Future-Proofing Factory Operations from Edge to Cloud

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Introduction

Manufacturing organizations that take the lead in digitalization will have strong competitive advantages: They can react faster to volatile supply chains, use their agility to adapt to changing customer demands, and produce more efficiently in terms of energy and resources.

Digital-first strategies will help these organizations ensure long-term business growth and future-proof factory operations.

A strategic approach to the digitalization of manufacturing is key to long-term success. Technologies like Industrial IoT (IIoT), artificial intelligence (AI) or automation from edge to cloud must be implemented to serve business goals and not just for the sake of obtaining the latest technology.

This IDC Industry Spotlight provides insights and recommendations on how manufacturing companies can future-proof their factory operations.

Recommendations focus on the need to become truly digital businesses. To this end, businesses must not only embrace digital-first strategies, but also comprehensively evaluate the use of digital technologies based on the three key dimensions of Impact, Scale, and Trust (Figure 1).

It also describes how Dell Technologies and NTT DATA can support manufacturing organizations with future-proofing their factory operations through the digitalization of the shop floor and implementing the required edge-to-cloud architectures, while considering individual customer needs for Impact, Scale, and Trust.

AT A GLANCE

This IDC Spotlight provides insights and recommendations on how manufacturing companies can future-proof their factory operations.

KEY STATS

The document includes survey results from IDC's *Global Manufacturing Survey 2023*, which was conducted among 741 manufacturing organizations worldwide.

WHAT IS IMPORTANT

To future-proof factory operations, manufacturers must evaluate technologies across the three key dimensions of Impact, Scale, and Trust.

KEY TAKEAWAYS

» **Impact:** Digital tech must be utilized to solve concrete business challenges and deliver measurable improvements of factory operations.

» **Scale:** Organizations need to shift gears from running a digital business to scaling a digital business.

» **Trust:** Utilization of digital tech needs to support the organization's efforts to be a trusted supplier and ecosystem partner.

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FIGURE 1

Thriving in the Digital-First World with Impact, Scale and Trust
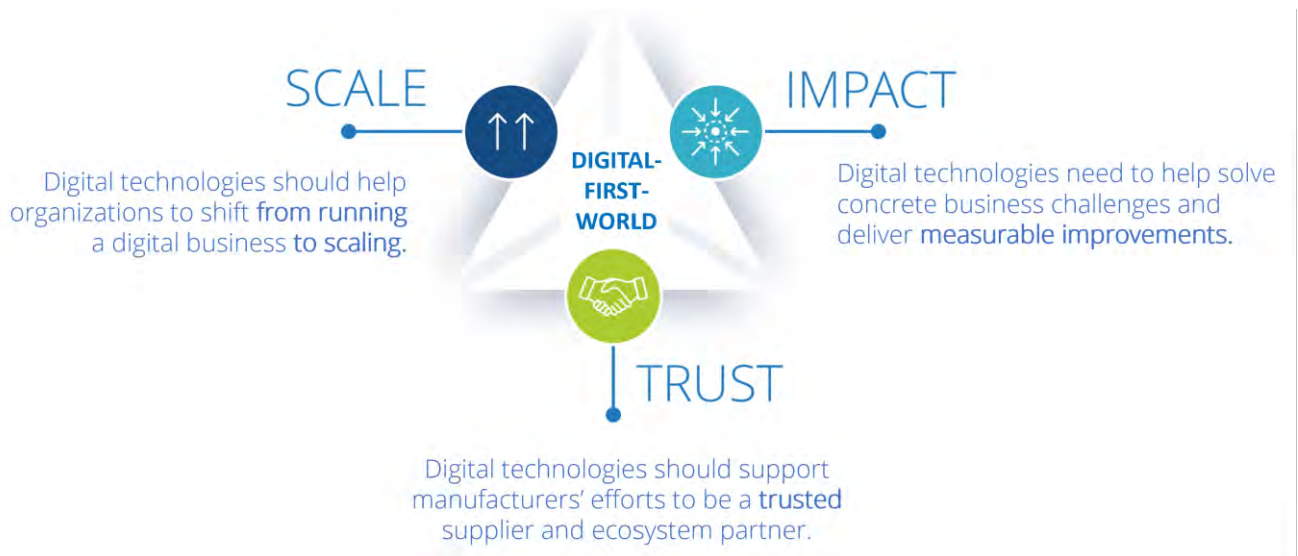
Source: IDC Manufacturing Insights, 2023

Future-Proofing Factory Operations with Impact, Scale, and Trust

Impact

Key recommendation:

Utilization of digital tech needs to solve concrete business challenges and deliver measurable improvements of factory operations.

Factory operations today face business challenges that include quality issues, improving the efficiency of operations and ensuring agile order fulfilment, reducing health and safety incidents, and optimizing energy consumption.

