DIGITAL TRANSFORMATION: WHAT'S NEW, WHAT'S NEXT, AND WHAT IT ALL MEANS

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TABLE OF CONTENTS

HOW TO SURVIVE AND THRIVE IN THE DIGITAL ECONOMY

The global pandemic has changed the way we work—perhaps forever. Companies further along their digital transformation journey have been able to pivot and respond more quickly to changes in supply and demand. For others, the urgency of the pandemic has forced a level of digitalization upon them that might not have occurred otherwise. The net effect is the reinforcement of technology as a lever for greater flexibility and agility, faster growth, and better productivity.

Digital tools enable businesses to operate at their best, without interruption. They enable frontline workers to remain safe while performing their tasks and provide the right information to the right professionals at the right time. These tools include digital twins and Augmented Reality (AR) for asset, product, and service life cycle management, advanced analytics and Artificial Intelligence (AI) for business process optimization, and cloud-based Software-as-a-Service (SaaS) solutions for better communication and collaboration. Now, more than ever, companies are embracing these tools and the service models that come with them to create a better world.

This whitepaper covers the key digital transformation initiatives that are here to stay, including:

- **The Internet of Things (IoT) and intelligent systems**, not just as a technology or platform, but as a set of solutions that can address specific problems with great efficiency.
- **Analytics and AI** as a foundation for shared data models and the emergence and role of **digital twins/digital thread**.
- **Augmented Reality (AR)** for frontline workers and the impact of spatial computing on the industrial enterprise.
- **Cloud and SaaS** as catalysts for better collaboration, creation, customer centricity, and overall business agility.

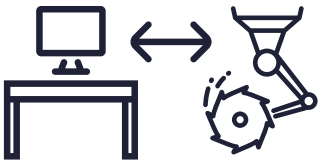
Activities that companies will continue to use to differentiate from their peers long after 2020

Source: ABI Research

WORKFORCE MOBILITY AND RESILIENCY

FLEXIBLE AND INNOVATIVE SUPPLY CHAINS

FRONTLINE WORKFORCE CONNECTIVITY AND COLLABORATION



REMOTE MONITORING OF PRODUCTS AND FACTORIES

THE DIGITAL TRANSFORMATION JOURNEY

Digital transformation relates to the adoption of digital technologies to optimize or differentiate products, processes, and services. More companies are leveraging these technologies to work smarter, reduce costs, and accelerate innovation. But this does not happen overnight. In fact, digital transformation is a four-step process that starts with awareness, education, alignment, and execution. Figure 2 below depicts a digital transformation journey and key questions to ask at each stage.

The Digital Transformation Journey

Source: ABI Research

- Awareness
  - Goal: Identify opportunities, understand the emerging ecosystem.
  - Questions to ask: What is the problem that needs to be solved? Who are the key stakeholders? What is the near-term priority?
- Education
  - Goal: Distill outside information, focus on what is important, communicate with stakeholders.
  - Questions to ask: What data do you need and how/where do you get them? What does the ecosystem look like? How much of the solution or expertise do you have in-house versus *via* a partner?
- Alignment
  - Goal: Set priorities, determine business value, and get stakeholder decision.
  - Questions to ask: Who are the key stakeholders? What are the deployment options? What does a proof of concept look like? What are the Key Performance Indicators (KPIs)? What determines success?
- Execution
  - Goal: Proof of concept, scaled implementation.
  - Questions to ask: How does the solution scale? What are the best practices?

IOT AND INTELLIGENT SYSTEMS

The IoT is more than a technology or platform, but a category of solutions that addresses specific problems. All solutions in this category have some form of connectivity, data creation, and management, and, often, applications built around that data. While manufacturing is complex in terms of the devices, protocols, and vendors in use, the IoT helps organize the different components and their data for more informed decision-making. The IoT also helps manufacturers work from a single dashboard of information, predict downtime, perform active monitoring, and improve efficiency. Figure 3 below depicts the evolution of automation as a result of the IoT and intelligent systems and its impact on the market.

