

INDUSTRIAL EQUIPMENT

# THE SMART MANUFACTURING HANDBOOK

Your practical guide to realizing the factory of the future, enabled by virtual twin experiences.

# EXPERT CONTRIBUTORS



**Michael Mayr**

*Industrial Equipment/Robotics and Industrial Automation  
Industry Business Strategy Director, Dassault Systèmes*

Michel Mayr has over 20 years of experience in industrial automation at leading global sensorics and robotics companies (including Leuze, Yaskawa and KUKA). He has held positions as a product manager and the head of portfolio management and business development. Since 2019, he has been leading Dassault Systèmes’ robotics and machine tools industry segment as Director of Business Development.



**Bertrand Lacoste-Bourgeacq**

*Industrial Equipment Industry Solution Experience Director,  
Dassault Systèmes*

Bertrand Lacoste-Bourgeacq is dedicated to serving industrial equipment manufacturers in their journey to success. Together with his team of 15, he demonstrates the full value of the **3DEXPERIENCE®** platform by developing Dassault Systèmes' portfolio of solutions to enable digital transformation in line with market trends.



**Isabelle Morin**

*Industrial Equipment Industry Solution  
Technical Manager, Dassault Systèmes*

Isabelle Morin supports sales efforts by managing the industrial equipment industry’s technical team. As a solution technical manager, she combines technical expertise and strategic insight to sustain operational excellence and customer satisfaction, delivering compelling demonstrations that underscore long-term value for industrial clients.



# SMART MANUFACTURING, DONE RIGHT FIRST TIME

Smart manufacturing is transforming how companies operate, with 92% of manufacturers expecting it to drive competitiveness over the next three years.<sup>1</sup> It's evident why leaders are turning to advanced technologies to improve manufacturing processes: Pressed by market volatility, dynamic customer demand and growing labor shortages, manufacturers expect **automation and artificial intelligence (AI)** to help them stay ahead.

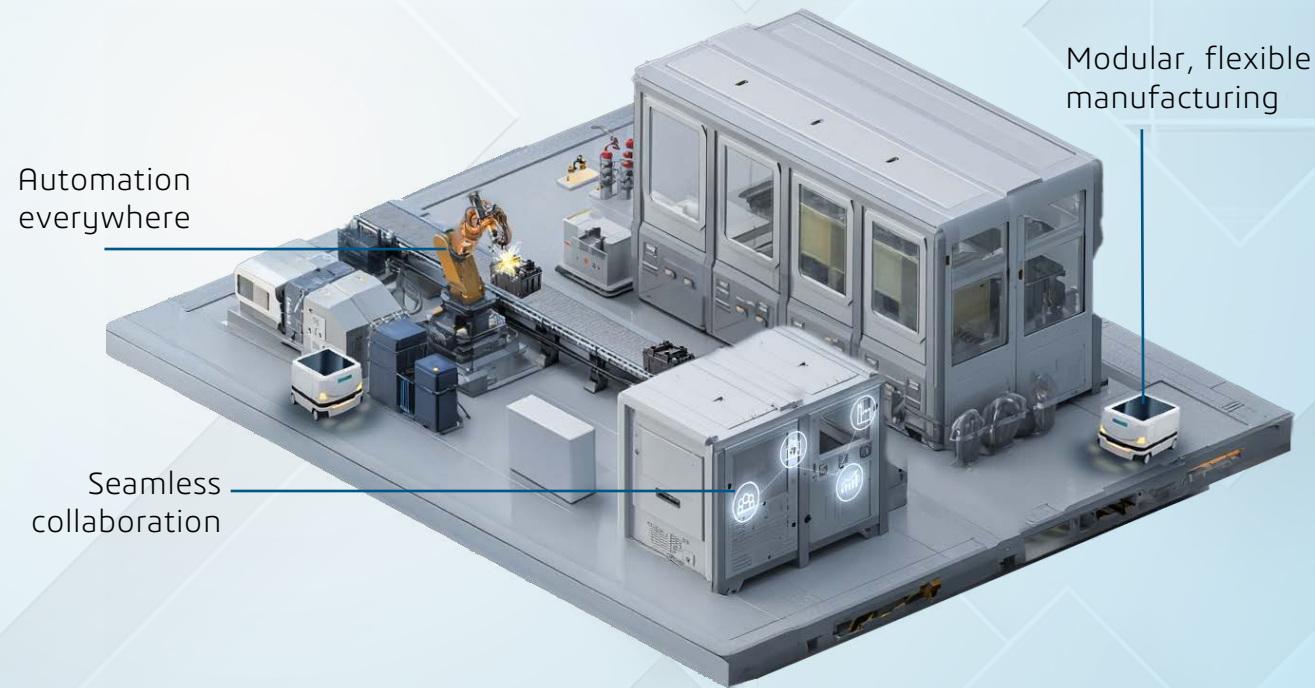
However, only one in eight CEOs reported both revenue growth and cost reduction from AI, while more than half achieved neither.<sup>2</sup> Why is there a gap between AI ambitions and execution? It's because AI cannot be deployed in isolated environments using outdated data. Success, especially in smart manufacturing, depends on strong foundations characterized by:

