

Manufacturing companies must harness the power of data and cutting-edge technologies like AI and GenAI to revolutionize operational efficiency, predictive capabilities, and innovation.

Leveraging Data for Actionable Insights in Manufacturing: A Path to Enhanced Enterprise Visibility and Innovation

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Introduction

For several years, the manufacturing industry has been in the midst of digital transformation driven by an exponential increase in data generation and advancements. This has led to increased adoption of technologies like the Internet of Things (IoT), artificial intelligence (AI), machine learning (ML), and generative AI (GenAI). Data is no longer just a by-product of operations; it is a valuable resource that can drive significant business improvements, such as operational efficiency, predictive capabilities, and innovation when managed correctly.

This paper explores how manufacturing companies can leverage data to gain actionable insights, focusing on enterprise visibility, operational impact, predictive analytics, and advanced technologies like AI and GenAI to make more strategic and informed decisions.

Increased Enterprise Visibility Through Data

Enterprise visibility enables organizations to gain a comprehensive, real-time understanding of their operations. In manufacturing, this visibility is crucial for optimizing workflows, enhancing production quality, and improving decision-making. Manufacturing leaders can achieve a detailed view of their supply chains, production lines, and operational processes by integrating data from various sources — such as Internet of Things devices, sensors, production machinery, and enterprise resource planning (ERP) systems. Some key benefits of enhanced enterprise visibility are:

- » **Real-time monitoring:** Tracking the performance of machines and systems in real time allows workers to identify and address issues immediately before they impact production, such as monitoring equipment health for proactive maintenance.

AT A GLANCE

KEY TAKEAWAY

Enhanced enterprise visibility through data integration can optimize workflows and improve decision-making. Valuable insights through predictive analytics enables more accurate demand forecasting, improving inventory management and anticipating supply chain disruptions.

- » **Optimized inventory management:** Data-driven insights into inventory levels, lead times, and demand patterns improve inventory planning and reduce costs associated with overstocking or stock-outs.
- » **Supply chain transparency:** Data across the entire supply chain, from raw material suppliers to product distribution, provides visibility into bottlenecks, delays, or inefficiencies, building more resilient supply chains.

The Impact of Data on Operations and Business Innovation

Data is pivotal in improving operational efficiency, driving innovation, and generating business value. Operational data can help manufacturers identify areas where improvements can and should be made, such as production processes, resource allocation and governance, or energy consumption.

Operational Efficiency and Process Optimization

By leveraging predictive maintenance strategies, manufacturers can use historical and real-time data to drive operational efficiencies, such as forecasting when machines are likely to fail, thereby reducing unplanned downtime. Data can also help manufacturers analyze and optimize production flow and resource utilization to ensure that assets such as labor, equipment, and materials are used as efficiently as possible. When it comes to energy consumption, by analyzing data across production lines, manufacturers can identify processes that consume excessive energy and take steps to reduce waste, driving both cost savings and sustainability.

Driving Business Innovation

The rise of Industry 4.0 technologies has enabled mass customization, where products are tailored to individual customer needs without sacrificing efficiency. Data allows manufacturers to better understand customer preferences, enabling the production of customized or personalized on-demand products. With data-driven design and simulation tools, manufacturers can create digital twins — virtual representations of physical products or processes — that facilitate rapid prototyping and design optimization before committing to costly physical iterations. It also opens opportunities for manufacturers to explore new business models, such as servitization — where instead of being limited to only selling a product, companies can offer expanded combinations such as product as a service (PaaS) monitored and maintained using real-time data, creating new revenue streams for the business.

Identifying and Prioritizing Projects and Use Cases for Data Collection

Not all data holds the same value; manufacturers must focus and prioritize data collection projects aligning with their strategic objectives. Some primary use cases for data collection in manufacturing include predictive maintenance, quality control, defect reduction, and supply chain optimization. The majority of use cases result in minimized asset downtime, optimized procurement, reduced waste, and enhanced product quality. To accomplish this, organizations must first define the business problems they aim to solve and identify the key metrics that will drive optimal success in the shortest amount of time.

Some key practices manufacturers should prioritize when it comes to data collection are:

- » **Clear and defined objectives:** As one of the first steps in leveraging data effectively, defining clear objectives and aligned goals (e.g., a manufacturer might prioritize reducing energy consumption versus improving product quality) ensures that organizations experience the highest level of impact and benefit that helps them reach their goals faster.

- » **Use cases with high return on investment (ROI):** Once objectives are defined, focusing on use cases that offer the highest return on investment is crucial. Common high-impact areas in manufacturing include predictive maintenance, demand forecasting, and quality control.
- » **Availability and quality of data:** Data quality is critical to the success of any initiative. Manufacturing companies need to ensure they invest in data governance frameworks that focus on the accuracy, completeness, and consistency of data across the organization.
- » **Cross-functional team support:** Data-driven projects often require collaboration between different departments, including operations, IT, and finance. Cross-functional teams help ensure that data initiatives address the needs of multiple stakeholders within the organization for the greatest impact.