AUTOMATION THEN

AUTOMATION NOW

FIRST-GENERATION AUTOMATION	INDUSTRY 4.0	IMPACT
Large capital investment	Use case based	Value-driven decisions
Long deployment cycles	Faster deployment cycles	Digital thread
Dependent on System Integrators (SIs)	Empower users directly	Low code
Inflexible and hard to reprogram	Flexibility and agility	Big focus on software
Difficult to replicate and scale	Easy to replicate and scale	Servitization

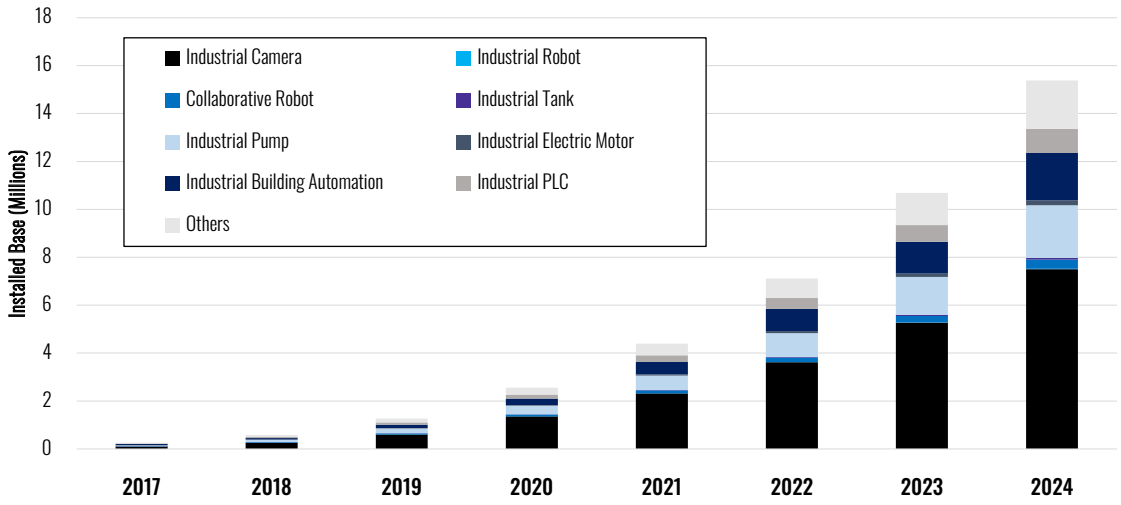
FROM IOT ANALYTICS TO AI

The IoT and analytics have evolved from describing problems on the factory floor (descriptive analytics) to predicting issues before they arise (predictive analytics) and serving the corrective action (prescriptive analytics). The benefits are less unplanned downtime using condition-based monitoring for predictive maintenance, fewer defects and reworking with closed-loop quality control, and leaner operations *via* Overall Equipment Effectiveness (OEE) optimization.

Furthermore, by investing in IoT analytics, manufacturers can experiment with product, process, and place parameters (location/environmental context) to derive insights from previously unforeseen correlations. Although once impossible, these types of experiments can now be done in a matter of hours, with AI helping to automate the task. The combination of IoT analytics and AI also creates new business propositions, such as power-by-the-hour in the transportation industry or Data-as-a-Service for reporting on the performance of equipment on behalf of clients.

The total installed base of AI-enabled devices

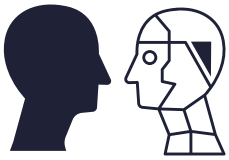
Source: ABI Research



The total installed base of AI-enabled devices in industrial manufacturing will reach 15.4 million in 2024, with a Compound Annual Growth Rate (CAGR) of 64.8% from 2019 to 2024 (MD-IAIM-101).

Howden is a global leader in manufacturing air and gas handling solutions with more than 160 years of experience and a presence in more than 100 countries. To optimize its operations, the company launched an initiative called the Data-Driven Advantage (DDA) to better service and support equipment in the field. The first step was to connect equipment and use the data for better monitoring. This resulted in a solution it calls Howden Uptime—an Industrial IoT (IIoT)-based platform that takes a holistic approach to gathering, interpreting, and analyzing rotating equipment data. Now, Howden's digital systems capture and analyze data to improve decision-making and reduce the Total Cost of Ownership (TCO) for customers.