- **Simulation and modeling capabilities** that allow testing before deployment to safeguard uptime and optimize overall equipment effectiveness (OEE)
- A **unified environment** where systems, processes and people operate in sync
- A **closed feedback loop** where real-time data continuously drives learning and operational improvement

Dassault Systèmes' **3D UNIVERSES** provide that foundation. 3D UNIVERSES unite modeling, simulation, data science and AI capabilities so manufacturers can experiment, learn and innovate within a secure industry environment. By linking virtual twins across the lifecycle, manufacturers are empowered to capitalize on their knowledge and know-how and be more profitable, efficient and agile.

In an age where industry is evolving at an unprecedented speed and disruption shows no signs of slowing, manufacturers cannot afford to stumble. This handbook outlines how you can harness virtual twin experiences to build a strong foundation for AI-powered smart manufacturing.

It's time to step into the factory of the future. Get ready for:



<sup>1</sup> ["2025 Smart Manufacturing and Operations Survey" by Deloitte Insights \(May 2025\)](#)  
<sup>2</sup> ["PwC's 29th Global CEO Survey" by PwC \(January 2026\)](#)



CHAPTER

# UNLEASH AUTOMATION EVERYWHERE

Design, implement and scale AI-powered automation  
across the factory to optimize operations.

# THE CHALLENGES OF MODERN MANUFACTURING

Automation has powered manufacturing for decades. Robotic arms perform repetitive assembly tasks, pick-and-place systems transfer components across production lines and conveyor belts move materials efficiently across the shop floor. But in many factories, these technologies still operate in silos, tied to individual machines or isolated processes.

In today's competitive manufacturing landscape, isolated tools are no longer sufficient to warrant success, especially with growing pressures such as:

## Dynamic market demands

High-mix, low-volume production requires production lines that can adapt rapidly without sacrificing quality or margins.

## Labor shortages and skills gaps

Experienced workers are retiring. Automation-literate technicians are scarce. Critical know-how is becoming harder to retain.

## Limited real-time operational visibility

Disconnected systems and fragmented data create reactive firefighting instead of proactive optimization.

To stay competitive, manufacturers are accelerating investments in **intelligent automation**. Collaborative robots, or cobots, take on repetitive, physically demanding or hazardous tasks in place of human workers. On the shop floor, autonomous mobile robots (AMRs) transform intralogistics.

But robot systems and software-defined machines are typically built by different suppliers, each with its own architecture and interfaces. How can manufacturers reconcile complexities and differences while managing safety protocols — without risking uptime?

"Manufacturers must move from isolated tools to a more unified virtual twin strategy where products, processes and resources are validated before they're even deployed," says Bertrand Lacoste-Bourgeacq, Industrial Equipment Industry Solution Experience Director at Dassault Systèmes.