Resolving these challenges requires more well-informed decision-making, with access to pertinent data serving as a foundation for improving operations in these areas.

The utilization of digital technologies such as IoT, data analytics, AI/ML, and edge and cloud solutions plays a pivotal role in capturing, storing, managing, contextualizing, and analyzing (industrial) data in an efficient and secure manner. Tech-supported utilization of data can not only enhance the quality and speed of decision-making, but also improve measurement of key performance indicators (KPIs) — which is of critical importance and often easier said than done.

Figure 2 shows examples of initiatives/use cases addressing selected business challenges. It highlights the relevant KPIs and showcases the technologies that play a key role.

FIGURE 2

Initiatives Addressing Business Challenges, Related KPIs, and Enabling Tech

Business Challenges	Long Production Cycles	Quality Issues	Limited Flexibility to Fulfill Customer Orders	Workforce Safety	Reduction of Energy Consumption
Initiatives/ Use Cases *Description*	**Predictive Maintenance** Machine-learning algorithms that build an accurate predictive model of potential failures based on data from various sources and automatically schedules required maintenance.	**Cognitive Root Cause** Connected quality metrology feeds an analytic model that can support automated analysis of quality anomalies with the ability to adjust processes in an automated way.	**Real time scheduling** Real-time assessment of current demand and capacity availability continuously and intelligently re-sequences work orders in the factory.	**Asset or Process Condition Monitoring** Monitoring the real-time condition of a process or assets against dynamic benchmarks, applying analytics to determine needed inspection.	**Cognitive Planning** Sensors are deployed across the manufacturing environment to capture and analyze energy use and requirements down to the machine level, allowing cognitive systems to structure operations in a way that minimizes energy use.
Key Performance Indicators (KPIs)	• Improved unplanned asset downtimes • Improved throughput	• Reduced scrap rates • Lower costs of adverse quality (e.g. reduced rework, end-of-line inspection, lower repeat errors)	• Improved throughput • Lower unit costs • Improved customer satisfaction rates	• Reduced safety incidents	• Reduced energy costs • Reduced CO2 emissions
Enabling Digital Tech	IoT, big data, AI, edge computing, cloud	IoT, big data, AI, edge computing, cloud	IoT, analytics, AI, edge computing, cloud	IoT, AI, analytics, edge computing, cloud, IT/OT security	IoT, big data, AI, edge computing, cloud

Source: IDC Manufacturing Insights, 2023

Scale

### *Key recommendation:*

Organizations need to shift gears from running a digital business to scaling a digital business.

One prerequisite for future-proofing factory operations is the utilization of digital tech to support scalability.

IDC research shows that manufacturers are investing in cloud-based or cloud-enabled manufacturing applications, particularly in manufacturing operations management (MOM) and manufacturing execution systems (MES) applications. As per Figure 3 below:

- 70% of manufacturers' current MOM/MES applications investments are cloud-based.
- 66% of future investments (in the next two years) are going to be cloud-based.
- Other manufacturing applications which are on the cloud roadmap relate to enterprise asset management (EAM), asset performance management (APM), quality management, sales & operation planning (S&OP), and environmental, social, and corporate governance (ESG).

FIGURE 3

Current and Future Investments in Cloud-Based Manufacturing Applications
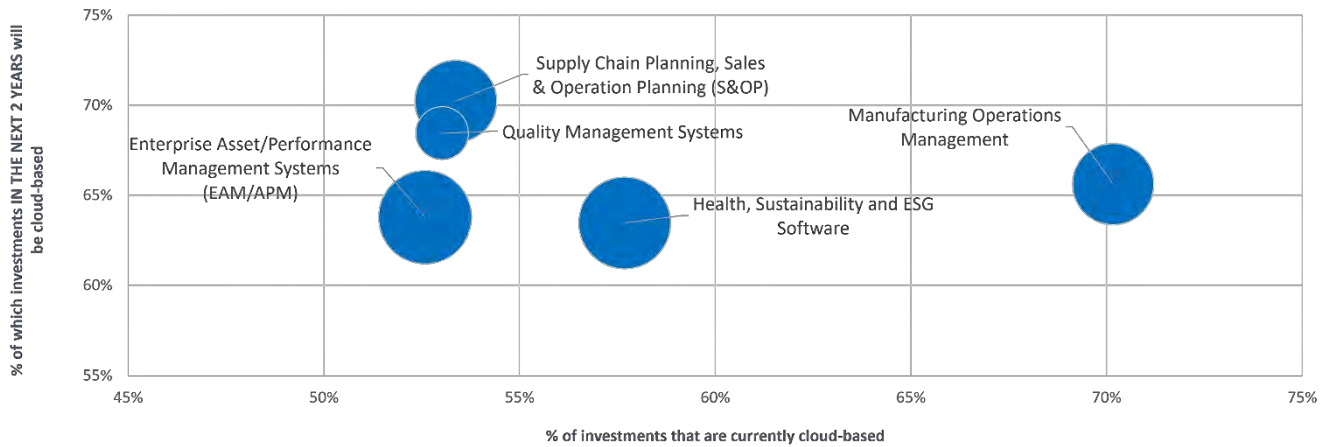
Note: Bubble size = percentage of manufacturers that consider IT area as top investment priority
Source: IDC #EUR151263223 and IDC's *Global Manufacturing Survey, 2023* (N = 1,332)