DIGITAL TWINS AND AR



DIGITAL TWIN

DIGITAL THREAD

A digital twin is a virtual representation of a physical product or process. A digital thread takes the concept of a digital twin a step further by integrating data across enterprise systems for a single source of data truth. Overall, digital twins and digital thread allow better visibility into the health and performance of operations by improving consistency, collaboration, and alignment across teams. Digital twins and digital thread also improve remote monitoring, which leads to better predictive maintenance.

Paired with AR, digital twins and digital thread empower frontline workers with the tools they need to accelerate learning and minimize error, which protects margin. These capabilities are a necessity in the face of global travel restrictions and even more so as manufacturers reopen factories with an impetus to ramp up production immediately to make up for lost time.

AR solutions were a natural extension of Howden's digital transformation initiative (mentioned on pg 5). Howden already had better product condition and performance data. All it had to do was build applications on top of that data for engineers to use. Now, Howden provides AR applications that enhance customer self-service using animated repair sequences and visual overlays of machine data; enables remote assistance for customer service teams in different geographies; and allows design engineers and manufacturing teams to collaborate, accelerating training and on-the-job learning, which can save between US$2,000 and US$2,500 per employee compared to traditional training.

Local service teams use tablets and mobile devices to communicate with remote product experts. When a problem emerges, the product teams can triage complications and troubleshoot issues in real time via shared video and audio from the support team. Experts see exactly what the service team is looking at and can provide instructions by drawing digital annotations on the shared, real-world environment. Because these digital annotations are anchored to the technician's view, multi-step solutions are easy to follow and greatly reduce the potential for mistakes and miscommunication.

KEY DIGITAL TWIN + AR USE CASES

- **Frontline Work Enablement**: Frontline workers represent 75% of the global workforce, or 2.7 billion people. These professionals need a way to bring digital data into the real world, where they work. AR is essentially the frontline equivalent of the tools that desk workers rely on so heavily, such as Microsoft Office, Teams, and Zoom, but for the purpose of remote monitoring, maintenance, knowledge sharing, guided workflows, collaboration, and accelerated on-the-job learning. By 2025, there will be close to 60 million active users of AR for expertise and training applications across various verticals, such as healthcare, logistics, Architecture, Engineering, and Construction (AEC), and manufacturing.

- **Quality Assurance**: Training new operators on complex inspection procedures using traditional methods can take a significant amount of time. The use of digital twins and digital thread help improve traceability by establishing a single source of data truth throughout the supply chain. AR equips technicians and operators with this information in the field using the latest products and machine configurations for real-time support.

- **Product Differentiation**: The pace of New Product Introduction (NPI), change, and competition has never been greater. As a result, companies are looking to add intelligence to their products and allow end users to integrate that intelligence into their workflows. Digital twins and AR are viewed as important differentiators that can enable benefits like better lifecycle management, training, and support, as demonstrated by the Howden case study.

- **Process Efficiency**: Usually, deploying or modifying a production line involves collaborating with many different partners across geographies to coordinate all the needed changes. Partners can include Original Equipment Manufacturer (OEM) machine builders, SIs, and component or technology providers. Digital thread and AR can bring design contributions together to create a design for the entire line, rather than doing so piecemeal.

- **Spatial Computing**: Spatial computing allows the integration of information from the IoT, AR, Computer-Aided Design (CAD), and Product Life Cycle Management (PLM) with Three-Dimensional (3D) depth sensing cameras for a real-time digital view that encompasses people, products, and process in the context of time and place. This is the ultimate example of physical and digital convergence and should be regarded as the next frontier for digital thread + AR use cases. Although these are still early days, spatial computing will come into purview for industrial companies as the enabling technologies of IoT, AR, and AI become more widely adopted.