# ENGINEERING THE FACTORY OF THE FUTURE WITH 3D UNIVERSES

Testing automated systems directly on a live production line is risky and costly.

With **3D UNIVERSES**, manufacturers gain a risk-free environment to validate robot integration and simulate intralogistics flows across the factory floor. They can explore how decisions affect throughput, safety and quality before making any on-site changes.

Once trade-off analyses are complete, optimized models are automatically generated for virtual commissioning, accelerating project implementation and execution.

By uniting the virtual worlds of machine data and the real-world factory floor, 3D UNIVERSES equip manufacturers with **three key capabilities** to build the factory of the future:



## Virtual twin experiences

Scientific representations that embed physical laws, industrial constraints, knowledge and know-how into a persistent virtual environment.

- Standardize automation best practices and allow skill transfer across teams and global sites
- Preserve critical expertise as experienced workers retire, preventing knowledge loss

## Generative experiences

AI models capable of exploring thousands of design and process alternatives automatically, based on defined objectives and constraints.

- Combine generative AI with simulation-driven validation to identify high-performing configurations
- Reduce physical trial and error, shorten development cycles and accelerate the implementation of automation technologies

## Virtual companions

Generative AI-powered virtual companions that understand intent and offer real-time recommendations, risk alerts and optimization insights.

- Augment human expertise by automating repetitive analysis and surfacing contextual intelligence
- Free teams to focus on higher-value decisions and innovation



"Virtual twin experiences, enabled by 3D UNIVERSES, allow manufacturers to digitalize entire production lines and break silos with a unified, closed-loop data model. This improves predictive maintenance, performance and quality — all within a self-optimizing system."

**Michael Mayr**

Industrial Equipment/Robotics and Industrial Automation  
Industry Business Strategy Director, Dassault Systèmes

# THE REAL-WORLD IMPACT OF 3D UNIVERSES

Through the seamless integration of AI, data and generative user experiences, 3D UNIVERSES transform industrial operations from static, isolated entities into truly connected and automated factories. Manufacturers can achieve:

Up to  
**10 times**  
faster factory virtual twin creation

Quickly create up-to-date science-based virtual twins. Shift from intuitive to simulation-backed decision-making.

Up to  
**30%**  
shorter commissioning times

Resolve complex, multi-brand integration virtually, ensuring first-time-right site acceptance tests.

Up to  
**90%**  
reduction in unplanned stops

Implement predictive maintenance with AI-driven analytics to analyze sensor data and forecast failures before they occur.

Up to  
**50%**  
cost reductions through retrofitting

Test and evaluate retrofit strategies using AI-driven virtual twins to optimize line upgrades and maximize savings.

In the modern factory, automation is ubiquitous — spanning connected automated systems, humanoid robots and programmable logic controllers (PLCs) that direct line equipment. And as AI rapidly scales across manufacturing, **cybersecurity** is becoming a critical operational requirement.

3D UNIVERSES provide full traceability not only of hardware assets, but of software versions deployed across every system.

With an up-to-date software bill of materials (BOM) within a comprehensive virtual twin, manufacturers can identify vulnerabilities quickly and respond efficiently to emerging threats. This ensures data sovereignty, protects intellectual property and embeds compliance by design as automation reaches every corner of the shop floor.





