AI IN MANUFACTURING: ENABLING BUSINESS-DRIVEN FACTORY INNOVATIONS

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AI in Manufacturing: Enabling Business-Driven Factory Innovations

Introduction

Manufacturing organizations have been investing in the digital transformation (DX) of their factory operations for quite some time now. Compared with a few years ago, the range of digital technologies that manufacturers have available to them today ranges from IoT, cloud, edge computing, low-code/no-code applications, and robotics to advanced data analytics and artificial intelligence (AI). In particular, the role of data and increasing utilization of data as a central pillar for DX initiatives has increased.

IDC research shows that investments in data management and data analytics programs will be a priority technology investment area for 73% of manufacturers in Europe.

Data analytics and AI will enable innovations in factory operations and will help improve business KPIs — better utilization of data increases transparency, thereby enhancing the speed and quality of decision making.

IDC predicts that by 2023, 65% of global manufacturers will realize savings of 10% in operational expenses through process digital twins driven by IoT and ML routines.

AT A GLANCE

Examples of business-driven AI-enabled factory innovations and use cases include advanced digital simulation, autonomous factory operations, digital quality management, and strategic asset management.

Manufacturers are increasingly investing in these use cases:

- On average, 36% have already invested in these AI-enabled initiatives — and plan to invest more.
- On average, 20% plan to invest in such initiatives for the first time.

Key benefits of investing in AI-enabled use cases include improving speed and quality of decision making and subsequently improving business KPIs.

Key challenges relate to obtaining the right OT data from legacy production equipment, a lack of adequate data volumes to train data models, a lack of skilled personnel, and a lack of scalable solutions.

This IDC Vendor Spotlight examines the investment plans of European manufacturers related to selected data-driven and AI-enabled use cases on the shop floor and highlights key challenges that need to be addressed.

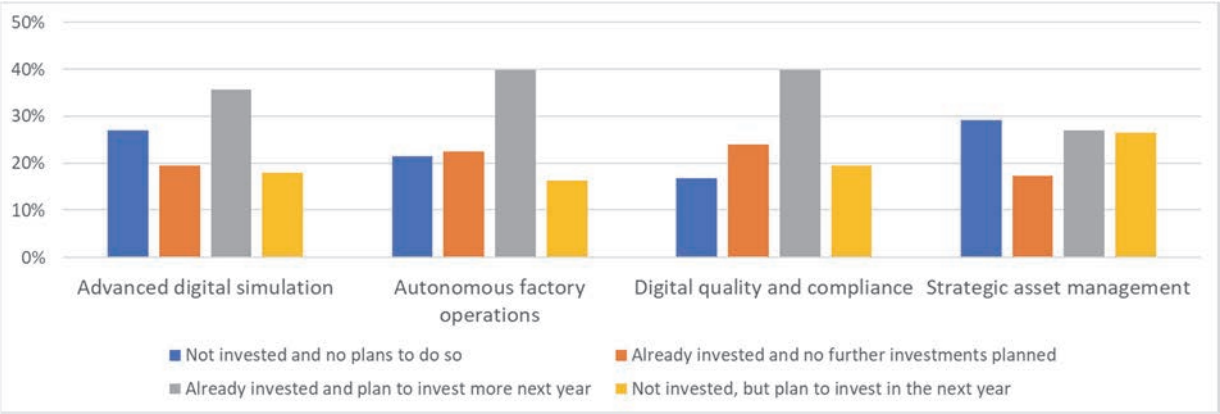
It also describes how analytics solutions from SAS help manufacturing organizations address major business challenges on the shop floor and how to implement and scale AI-enabled process innovations in factories.

European Manufacturers' Investment Plans Related to Data-Driven and AI-Enabled Innovations of Factory Operations

Figure 1 highlights the investment plans for DX initiatives across manufacturing organizations in Europe. What these initiatives have in common is that they are all data driven and to a large extent enabled by advanced data analytics and AI.

FIGURE 1

European Manufacturers' Investment Plans in Selected Digital Transformation Initiatives



Source: IDC Insights, 2021

IDC research shows that a large share of manufacturers in Europe — an average of 36% — have already invested in AI-enabled initiatives related to factory innovations and plan to invest more (grey column). While some manufacturers don't plan to invest in such initiatives at all (blue column), on average 20% of manufacturers plan to invest in these initiatives for the first time (yellow column).