CLOUD

The cloud allows information to be easily and quickly shared, improves collaboration, and makes it easier to replicate and scale success. For capabilities like remote monitoring, remote service, and remote support, the cloud is critical. Furthermore, the cloud allows manufacturers to access—and pay for—only the applications and capabilities they need, rather than buying systems or software with features that are not fully used. This removes the investment risk and reduces deployment costs. The cloud also greatly enhances collaboration and enables new paradigms like SaaS and servitization.

Case Study: The Volvo Group is one of the world's foremost manufacturers of trucks, buses, construction equipment, and industrial engines with more than 100,000 employees and production facilities in 18 countries. The company has stringent supply chain and efficiency requirements to achieve its 0 Part Per Million (PPM) quality goal. The Volvo Group has undergone a transformation to replace paper-based procedures with digital tools, including digital twins, AR, and the cloud.

One of the applications enabled is for engine quality control and assurance, which require rigorous checks and are tasks reserved for Volvo's most experienced technicians due to their complexity. For example, in one plant, each engine requires 40 checks and there are 200 possible Quality Assurance (QA) variants.

It previously took Volvo more than an entire day to update and validate the configuration and QA checklists with new engine iterations across workstations and facilities. Now, it uses an IIoT platform to integrate information from multiple software systems, *i.e.*, engineering updates from CAD iterations and downstream from PLM and other manufacturing operations systems for real-time data synchronicity. The same task that took 1 day now takes less than 1 hour.

Volvo is also using AR to reduce training time, from 5 weeks to less than 2 weeks, and to be more flexible and agile in response to shifting market and customer demands. In the future, it will have AR applications that provide step-by-step assembly instructions on the manufacturing line, service instructions for maintenance of factory equipment, and real-time operational insights and KPIs across the value chain.

SAAS AND SERVITIZATION

SaaS solutions allow companies to capture new value from digital technology across the enterprise in three main ways:

BUSINESS AGILITY

Traditional on-premises software deployments require purchasing new licenses and upgrading to new versions to access the latest features. SaaS solutions, by contrast, improve with continuous updates and can scale up or down to meet the evolving needs of the organization. The combination of scalability and continuous functionality improvement means that companies that rely on SaaS are not only able to take advantage of the latest features and capabilities, but also respond more effectively to changes in market demand.

COLLABORATION

Multi-tenancy and non-relational databases improve collaboration. Examples include simultaneous document viewing and editing; controlled processes for sharing documents with external organizations; and more effective customer support with SaaS-based digital twins and AR. Individuals and companies are becoming accustomed to using these tools to meet the needs of communication and collaboration in today's increasingly global and interconnected world. Furthermore, working from a single source of data truth, where files do not need to be downloaded and instead are kept up-to-date in a centralized location, accelerates product innovation and improves service and support.

IT/OT INTEGRATION AND COLLABORATION (OFTEN REFERRED TO AS IT/OT CONVERGENCE)

Integration of Information Technology (IT) and Operational Technology (OT) greatly improves operational efficiency and enables new business models by allowing companies to invest where value is added and to divest where it is not. For example, by consolidating the cost of maintenance, hardware infrastructure, and related IT overhead across all end users, SaaS vendors can leverage economies of scale to deliver a better software experience at a lower TCO.

CONCLUSION

When uncertainty and disruption become the expectation, accelerating digital transformation is the ideal response. As a result, the level of digital innovation has never been faster than it is right now. This makes digital transformation increasingly important and a differentiator for industrial companies that can sustain their business, while continuing to innovate. This is the new normal.

This whitepaper highlights the key digital tools and technologies that are here to stay: the cloud and SaaS for greater agility and flexibility from design, engineering, and production throughout the supply chain; AR for frontline workers to collaborate in new ways, improving access to information at the time and place it is needed; digital twins/digital thread for a consistent data source that drives synchronicity across systems and teams; and the IoT, combined with data analytics and AI, for factories and product fleets to achieve double-digit improvements in operational KPIs. Companies will continue to embrace these tools at an accelerated rate with the increase in digital transformation initiatives.

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