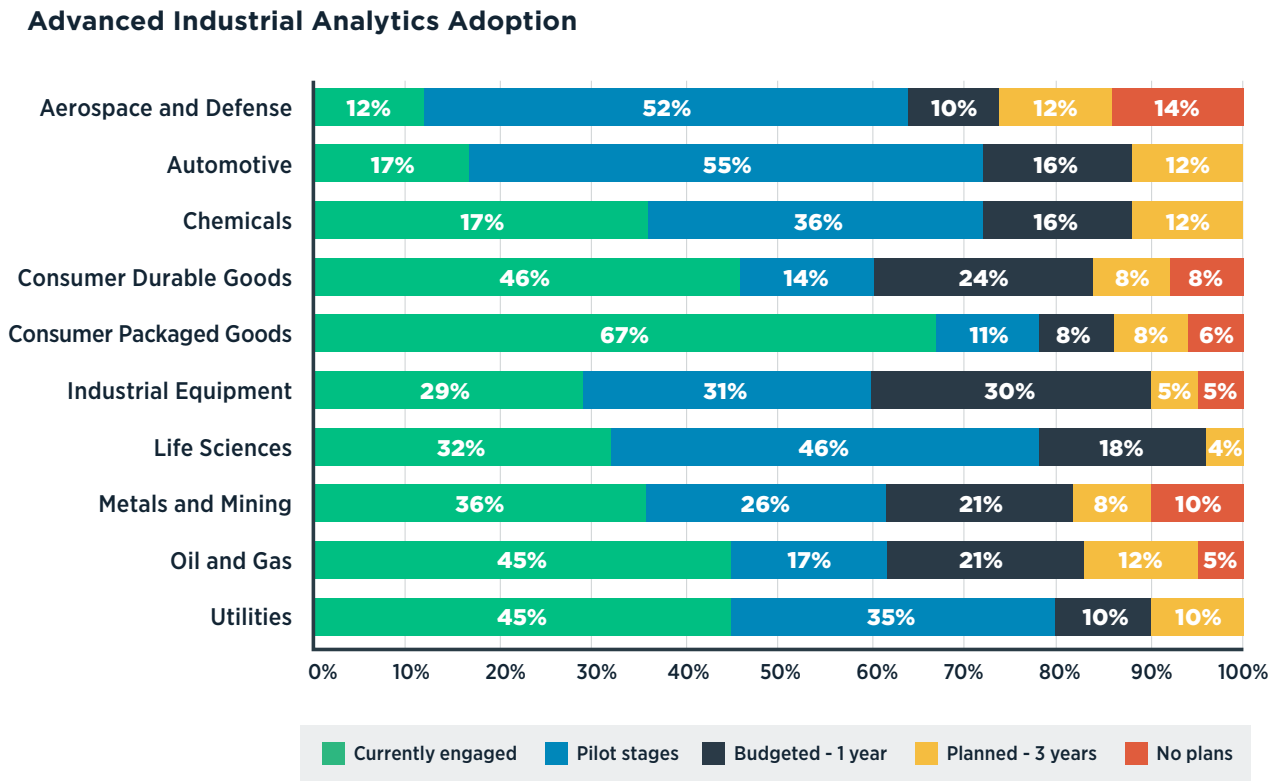


FIGURE 7 - Advanced Industrial Analytics Adoption Rate by Industry

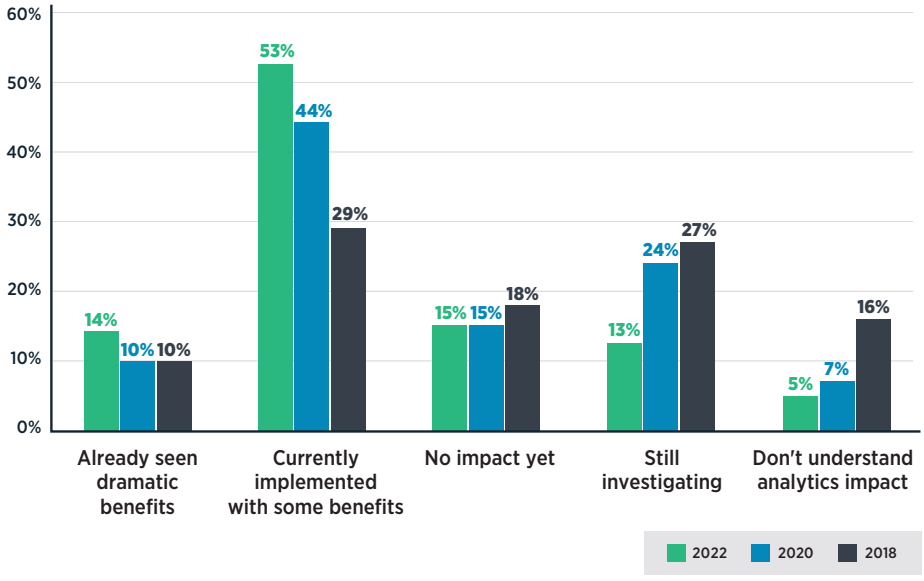
- **Automotive and Aerospace & Defense (A&D) companies** had some of the lowest adoption rates but with some of the highest pilots! This is not surprising as these industries have unique data collection and aggregation issues given complex discrete manufacturing processes, an even more complicated supplier network, and the lack of existing data historian deployment – most data is still stranded at the machine or line level. Adding to that, their strict compliance standards, such as iTAR regulations and requirements, have created unique speed bumps for these companies to ramp up analytics programs.

