



**FUTURUM.**

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# INTRODUCTION

In today's digital world, manufacturing is the production engine that serves as the foundation for every other industry across the global economy. From paints and plastics to computers and the cloud, if it exists, it's been manufactured. In fact, the digital economy — with its reliance on physical infrastructure, communications systems, and computers — would not exist without the manufacturing industry. But the inverse is also true. Manufacturing as it exists today would not be possible without the infusion of computers and data, lots of data that drives both operational and business decisions and efficiencies.

## Manufacturing IS Digital

The operational technology (OT) that controls, coordinates, and completes the manufacturing process is subject to the same macro trends shaping the digital era. When converged with information technology (IT), a host of use cases aimed at improving factory productivity and product quality becomes possible. As digital technology has matured and become a defining force in the global information economy, manufacturing has benefitted significantly, becoming one of the most digital and technology-driven industries.

Every device and every sensor is a potential data source, and every data source is a potentially actionable insight whether it's generated from a manufacturing application such as MES or supply chain management systems, a fixed asset or a mobile or wearable asset at the edge. The way we look at data — the recording of events, actions, or transactions — has changed over the past decade as the value of data has evolved from a purely historical perspective to a future, or predictive, perspective. And with improvements and leaps in computing capabilities, data has now become a real-time asset.

- ▶ The value of data has traditionally been in the recording of events and an understanding of what has happened but that is rapidly changing as data's value is increasingly in understanding what is happening and what will or may happen in the future.
- ▶ The arrival of the 360° view for data pertaining to customers, assets, supply chains, and overall business operations, and the ability to integrate them all into a single source of truth, has created a richer level of real-time data that can be used to link the first supplier to the end customer in near-real time.
- ▶ Data sources now include products themselves, as manufacturers are increasingly able to leverage Industrial Internet of Things (IIoT) to monitor a customer's product use and model future product behavior, performance, and availability.





## Real-time Changes Everything

The number of sources and the volume of data available within a manufacturing environment continues to increase every day, adding new layers of complexity and variable performance requirements. Capturing, processing, and deriving real-time actionable insights from all of this data has led manufacturers to embrace many emerging technologies and solutions, such as hybrid on/off-premises clouds for data storage and compute resources; edge computing and flexible network architectures to capture and analyze data as close to its creation as possible; and artificial intelligence, including machine learning and predictive analytics, as a tool to gain real-time insights that enable more self-optimizing production.

And as data architectures and computing systems have become more complex, manufacturers have begun to rethink how they manage all these new data assets, increasingly realizing the value from in-memory database solutions, such as SAP S/4 HANA, that eliminate traditional drive I/O constraints and combine advanced analytics and high-speed transaction processing to enable real-time processing of massive amounts of data with near zero latency. And, as manufacturers continue to work toward a lean focus and shift purchased (CapEx) technology assets to subscribed assets-as-a-service (OpEx), they've also begun embracing consumption-based delivery and pricing models, such as are available through HPE GreenLake offerings, to achieve the scalability, flexibility, and cost-effectiveness they require to remain agile and competitive in a dynamic and rapidly transforming market.



## THE CHALLENGES TODAY

The past few years have clearly helped illustrate the fragility of the manufacturing industry and the supply chains on which it depends for its materials. From trade-based destabilization of the global supply chain to the rapid conversion of manufacturing capabilities from planned products to pandemic-related products, recent events have highlighted the value of agility while exacerbating existing technical and operational challenges faced by many organizations today.

- ▶ **Lots of Data, Limited Compute.** As manufacturing technology becomes infused with smart sensors and IIoT devices, massive amounts of data are being created in real time, but often exceeding the ability of existing or legacy storage and compute resources. As a result, actionable insights and opportunities can be delayed or lost entirely, increasing both risk and limiting business agility.
- ▶ **Increased Complexity, Limited Resources.** New architectures and deployment models, such as Edge Computing, offer significant opportunity to both capture and process data at the source where its real-time value is the greatest. But these opportunities come with an added level of complexity that can stress both OT and IT organizations, particularly if OT/IT systems are not converged or if their organizations are not aligned from a planning, implementation, and ongoing management perspective.
- ▶ **Staffing, Knowledge Limitations.** The rapid pace of technology development and deployment, coupled with the recent acceleration of digital transformation plans, is stressing many organizations from both a pure staffing perspective and through the increased need for higher-level skill sets and expertise. This challenge can be magnified for organizations that are unable to access the experience and expertise of the right services and solutions providers.