Drivers for Investments in Cloud-Based Manufacturing Applications

A wave of market disruptions over the last few years is forcing companies to seek solutions that can be deployed as rapidly as possible. The cloud platform allows for faster deployment than traditional IT, as well as being a cost-effective manner of IT procurement (e.g., capex vs. opex). Organizations seeking access to the latest IT solutions, such as AI/ML or generative AI, will also increasingly turn to cloud-based applications.

While IDC's research on cloud-based investments in manufacturing applications (Figure 3) covers both public and private cloud deployments, organizations will also run applications in hybrid architectures, which also include on-premises datacenters and edge locations.

Drivers for Edge-to-Cloud Investments:

There are several drivers for investments in edge-to-cloud architectures:

- Edge-to-cloud architectures enable near-zero latency in cloud deployments. Manufacturers are increasingly aware that this cloud capability is extremely valuable for supporting the requirements of a modern shop floor.

IDC research shows that 58% of manufacturers are currently utilizing edge-to-cloud solutions and architectures, while another 30% are planning to deploy such solutions within the next 18 months.

- Manufacturers will increasingly require hybrid edge-to-cloud architectures to accommodate AI-based use cases that require inferencing at the edge or more critical workloads that require high availability at the edge.

- Cyberwarfare is making OT and IT functions more aware of the liability created by individually managed technology silos, which increases the attack surface. Cloud technologies enable standardization and automatization to eliminate or reduce silos, thus bolstering security. An edge-to-cloud architecture also simplifies the implementation of additional redundancy and backup, thereby decreasing liability, also depending on the agreed SLAs.

Trust

Key recommendation:

Utilization of digital tech should support manufacturers' efforts to be a trusted supplier and ecosystem partner.

To be a trusted supplier, organizations must demonstrate that compliance requirements are being met, that data exchange within the supply chain and ecosystem is secure, and that data sovereignty is ensured.

Manufacturing organizations have to comply with a huge number of regulations. More prominent regulations relate to ESG, which covers not only environmental sustainability and employee health and welfare, but also a thorough examination of a company's supply chain. Regulations also relate to cybersecurity, and organizations must be compliant with the latest mandates in this area, such as the NIS2 Directive in Europe, which requires organizations to take appropriate security measures and notify relevant national authorities of serious incidents.

IDC research shows that 33% of manufacturers worldwide consider increasing cyberattacks to be a major concern. For manufacturers, cyberattacks pose a heightened risk, as they can lead to factory shutdowns and can also result in high costs for remediating security breaches. Clearly, there is a need for organizations to ensure that their operations run securely and that they are protected from cyberattacks of any kind.

IDC research shows that currently only 52% of manufacturers have invested in securing their OT assets and environments, but 67% have plans to invest in OT security within the next two years.

OT investments include enabling/ensuring secure and reliable data transmission, as well as securing IT, IoT, all edge devices, and production assets and tools.

It will also be key for digital businesses to become a trusted ecosystem partner, because, in the future, manufacturers will have to collaborate with ecosystem partners to deliver higher levels of customer value. Digital businesses embrace ecosystem-enabled, value-driven innovation. And, when collaborating more closely with ecosystem partners, this requires secure data exchange and ensured data sovereignty — i.e., ownership of data in a partner ecosystem.

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Considering NTT DATA and Dell Technologies

NTT DATA

Services from NTT DATA include consulting services related to determining the right cloud model for manufacturing organizations, optimizing cloud spending, managing multi-cloud complexity, modernizing application landscapes, managing SAP, and driving cyber resilience.

NTT DATA's Cloud Services focus on delivering business outcomes, from cost savings and process efficiency to business resilience and improved business performance.

Dell Technologies

Dell Technologies provides the full technology stack for an edge-to-cloud architecture. Dell Technologies' infrastructure extends from industry-grade gateway devices and edge platforms with cloud-native technologies to public cloud services. All elements of the portfolio include state-of-the-art AI solutions developed for the fast and scalable deployment of this key technology.