- **Process industries, including, Chemicals, Oil & Gas, and Metals & Mining**, are generally leading the pack and more advanced than the rest, as they have a solid foundation of collecting asset and process data through historians for many years. This has helped them run advanced analytics more than the other industries which did not have this same advantage.

4 Strategies Proven by Analytics Leaders to Successfully Scale Transformation

In the previous section, we saw that adoption of advanced analytics programs remained nearly flat over the past two years. But perhaps more importantly, we also saw that there has been a significant, 40% increase in the number of companies that have seen dramatic benefits from these programs (which had remained flat two years ago). What does this mean? It means that while the majority of the market has only progressed from skeptics and planning to budget and pilots, the few Leaders that already have experienced big results (the top 14%) have pulled even further ahead and are reaping the benefits of sustained accumulated advantage.

Advanced Industrial Analytics Adoption



*2018 numbers denote Analytics/IIoT

FIGURE 8 - Impact of Advanced Industrial Analytics Programs

In the next part of this study, we will drill into some of the best practices followed by the Leaders that have enabled them to be successful in their analytics journey.

#1 Invest in Data Infrastructure – Including Machine Connectivity and Next-Gen Automation:

One of the foundational elements of a strong analytics program is high quality, available, and accessible data. This requires investing in machine connectivity, including from equipment traditionally connected to automation tools, such as PLC, SCADA, DCS, but also from equipment that has been stranded in islands of automation, like SMT machines, CNC machines, and many other asset classes. Further, next-generation automation, such as robots/co-bots, AGVs, and vision systems, deliver both added productivity and robust sets of new data that are more easily provided through IIoT, edge, and lightweight protocols.