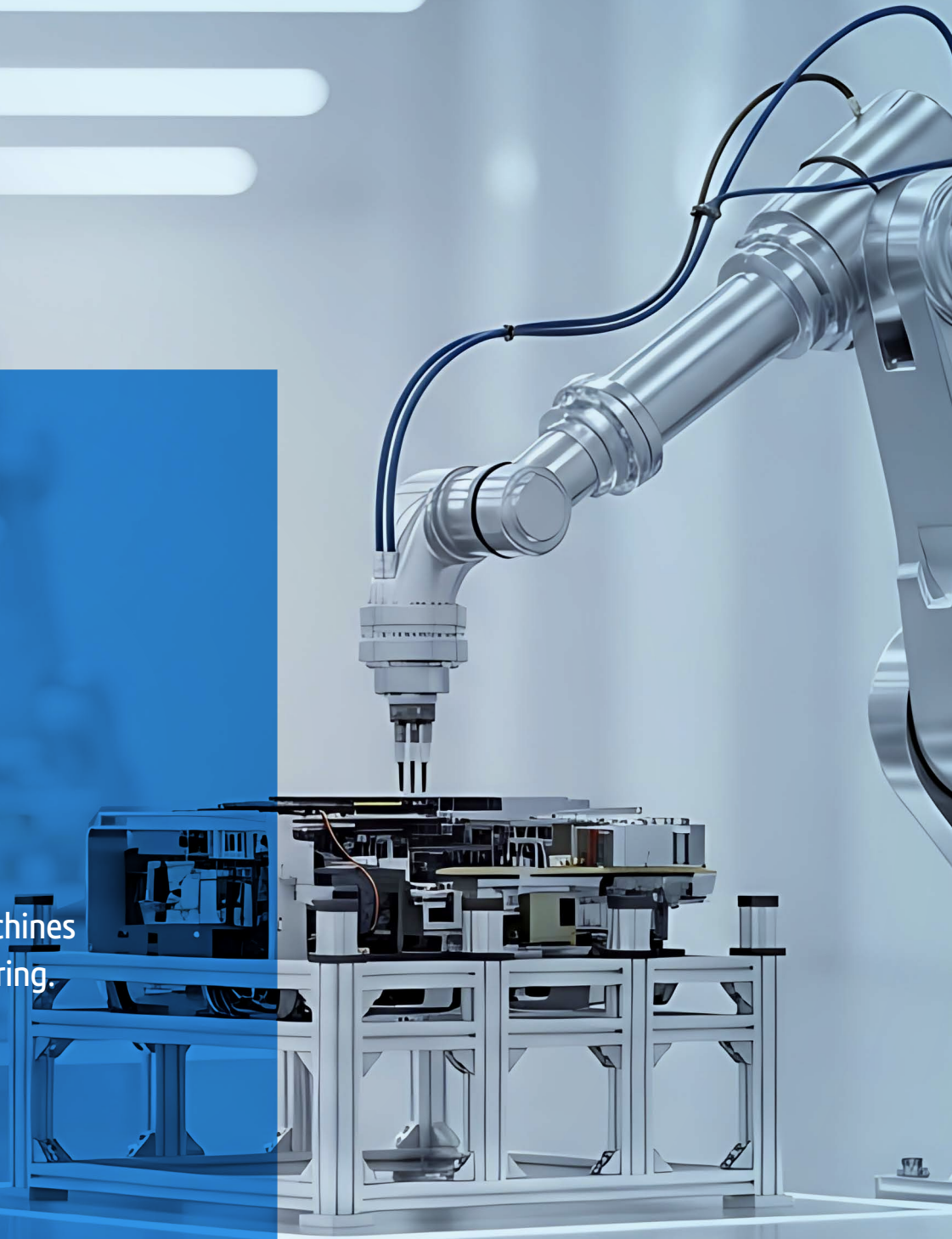
CHAPTER



# FOSTER SEAMLESS COLLABORATION



Connect people and intelligent machines  
for safer, more efficient manufacturing.



## COLLABORATION: THE FOUNDATION FOR SAFER FACTORIES

Manufacturers are facing a structural workforce shift. Skilled tradespeople are retiring faster than they can be replaced while production systems are becoming more automated, interconnected and complex. To maintain output and protect margins, many companies are accelerating the integration of robotics across their operations.

However, adding robots does not automatically resolve the workforce gap. Without coordinated oversight and a unified operational framework, increasing technical complexity can introduce new safety risks, integration challenges and

performance variability. What was intended to improve productivity can instead create fragmentation and blind spots, leading to slower decision-making.