- ▶ **Limited Visibility, Increased Unpredictability.** Every action or transaction creates a data point, but these data points are often not collected and integrated into an ecosystem-wide data set. This is a problem both within the enterprise and the extended supply chain that fuels its manufacturing capabilities. This may be a result of shadow data or devices (that exist but are not known or tracked) or underutilized data (that is known but cannot be adequately or efficiently captured, analyzed, and acted upon). In this situation, visibility into upcoming shortages of materials, resources, or components can be extremely limited.
- ▶ **Limited Scalability or Agility.** As manufacturing organizations continue to expand their use of new, digital technologies and generate massive volumes of real-time data, limitations in existing infrastructure, processes, and operational models can severely limit the realization of actual value. Examples include physical space or expansion constraints on existing data centers; limited scalability and/or agility of database or computing resources; and fixed or rigid consumption, cost, or contractual models.
- ▶ **Uncertain Asset Availability or Security.** Ensuring the security, reliability, and availability of physical and data assets across the entire manufacturing ecosystem can be a significant challenge, particularly for organizations that have limited real-time visibility into these assets. The inability to monitor these assets, both active and operational, can limit the value of that asset and lead to increased down-time, unexpected repairs, and unpredictable availability.

These challenges alone can be significant. But current events, from increased trade conflicts and the ongoing pandemic to shipping disruptions and global chip shortages, have heightened risks of not addressing these challenges while highlighting the need for organizations to focus on technology solutions, partnerships, and processes that increase agility and the ability to adapt rapidly to unexpected events.



## FOCUSING ON AGILITY

The short-term disruptions highlighted above have increased the importance of the long-term trends shaping the manufacturing industry and made the associated push to transition to a more data-centric model, accelerate digital transformation initiatives, and overcome the technology (and process) challenges the industry faces all the more critical.

Manufacturing organizations must embrace new database and compute models that are designed to support the increased volume of real-time data, leverage hybrid cloud models to improve operational resource utilization, and increase flexibility around how storage/compute resources are consumed and procured.

### Overcoming Manufacturing's Challenges

We believe the following drivers will be key to helping manufacturers implement the right technologies and processes to optimize for business agility ahead:

- ▶ **Converged IT and OT Systems.** The convergence of operational and information technologies – particularly at the edge – is a smart move for manufacturing systems. For example, data from sensors and actuators within an assembly line can be fed into a single hardware/software OT/IT Edge solution rather than disparate systems. In addition to reduced rack/power requirements, convergence helps operational management (through having a single system) and supports improved security, reliability, and availability by bringing OT assets directly under IT security and support.
- ▶ **Improved Analytics and Insights.** The future of manufacturing is smart, and that means not only smart sensors and monitoring systems embedded in equipment and assets but the storage and compute power to rapidly process massive amounts of data into intelligent insights. This is best achieved through the combination of an in-memory database and computing platforms to handle

variable volumes of real-time data and smart (AI-based) analytics tools to uncover patterns and insights from a historical, real-time, and predictive, or modeled, perspective.

- ▶ **Real-time Asset Tracking.** Understanding the real-time operational performance and status of an asset is critical to ensuring maximum availability and utilization. Data from embedded sensors can track location and usage data which can be analyzed with machine learning and predictive analytics tools to better schedule pre-emptive maintenance and repair.
- ▶ **Connected Supply Chain, Production, and Distribution Data.** Bringing together data from the extended manufacturing ecosystem can provide operations and management a more complete picture of the entire process, allows for data-driven insights from the first supplier to the last customer, informs operational decisions, and provide the visibility necessary for management to make smart business decisions.
- ▶ **Adaptive Manufacturing.** The ability to rapidly adapt manufacturing assets to meet changing market or customer requirements is critical to surviving in a global economy where uncertainty, from resource availability to trade policies, abounds. This goes beyond producing more or less of a given item to being able to rapidly repurpose existing assets to manufacture alternative products to meet evolving or unexpected requirements.
- ▶ **The Need for Continued Connectivity.** Consumers continually demand smart, connected products that bring aftermarket support to life. Manufacturers need to remain connected to products and customers to monitor their behaviors, and offer the necessary support by way of replacement parts, upgrades, and other enhancements.