How Companies are Addressing Flexibility Issues in the Factory

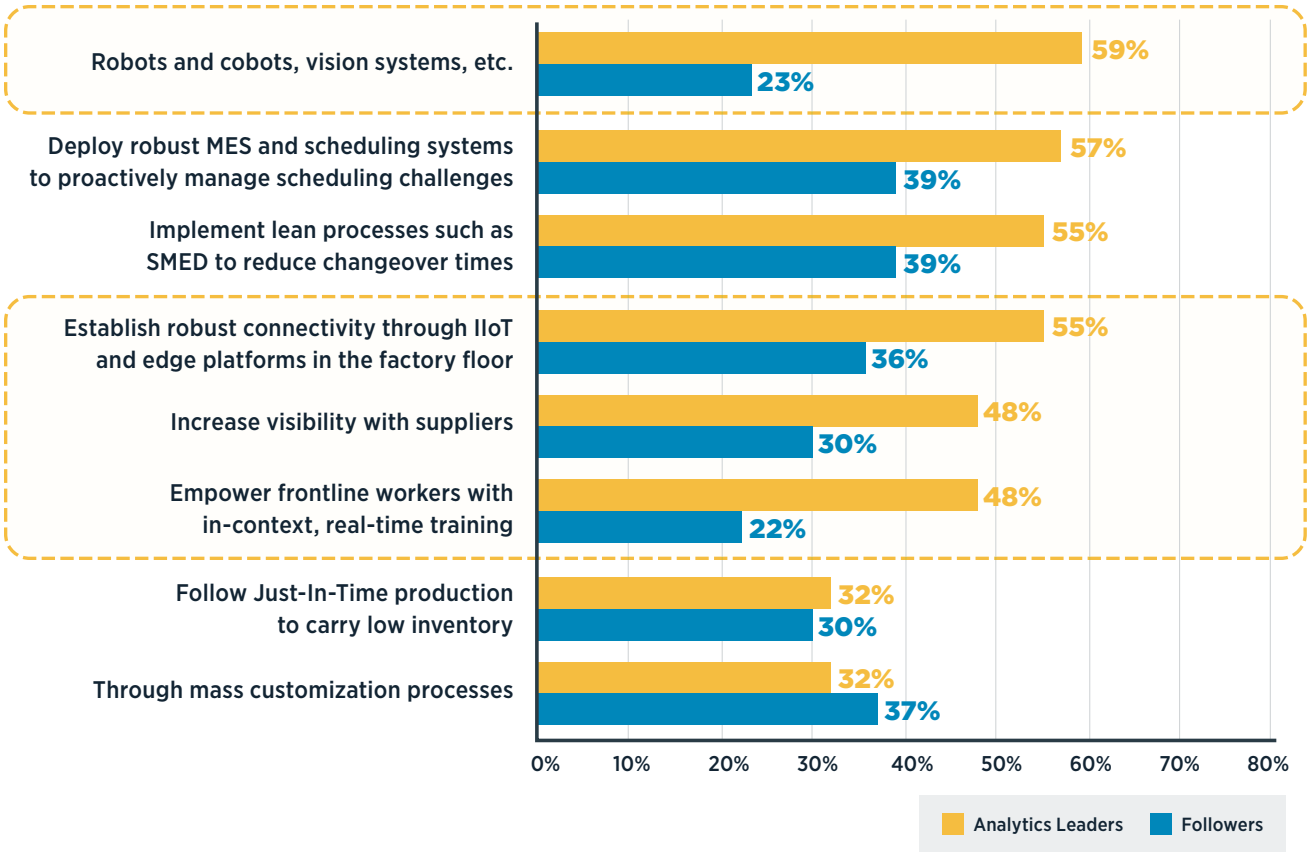


FIGURE 9 - Leaders and Followers Implementation of Machine Connectivity and Next-Gen Automation

#2 Build Toward a Self-Learning Analytics System

Some of the biggest differentiators of Advanced Industrial Analytics is going beyond predictive analytics and adding on prescriptions and prognosis to build a closed-loop self-learning system. The research data shows that the Leaders are more likely to have this capability.

A big mistake many companies make is that they place too much emphasis on predictive (often as a starting point) without enough focus on the starting and ending portions of this closed-loop system. LNS Research recommends companies to first build a strong data foundation in a way that delivers quick wins – often with machine connectivity coupled with descriptive and diagnostic capabilities. Then, with value created, move to add predictive, prescriptive, and prognosis to create full closed-loop learning.

Analytics, Levels of Sophistication

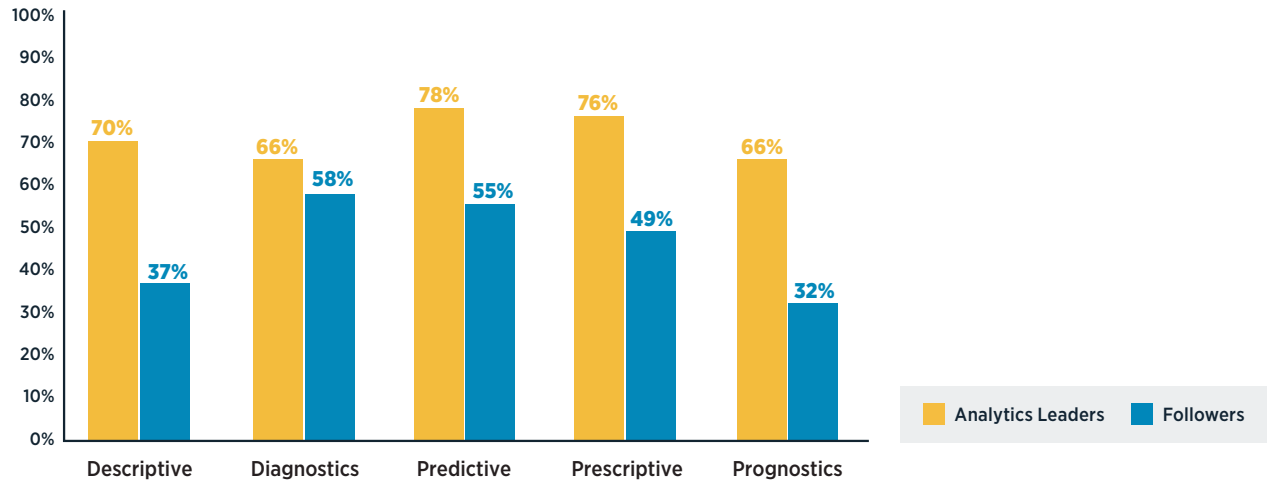


FIGURE 10 - Types of Analytics Utilized by Leaders and Followers

#3 Let Operational Support Roles Drive and Own Analytics

Another differentiator that separates the Leaders from the Followers is which role owns and drives analytics success. The research data shows that the best role to give responsibility of Advanced Industrial Analytics are the operational support roles, like quality, reliability,

continuous improvement, or transformation. These are the roles that already have analytics skill sets, are most accustomed to providing decision support to operations, and fits most easily within their existing business processes. IT is another good choice, especially if the group has trust, credibility, and domain expertise.