Dell Technologies' edge-to-cloud architecture aims to provide a simplified route towards maximum business impact by technology. Three elements that help to achieve this are:

- The ability to consolidate and simplify disparate infrastructure.
- Ensured intrinsic security, enabled by Dell Technologies' Zero Trust strategy, designed to protect Dell Technologies products, solutions and services from the ground up, starting with the design and development phase, and continuing through the manufacturing, delivery, and end-of-life phases.
- The ability to generate insights at the point of data-generation.

Dell Technologies recently released NativeEdge, which enables Zero Trust implementation of infrastructure and orchestration use cases in an edge-to-cloud architecture. Key use cases for digitalization in manufacturing are available as blueprints in the NativeEdge ecosystem, which allows fast and secure implementation.

The Combined Dell Technologies/NTT DATA Value Proposition

Dell Technologies services are aimed to support NTT DATA with transformation and migration projects, the delivery of cloud platforms and technologies, and the assessment and implementation of traditional and generative AI use cases.

Joint solutions from Dell Technologies and NTT DATA deliver a complete managed or as-a-service edge-to-cloud environment globally, incorporating public cloud, managed private cloud, fully owned datacenters, campuses, and telecom networks.

The joint solution is tailored for digital manufacturing. The digitalization of the shop floor can be implemented end to end, starting with understanding the individual customer needs for impact, scale, and trust and implementing the required edge-to-cloud architecture. This allows customers to focus on factory processes and address increasingly complex end-customer demands with agile and secure operations.

Challenges

Although utilization of digital tech and the development and implementation of digital initiatives on the shopfloor can help to future-proof factory operations, a lack of employee/worker willingness to participate, or their resistance to change (36%), can inhibit digital initiatives. This is why people and change management are as important as successfully implementing the technology.

Takeaways and Recommendations

To ensure long-term business growth, manufacturers will have to embrace the three dimensions of digital businesses: Impact, Scale, and Trust. Utilization of digital tech is a major enabler.

Generative AI is proliferating rapidly and democratizing access to and utilization of AI. Along with hybrid architectures (cloud/multicloud and industrial edge), such emerging tech paves the way for the widespread deployment of innovative practices on the shop floor, including:

- **Automation**: AI-enabled edge analytics for industrial process improvements — e.g., automated in-line quality inspection
- **Agility**: Adjustment of production planning based on real-time supply-chain insights enabled by application integration, AI, automation, and digital twins of factory operations
- **Productivity:** Workforce productivity augmentation through improved quality and speed of data-enabled decision-making and increased automation through automated decision-making
- **Collaboration**: Improved workforce collaboration on the shopfloor and in field-service/engineering enabled by cloud-based collaborative platforms, secure IT/OT integration, and automation

To ensure that future-proofing factory operations are not hindered by a lack of employee willingness to participate in potential shop floor transformations, CIOs and COOs need to take joint responsibility and foster close cooperation between IT staff and OT engineers. In particular:

- CIO organizations need to understand how to best support OT-specific demands and to provide technologies that help the OT domain to improve the key performance indicators (e.g., reduced scrap rates, energy costs, safety incidents) of applying digital technologies.
- OT organizations need to better understand how IT can help them to do their job more effectively, including how to address security concerns and how to ensure the ROI of initiatives scale, by using the technology know-how of CIO organizations.

Such integrated governance models support trust between OT and IT, which is essential. It is also important to have strong collaboration with all other stakeholders (beyond IT and OT), such as the CIO, CFO, and CDO, to make sure lines of business and C-suite leaders are also committed to making changes happen and initiatives successful.

To the extent that Dell Technologies and NTT DATA can address the topics and challenges described in this paper, the companies are well positioned to support manufacturing organizations' efforts to future-proof factory operations from edge to cloud, thereby helping them to ensure long-term business growth.

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NTT DATA, part of NTT Group, is a trusted global innovator of IT and business services. We help clients transform through consulting, industry solutions, business process services, IT modernization, and managed services. NTT DATA enables clients, as well as society, to move confidently into the digital future. We are committed to our clients' long-term success and combine global reach with local client attention to serve them in over 50 countries. In addition to being named a top employer in over 20 countries in 2023, we collaborate and have strategic relationships with market-leading technology and cloud service providers, including Dell Technologies.

MESSAGE FROM THE PARTNER

Dell Technologies (NYSE:DELL) helps organizations and individuals build their digital future and transform how they work, live, and play. The company provides customers with the industry's broadest and most innovative technology and services portfolio for the data era.

About the Analyst

Stefanie Naujoks, Research Director, Manufacturing Insights, IDC Europe

Based in Munich, Germany, Stefanie Naujoks has 20+ years of industry experience as an analyst providing insights for vendors and from the vendor side, utilizing insights provided by analysts. She works with manufacturing companies and IT vendors across Europe to help them understand how new technologies such as IoT, robotics, AI, cloud, augmented reality, and additive manufacturing can impact traditional processes and disrupt traditional business models.

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