- **Agile Services and On-Demand Consumption.** Through all of this, the ability to consume only what is required and to procure and pay for only what is consumed allows manufacturing organizations the flexibility to rapidly scale and adapt to changing requirements and provide a faster time to both insights and value than traditional legacy systems.

## Real-World Solutions from SAP and HPE

Implementing an in-memory database, such as SAP S/4 HANA either on premises or in the cloud, is ideal for helping to organize and process the massive amounts of data created by manufacturing organizations every day. We've researched SAP S/4 HANA and find its support for wide-ranging data types, speed of query execution, and its embedded AI-based machine learning and analytics offer tremendous value. But that is only part of the picture. How and where a database is implemented and managed can be critical to a manufacturer's ability to achieve the agility we believe is needed today.

*A global auto manufacturer leveraged the agility of an SAP S/4 HANA/HPE GreenLake consumption-based solution to help reconfigure their manufacturing operations to produce breathing ventilators to aid in COVID response.*



HPE GreenLake provides the consumption-based model for SAP HANA that manufacturer's need. With simplified management and operations of a converged solution, the ability to scale and integrate multiple SAP landscapes, and a highly scalable consumption-based usage and pricing model, the combination of SAP S/4 HANA and HPE GreenLake allows manufacturing organizations to speed time to insights from data generated across the ecosystem, from the

manufacturing floor to the assets at the edge. It also relieves the burden of operating complex infrastructure allowing organizations to free up time to focus on more value-added tasks like monitoring connected products and offering as-a-Service options for additional revenue streams.

## Case Study: Data-driven Sustainability

There are several benefits from adopting HPE GreenLake technologies, but don't just take our word for it. A global provider of technology, products, and solutions focused on sustainability and social good needed to align and consolidate its global operations; improve its ability to support data and compute-intensive engineering tools (requiring advanced simulations, artificial intelligence, and machine learning); and improve the scalability, security, and cost-efficiency of its operational systems. It also sought to leverage the massive amounts of operational data created by its own organization and the products it delivered to its customers to better understand its supply chain, manufacturing systems, and evolving customer needs.

However, the company was constrained by a legacy data/compute architecture and a fragmented ERP system, built both organically and through acquisitions, that were too inflexible and rigid to meet the company's requirements.

By partnering with HPE and SAP to implement a new, converged infrastructure, the company was able to meet its ERP needs, leverage in-memory compute to satisfy engineering and data processing needs, and is now able to scale with a flexible pay-per-use model. The company, once hampered by legacy constraints is now able to generate data-driven insights that have improved operational reliability and asset utilization, decreased the time-to-market for new products and solutions, and allowed the company to expand its sustainability-focused engineering designs and products into new markets.