Finally, and perhaps counter-intuitively, direct control and ownership of analytics by operations is highly correlated to Follower status. Although, if your organization is using an Agile methodology, these roles should most definitely be the "product owner;" in most cases, plant managers and operations people can't afford the time and resources required to truly "lead" analytics initiatives that include maturity assessments, technology architecture discussions, solution selection workshops, testing pilots, etc., without sacrificing productivity and delivery KPIs. Operations need to set the vision, strategy, and priorities – but then relinquish ownership and control of analytics to others.

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– Vivek Murugesan
Senior Research Associate

Who Leads Analytics at Plant-Level?

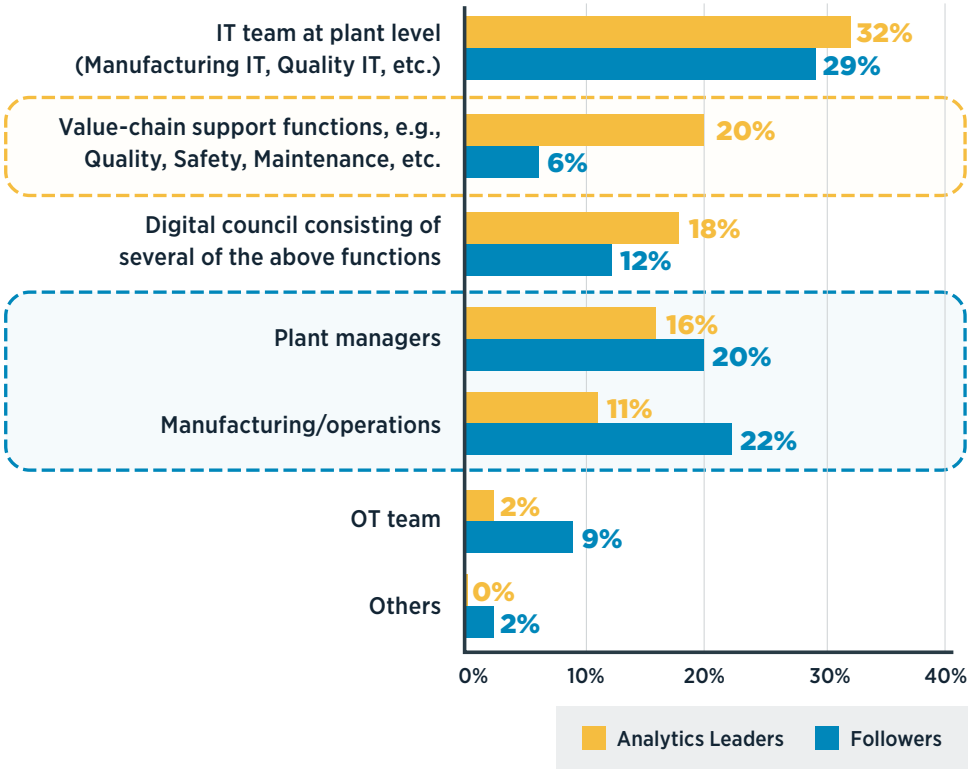

FIGURE 11 - Roles Leading Analytics within Plants

#4 Change Management and the Power of Prepositions – Focus on "With," not "To" or "For"

Getting organizational buy-in to any new program or initiative is one of the top challenges facing any organization. This is especially true of advanced analytics programs where data science teams are involved. Often, data science teams lack domain expertise and understanding of the true problems faced by operations. But they are experts in the tools and methodologies to drive insights from data. And often, operations lack expertise in the tools and methodologies of advanced analytics but understand the domain and problems.

To drive buy-in across the organization, these two teams must work together effectively. And if they don't, the outcomes are well understood:

- Data science teams spending weeks or months uncovering insights in the data that are a well-understood phenomenon to anyone who has completed freshman course work in the domain.
- Operations teams deploying a new solution to solve each new problem with no eye toward sustainment of the solutions or scaling the solutions across the plant network.