In highly automated environments, seamless collaboration is no longer optional. When people, robots and intelligent machines operate with **shared context** and **real-time visibility**, manufacturers sustain performance while maintaining safety and control. 3D UNIVERSES make this collaboration possible in three ways:

### 1/ Validate human-robot workflows before deployment

“Having virtual twins in place makes it easier to simulate human-robot workflows, improve ergonomics and continuously integrate feedback and operational data from the shop floor,” says Isabelle Morin, Industrial Equipment Industry Solution Technical Manager at Dassault Systèmes. “AI analytics enables safer human-robot collaboration because it’s predicting interactions and identifying risk zones even before incidents occur.” **Multi-robot coordination** allows manufacturers to simulate synchronized robot cells to optimize paths and avoid collisions.

AI-driven virtual twin experiences evolve alongside real-world operations, helping manufacturers refine processes, update safety strategies and continuously improve performance on the shop floor.

## 2/ Create a single operational context across the ecosystem

3D UNIVERSES connect people, partners and intelligent machines around a shared virtual twin, creating a single, trusted environment for collaboration and innovation. Within this connected ecosystem, critical expertise is captured and made accessible across the organization to upskill future workers. The combination of **knowledge, know-how and transparency** enhances decision-making and accelerates time to market while protecting quality and compliance.

“3D UNIVERSES integrate data from multiple sources and formats to continuously enrich virtual twin experiences with operational contexts. Powered by AI, they translate vast data into actionable insights to reduce delay and coordination errors,” adds Morin.

## 3/ Develop smarter, easier-to-program automation

Manufacturers are increasingly adopting AI-powered robotics and cobots for tasks such as quality inspection and predictive maintenance. Testing workflows and validating functions within the virtual twin reduces downtime. Manufacturers can ensure that robots are easy to handle, with minimal or offline programming, so existing workers can operate alongside them without extensive retraining.

AI, integrated into robot technologies, continuously refines self-learning procedures and updates systems with real-time operational data. The result is a **self-optimizing automation network** that increases efficiency and flexibility across the manufacturing line.



# AUGMENTING INTELLIGENCE IN SMART MANUFACTURING

Augmented reality (AR), supported by Dassault Systèmes' 3D UNIVERSES, can elevate collaboration to the next level.

AR overlays information such as blueprints and real-time data onto the user's physical surroundings to guide factory workers through complex tasks. Paired with AI, it creates safer, more efficient operations across the smart factory:

| Manufacturing Function         | AI + AR Capabilities                                                                                                                                                                                                                                           |
|--------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Assembly and production        | AR guides workers through unfamiliar steps in product assembly or production activities; AI adjusts instructions based on workers' real-time progress and capabilities.                                                                                        |
| Robot programming and training | Workers use AR to demonstrate a task; AI generates the corresponding code and automatically programs the robot to perform the task. With Dassault Systèmes' solutions, manufacturers experience <b>up to 40% less downtime</b> when deploying new robot tasks. |
| Quality control and inspection | AR allows workers to easily identify defects on physical parts; AI cross-references findings with the virtual twin to confirm anomalies.                                                                                                                       |
| Maintenance and repairs        | AI detects equipment issues and variations; AR provides workers with step-by-step repair guidance.                                                                                                                                                             |
| Human-robot collaboration      | AR helps workers simulate and visualize cobots' next moves, <b>improving worker productivity by up to 25%</b> ; AI calculates safe distances and coordinates seamless collaboration on the shop floor.                                                         |