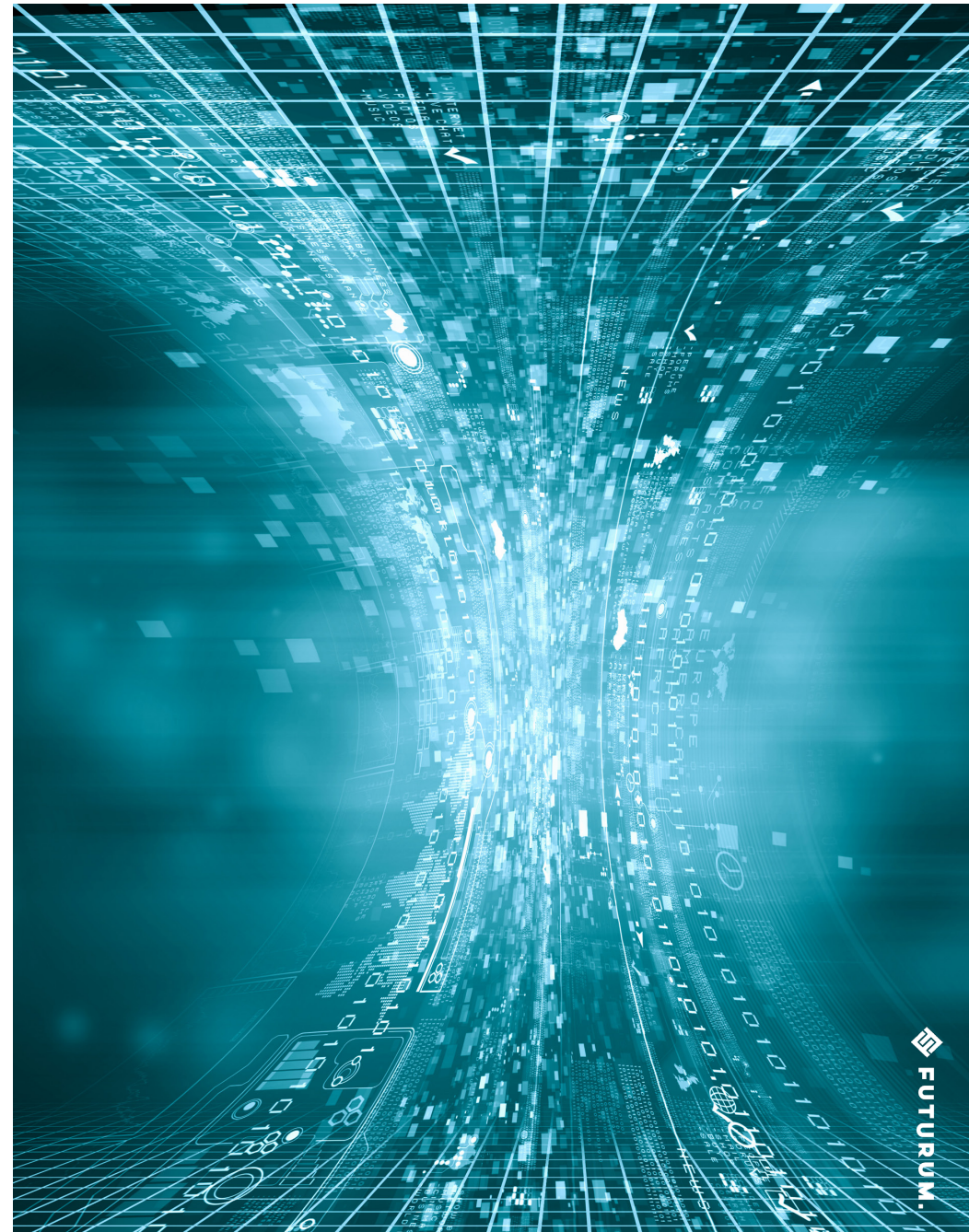
## THE NEXT STEP

Manufacturing organizations, the core of the global production economy, have embraced digital transformation and are becoming more digital every day. They understand the value of both historical and real-time data to gain visibility into operational systems, to better manage supply chains, and to gain insights into product usage and emerging customer requirements.

Overcoming the obstacles we laid out previously requires a holistic and enterprise-wide focus on implementing technologies and processes that intrinsically enable agility. We recommend an emphasis on:

- ▶ the convergence of OT and IT systems from a physical and management perspective
- ▶ data storage, in-memory compute, and analytics tools capable of driving real-time insights
- ▶ real-time asset tracking and monitoring to improve utilization, preventative maintenance, and operational readiness
- ▶ connecting the supply chain, production lines, and distribution systems to create an end-to-end single source of record

With a goal of creating an adaptable manufacturing model, organizations must also look to the right technologies, services, and partners that allow organizations to easily scale or refocus consumption on demand, with a shift away from fixed-cost or owned assets to flexible, on-demand services with consumption-based or pay-as-you-go pricing.



# IMPORTANT INFORMATION ABOUT THIS PAPER

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