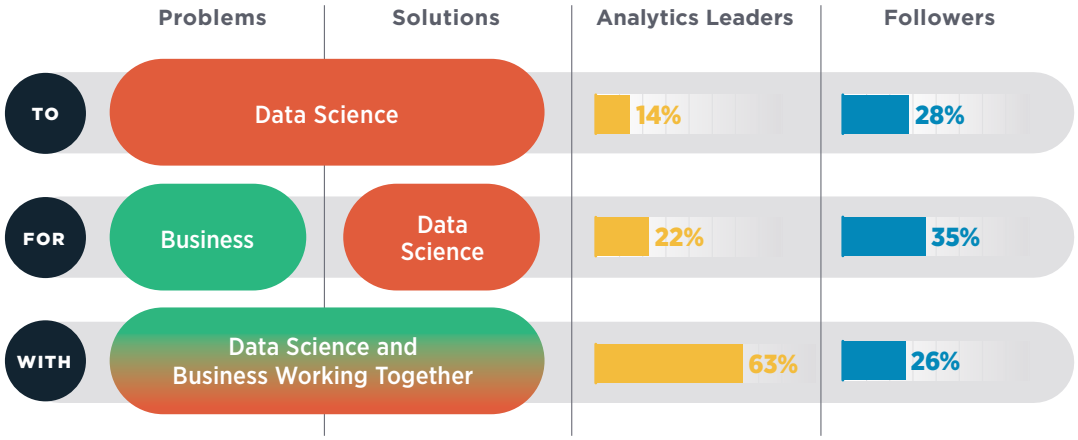

FIGURE 11 - Addressing Problems & Developing Solutions – Leaders vs. Followers

But how do teams work together effectively? The data shows that Leaders are over twice as likely as Followers to do two specific things.

First is language and positioning. Data Science teams shouldn't be doing analytics "for" operations and change shouldn't be happening "to" operations. Instead, data science teams should be working "with"

operations. Second, the teams should be working with each other to jointly identify the problems to be solved and then developing and choosing the solutions to be used, with the data science team driving the parameters and structures of these engagements, i.e., vision-setting sessions, problem prioritization polls, solution selection workshops, etc., and the operations team providing the bulk of the content in these activities.

Summary & Recommendations

Advanced Industrial Analytics programs are at a pivotal stage in today's manufacturing industry. LNS Research's latest Analytics That Matter research shows that a third of recently surveyed industrial companies have fully engaged in advanced analytics programs, and almost twice as many are running pilots or have budgeted to do so within the next 12 months.

While the industry leaders have already laid the foundation and are now accumulating step change benefits, these companies still need to define what is next and how to deliver these insights with fewer resources. As for the Followers, while the remaining majority are still lagging, they are making progress and must start moving faster, along with the vendor community, to make it easier to quickly address challenges and catch up to the competition – especially during these uncertain times when budgets are being challenged and long-term strategic planning is difficult.

LNS Research recommends companies struggling with their analytics programs should start addressing these challenges by:

#1 Investing in Data Infrastructure – Including Machine Connectivity and Next-Gen Automation

#2 Building Toward a Self-Learning Analytics System

#3 Letting Operational Support Roles Drive and Own Analytics Success

#4 Focusing on Change Management and the Power of Prepositions – "With," not "To" or "For"

Related Research on Industrial Transformation (IX)

RESEARCH | Quality 4.0 Analytics: A Data Hub Approach to Quality Management Execution →

RESEARCH | Connected Workforce: Enable a Competent, Agile Industrial Workforce →

RESEARCH | Industrial Transformation: Architecture and Analytics Just the Beginning →

RESEARCH | IX Architectural Paths 1 of 3: Three Paths & Understanding IX Infrastructure →

RESEARCH | IX Architectural Paths 2 of 3: Evaluating IX Platforms and IX Applications & Analytics →

RESEARCH | IX Architectural Paths 3 of 3: Looking at IX Strategic Partners →

RESEARCH | Avoiding Pilot Purgatory: How to Choose the Right Use Cases to Accelerate Industrial Transformation (IX) →

RESEARCH | Industrial Transformation Success: How to Secure Operations' Buy in to Create Effective Leadership →

RESEARCH | IX Digital Readiness →

BLOG | How Mature is Your Industrial Analytics Program Really? →

BLOG | The Why, What, and How of Industrial Transformation (IX) →

BLOG | Introducing the Industrial Transformation (IX) Reference Architecture →

BLOG | Understanding Industrial Transformation: Definition and Framework for Success →

EBOOK | Enable Operational Agility with a Digitally Connected Workforce →

EBOOK | Connected Worker: Connecting People and Systems to Transform Frontline Operations →

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