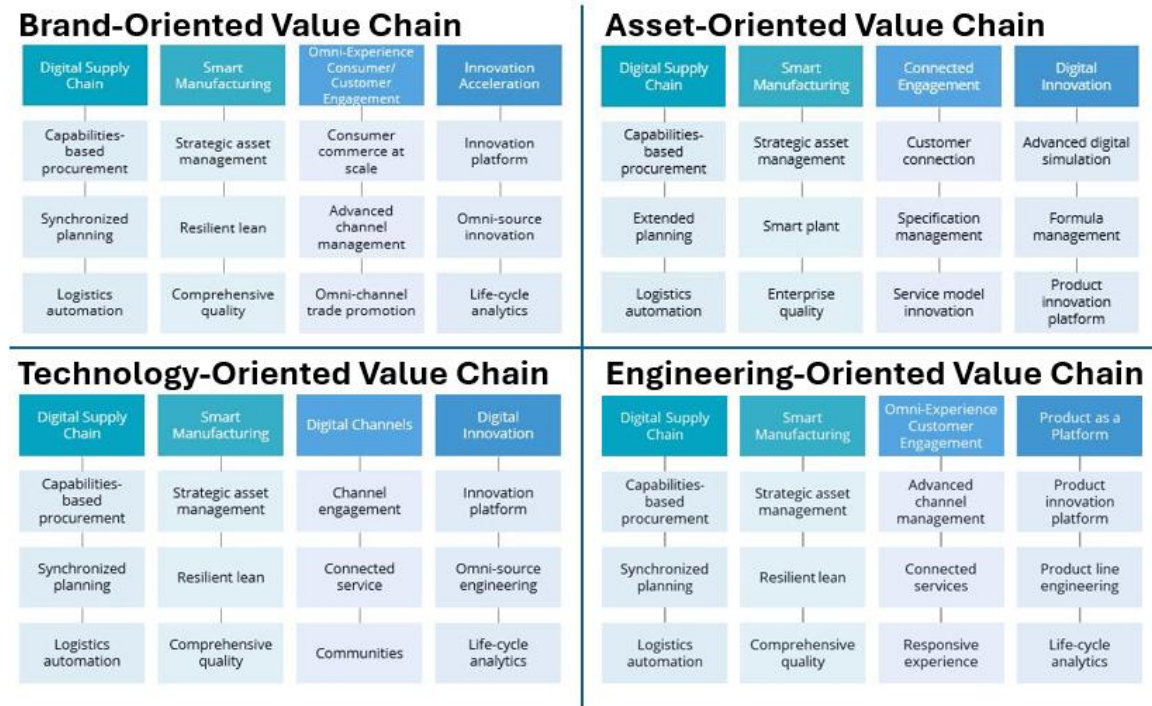
Predictive Analytics and Market Trends: Driving Efficiency and Resiliency

Predictive analytics use data, statistical algorithms, and machine learning techniques to identify patterns and forecast future outcomes. Some ways manufacturing companies are leveraging predictive analytics in their organizations today are:

- » **Data-driven operations:** Analyze machine behavior patterns for early issue detection and maintenance scheduling, reducing unplanned downtime and extending equipment life span. Predictive analytics enables more accurate demand forecasting, improving inventory management and helping anticipate supply chain disruptions.
- » **Reshoring and localization:** As supply chains have become more volatile due to geopolitical tensions, many manufacturers are moving toward reshoring or localizing production. Predictive analytics helps in this transition by optimizing production planning and supplier selection in local markets.
- » **Sustainability and green manufacturing:** Reduce energy consumption and waste and contribute to sustainability efforts. For instance, predictive analytics can be leveraged to analyze when energy usage is likely to spike and suggest adjustments to processes to minimize environmental impact.

Value Chain Use Cases

As we dive deeper into trends on how manufacturers are leveraging data in their digital transformation journey, organizations across the four different value chains in manufacturing — engineering-oriented value chain (EOVC), asset-oriented value chain (AOVC), technology-oriented value chain (TOVC), and brand-oriented value chain (BOVC) — are prioritizing their business goals and investments in technologies (see Figure 1).

FIGURE 1: *Program and Use Case Focus Areas in Manufacturing*

Note: For more details, see IDC's *Worldwide Digital Transformation Use Case Taxonomy, 2023*.