There are many more data-driven and AI-enabled use cases that will improve factory operations, but in the following section we will look more closely at those mentioned in Figure 1.

Advanced Digital Simulation

By using a digital twin of factory operations, production parameters based on changing customer demand can be simulated and tested before applying new parameters to real-life production. Simulating manufacturing processes can also help to identify production bottlenecks in the planning stage, as well as impacts on the supply chain.

Product digital twin simulation supports faster time to market of product innovations, reduces the cost of subsequent design and engineering changes, and helps, for example, to reduce the energy consumption of products in use. This can be realized by digitally pre-testing dependencies between mechanical, electrical, or software components and their effects on product performance or energy consumption. The goal is to adapt and optimize the design and engineering of all product components before production or use in production.

Advanced data analytics and AI detect correlations between product or process parameters and impact on output parameters such as energy consumption, capacity levels of production assets, or inventory levels by utilizing digital twin concepts.

Autonomous Factory Operations

Factory automation is aimed at increasing overall productivity, throughput, and product quality. This can be achieved either by augmenting workers with robots by applying collaborative robots ("cobots") or by replacing manual work with robots, thereby reducing dependency on manual work.

Automating factory operations can also intelligently resequence workloads on the shop floor based on a real-time assessment of current demand and available production capacity, thereby enabling greater agility and flexibility on the shop floor, higher throughput levels, faster time to market, and higher customer satisfaction.

Autonomous factory operations also include the utilization of automated vehicles on the shop floor or in the warehouse that are equipped with sensors that continuously scan the environment, with data analyzed in real time to enable autonomous driving. The objectives are to lower labor costs and ensure the health and safety of employees in the lifting and transportation of heavy product components or finished goods on the shop floor.

Key enabling technologies include advanced data analytics and AI, appropriate network connectivity infrastructures, and low-latency data communication technologies (such as 5G).

Digital Quality Management

Initiatives related to digital quality management aim to respond more quickly to product and service issues to reduce scrap rates in production, improve quality, and reduce the cost of bad quality, including rework costs and their negative impact on customer satisfaction.

Initiatives include monitoring of production systems and machinery, automatically detecting, predicting, and anticipating production deadlocks and failures, and understanding the root causes. Connected quality metrology feeds an analytic model that can support the automated analysis of quality anomalies with the ability to adjust processes in an automated way. Better error proofing lowers costs related to quality issues, particularly repeat errors. Use cases also include image- and video-based digital quality control during the production process based on an analysis of sample specifications or more complex, predictive models based on process parameters.

Advanced data analytics and AI can detect product anomalies during the quality assurance process.

Strategic Asset Management

Initiatives are intended to reduce unplanned downtime of production assets, thereby improving throughput, and extending the lifetime and value of a production asset.

A use case related to strategic asset management is predictive maintenance. This aims to identify potential issues of a machine early by applying machine-learning algorithms that build an accurate predictive model of potential failures and automatically schedules required maintenance and orders spare parts.

Another use case is augmented maintenance. The objectives are to lower downtime of production assets and factories, lower costs and time to repair, and achieve higher first-time-fix (FTF) rates. Instead of only using documented work instructions, the goal is to have instructions that are directly integrated into maintenance technician tooling. The use of augmented reality (AR) and virtual reality (VR) provides maintenance technicians with relevant information, training, and guided work instructions.

The key enabling technologies to ensure real-time awareness of asset conditions and enable meaningful analysis of data, advanced data analytics, and AI are IoT and cloud computing technologies.

The benefits of investing in data-driven analytics and particularly AI-enabled use cases are directly related to being able to detect correlations and dependencies much better and potentially faster than if done manually. This improves the speed and quality of decision making, enabling organizations to achieve business KPIs such as reducing costs.

This requires organizations to extract, manage, and utilize data from the operations technology domain, such as IoT sensor data from production assets, and the right data analytics capabilities to turn this data into valuable and actionable insights. But this is easier said than done.