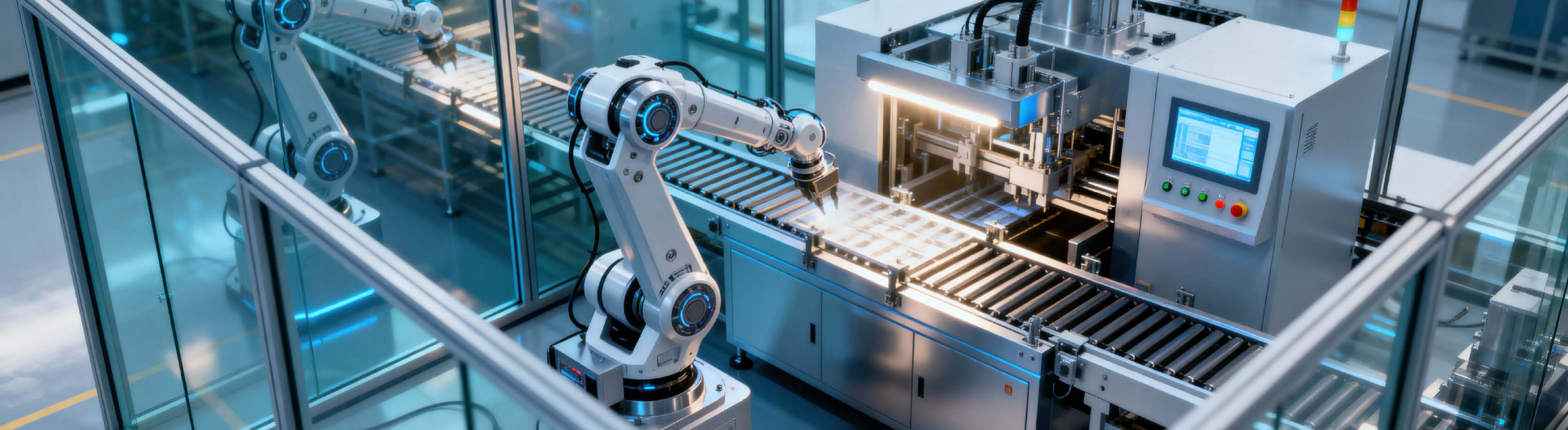


CHAPTER



# ENABLE MODULAR, FLEXIBLE MANUFACTURING

Leverage AI insights to reconfigure manufacturing lines at speed, adapting to today's demands and tomorrow's opportunities.



## FLEXIBLE MANUFACTURING FOR A VOLATILE WORLD

When manufacturers are expected to deliver personalization at scale, absorb supply chain disruption and ramp capacity up or down with minimal notice, one thing is clear: **Agility** is key to surviving in an unpredictable market. To cope with these changes, industry leaders are introducing flexible manufacturing at the physical level, for example, by rearranging equipment or adding modules to adapt production capacity. Yet these efforts often expose integration gaps and inefficiencies that were long hidden within the line.

“With market volatility and dynamic customer demand to be more agile, manufacturers need approaches that leverage **digital transformation** and data-

driven decision-making,” comments Michael Mayr, Industrial Equipment/Robotics and Industrial Automation Industry Business Strategy Director at Dassault Systèmes. This is where 3D UNIVERSES add value. By uniting simulation and data analytics into the virtual twin experience, manufacturers can engineer and scientifically simulate modular lines without risk or disruption. **Flexibility is designed intentionally**, supported by virtual commissioning to ensure modules interact optimally before physical deployment.

Powered by 3D UNIVERSES, the speed advantage is tangible:

Up to  
**30%**  
**faster response to market demand changes** through AI-driven forecasting in the virtual twin

As much as  
**90%**  
**faster numerical control creation** to program automation for processing equipment

Up to  
**50%**  
**reduction in changeover time** during modular line reconfiguration

# 3D UNIVERSES: MAKING AGILITY A REALITY

As manufacturers work to reconfigure production lines at speed and scale, 3D UNIVERSES help by establishing **industry world models** – advanced neural networks that understand the physics, behaviors and consequences of actions to generate optimal designs and make the best decisions.