Source: IDC, 2024

Organizations across the four different value chains have various digital transformation priorities and as such can focus their data journey and efforts in a more targeted way to optimize their impact:

- » **Brand-oriented value chain:** Focused on supplier network monitoring and asset management on their IoT projects and resource allocation for big data and analytics
- » **Asset-oriented value chain:** Focused first on supplier network monitoring and asset management on their IoT projects and understanding product performance/new product development for big data and analytics
- » **Technology-oriented value chain:** Focused on yield/materials optimization and transportation management of their IoT projects and data visualization and business process optimization for big data and analytics
- » **Engineering-oriented value chain:** Focused on creating experience ecosystems that transform the focus from designing, selling, and servicing complex products to evolving where the product becomes the platform through which new digital products and services are delivered

The Importance of Data Management

The journey of digital transformation accelerated with IT/OT, and IoT sensors not only generate data but also provide manufacturers with the ability to easily capture data — a lot of data. With the potential to unlock valuable real-time data-

driven insights, it is easy for manufacturers to quickly get lost in the data gathering and data collection process without a clear and defined goal. In the end, organizations end up with a lot of unstructured, irrelevant data that is also out of date, providing no real value to the organization. Leaders need to be particularly clear on their data strategy and goals to avoid data fatigue, which is a common mistake most companies experience.

With emerging technologies like AI and ML, manufacturers now can structure and analyze large amounts of unstructured data to derive the right data points necessary to focus on targeted areas of the business, maximizing impact on operations. To successfully navigate the journey of data management and governance, leaders must have a deep understanding of the significance of federated data management and how optimized data management contributes to a resilient organization. This involves implementing proper data controls and making strategic investments in the right tools. These efforts provide organizations with a significant competitive advantage by enabling faster, more accurate, and real-time data access.

Leveraging AI and GenAI in Manufacturing

Artificial intelligence and generative AI are transforming how manufacturers approach problem-solving, product design, and decision-making. These technologies help companies make sense of large data sets and derive actionable insights more quickly and accurately than traditional methods.

The role of AI is changing in manufacturing, and as adoption increases, leaders continue to look for more ways to leverage AI-driven insights to drive automation and efficiency. Today, AI algorithms can process vast amounts of data and provide recommendations on production schedules, resource allocation, and maintenance tasks without human intervention. AI-powered robots and autonomous systems are enhancing production capabilities by performing complex tasks with high precision and efficiency. These systems continuously learn from a variety of data sources to enhance their performance over time, emphasizing the crucial role of data in driving digital transformation.

The Potential of Generative AI

Generative AI allows manufacturers to elevate their AI game one step further when it comes to driving automation and efficiency. According to IDC's January 2024 *Future Enterprise Resiliency and Spending Survey*, when it comes to GenAI use cases, manufacturing organizations are prioritizing task automation and employee productivity over innovation of new business offerings. This shows that leaders are looking at ways to leverage digital tools internally to help solve some of their labor challenges, such as training, onboarding, and increasing collaboration between groups and their ecosystem.

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Challenges

Manufacturing leaders face several challenges in their efforts to leverage data for actionable insights. One significant challenge is data fragmentation, where data is stored across multiple systems, making it difficult to have one single source of truth to analyze effectively. This often results in incomplete or inaccurate information, which hampers decision-making. In addition, the lack of skilled workers with the right knowledge capable of interpreting complex sets and implementing advanced technologies like AI and predictive analytics further complicates data utilization efforts.

To address these challenges, manufacturers should invest in data integration tools and platforms that bring together data from multiple sources into a unified and secure system to provide a comprehensive view of operations. Leaders should also invest in the upskilling and training of workers in data analytics, AI, and ML, along with developing strong data governance frameworks to ensure security and compliance. Finally, adopting cross-functional collaboration across various functions will help ensure data-driven initiatives and alignment across the organization to deliver maximum value to drive innovation and efficiency in their operations.

Conclusion

A robust data strategy is essential for manufacturing success. Federated data management ensures seamless data integration across various systems, providing a unified view of operations. Integrating AI and generative AI further enhances this strategy by enabling advanced analytics and automation. These technologies help manufacturers derive actionable insights, optimize processes, and innovate rapidly. By focusing on strategic data initiatives, manufacturers can transform their operations, drive efficiency, and maintain a competitive edge in a rapidly evolving industry.

About the Analyst



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Sarah Lee is research director for IDC's Manufacturing Insights responsible for the IT Priorities and Strategies (ITP&S) practice. Sarah's core research coverage includes IT investments made across the manufacturing industry and manufacturers' progress with digital transformation. Based on her background covering the manufacturing space, Sarah's research also includes an emphasis on the technology enablers that help manufacturing executives make better informed operational decisions.

MESSAGE FROM THE SPONSOR

Building Digital Resilience in Manufacturing

The manufacturing industry is rapidly advancing its digital transformation, driven by AI, digital-to-physical conversions, and automation to improve efficiency. However, this acceleration also brings challenges, particularly in securing both informational (IT) and operational (OT) technology networks. Integrating them has expanded the attack surface, exposing traditionally isolated equipment to new risks. As the most targeted sector for cyberattacks, maintaining secure and resilient digital systems is critical.

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