Key Challenges Related to Applying AI in Factory Operations

The key challenges include:

- Lack of quality training data to train models. Data is in various silos and must comply with various standards, which makes it difficult to consolidate. Compliance issues can also prevent organizations from using certain data.
- Lack of personnel with the right data science know-how and capabilities, such as data scientists and data engineers.
- Factories that use legacy production equipment, which makes it difficult to obtain the right OT data.
- Security concerns on the OT side when it comes to closer integration of IT/OT to obtain, manage, and analyze OT data.
- AI-related projects often don't scale and can get stuck in the PoC stage because there is no framework that enables the organization to follow a road map to scale innovations related to factory operations.

SAS and the Manufacturing Industry

SAS helps manufacturing organizations to improve quality, productivity, and reliability by applying analytics with embedded AI and machine learning to their shop floor and IoT data. Through scalable data integration and advanced analytics, manufacturers can get deeper insights from existing data, determine data deficiencies, and move from a reactive to a proactive approach.

SAS also helps manufacturing organizations to adopt a decision framework to guide their approach to analytics and implement strong data management and analytics solutions that will help avoid the inertia of Industry 4.0 initiatives.

SAS' analytics solutions for manufacturing organizations aim to improve production operations by reducing costs and risks while capitalizing on data as an asset to help deliver quality products and innovative services in a connected economy.

SAS' solution offerings for manufacturing organizations are centered around the following topics:

- **Manufacturing quality:** The solutions enable manufacturers to improve enterprise quality and lower the costs associated with poor quality. They help increase production yield and throughput, improve end-product quality, achieve advanced process control, and empower scarce engineering resources.
- **Connected factory — predictive maintenance:** The solutions enable manufacturers to lower the cost of unexpected downtime and increase overall equipment effectiveness (OEE). By applying a combination of monitoring, diagnostics, and predictive maintenance techniques, potential issues can be detected early and appropriate measures can be taken to minimize unplanned downtime and increase the availability of key assets.
- **Supply chain optimization — demand-driven planning:** The solutions enable manufacturers to sense demand signals that indicate marketplace changes, increase forecast accuracy, and quickly align the supply chain to fluctuations in demand. They help reduce obsolete inventory, markdowns, and waste, and increase revenues and gross margin.
- **Warranty cost reduction:** The solutions provide warranty cost reduction capabilities that enable manufacturers to minimize risk and improve profitability by integrating and analyzing all types of structured and unstructured data to uncover valuable information hidden in warranty claims and service reports. This helps to identify emerging issues, spot the early-warning indicators, and identify root causes.

SAS also provides a framework to help manufacturing organizations to not only implement but also deploy and scale AI-enabled process innovations.

Considering SAS

SAS' solutions can help manufacturing organizations to develop and implement data-driven and AI-enabled use cases that help to execute business-driven factory innovations. SAS has a significant opportunity for success for several reasons:

- It provides key technologies and capabilities related to AI and machine learning, but also related to IoT, streaming analytics, and securely delivering edge manufacturing analytics via the cloud.
- It provides a framework to help manufacturing organizations not only implement but also and most importantly deploy and scale AI-enabled process innovations.
- For SAS it's not only about solving technological challenges such as developing appropriate algorithms. It is also about solving business challenges and enabling manufacturers to reduce costs, improve productivity, and minimize risks.

While SAS can help manufacturers to apply advanced analytics and AI to implement, deploy, and scale AI-driven use cases to innovate factory operations, it is not as strong in the OT domain.

MESSAGE FROM THE SPONSOR

Curiosity is our code. SAS analytics solutions transform data into intelligence, inspiring customers around the world to make bold new discoveries that drive progress.

SAS helps manufacturers to become nimble, AI-driven organizations that capture opportunities and minimize risk through deep operational insights. Their confident decision making is based on scalable data and advanced analytics that help make sense of complex information sources.

With SAS, manufacturers can capitalize on data as an asset that helps deliver innovative services and quality products. SAS' analytics solutions enable manufacturers to fine tune production operations at minimal cost and risk while simultaneously launching new service and subscription streams.

Manufacturing Analytics | SAS

About the Analyst

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Stefanie Naujoks has more than 20 years' industry experience, on both the analyst and IT vendor sides. She is based in Munich and works with manufacturing organizations, IT vendors, and technology providers to help them understand how digital technologies such as IoT, robotics, AI, and cloud will impact traditional operations and disrupt manufacturers' traditional business models.

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