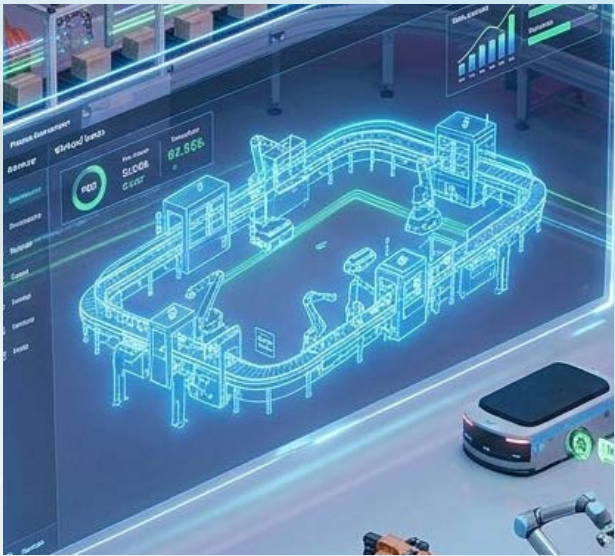
“Virtual twins, paired with world-class AI infrastructure built on open models and accelerated computing, provide manufacturers with trusted industry world models that are flexible and built to operate over the long term,” adds Lacoste-Bourgeacq.

Manufacturers gain **four key enablers** through industry world models to bring agility to life:



## 1. Simulation

Physics-grounded models in the virtual twin allow manufacturers to explore what-if scenarios and evaluate risks and constraints before deploying changes. Instead of reacting to market shifts, they can proactively simulate reconfiguration scenarios, optimize throughput and validate performance to ensure first-time-right modular lines.



## 2. Closed-loop optimization

Closed-loop optimization, enabled by the industrial internet of things (IIoT) and real-time data, automatically adjusts process parameters during line changeovers, stabilizing performance and reducing downtime. This continuous feedback loop within the virtual twin helps ensure long-term reliability while minimizing commissioning time and maximizing OEE.



### 3. Connectivity

A single source of truth within a connected ecosystem removes silos and fosters cross-functional collaboration on modular line designs. Real-time data synchronization across suppliers, partners and production systems accelerates decision-making and reduces coordination errors, ensuring seamless execution of modular reconfigurations.



### 4. Predictive analytics

AI analyzes demand and supply chain data to forecast future scenarios and dynamically adjust production. With automated scheduling and predictive maintenance, modular lines remain efficient, flexible and responsive.

Modular, flexible manufacturing is no longer a choice — it's essential for manufacturers to adapt to today's volatile markets and anticipate tomorrow's opportunities. 3D UNIVERSES equip manufacturers with a unified approach to engineer flexibility, turning the promise of modular manufacturing into a real competitive advantage.

## EXPERIENCE THE FACTORY OF THE FUTURE

In an era marked by market volatility, dynamic customer demand, labor shortages and skills gaps, manufacturers are turning to smart manufacturing to remain competitive. 3D UNIVERSES help them get it right by enabling:

- AI-powered automation everywhere on the factory floor
- Seamless collaboration between people, partners, robots and intelligent machines
- Modular, flexible manufacturing to reconfigure lines with speed and precision

By unifying virtual twins, simulation, AI-driven insights and real-time data across the enterprise, 3D UNIVERSES provide manufacturers with a connected, living system — delivering operational clarity and action. The result is a modern factory that works faster, safer and more efficiently while directly addressing the challenges unique to your business.

To find out more, click [here](#).



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**3DEXPERIENCE®**

**Europe/Middle East/Africa**

Dassault Systèmes  
10, rue Marcel Dassault  
CS 40501  
78946 Vélizy-Villacoublay Cedex  
France

**Asia-Pacific**

Dassault Systèmes  
17F, Foxconn Building,  
No. 1366, Lujiazui Ring Road  
Pilot Free Trade Zone, Shanghai 200120  
China

**Americas**

Dassault Systèmes  
175 Wyman Street  
Waltham, Massachusetts  
02451-1223  
USA

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