TRANSPORTATION & MOBILITY

RETHINK PRODUCTION AGILITY TO UNLEASH SUSTAINABLE TRANSPORTATION

With precise and agile operations planning enabled by an integrated platform, mobility manufacturers can increase sustainability, customer satisfaction and market leadership.

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DASSAULT SYSTEMES

INTRODUCTION

Global trends, local requirements and sustainability pressures continue to transform the transportation and mobility industry.

Today's consumers, cities and businesses demand more diverse mobility solutions — with specific and dedicated needs — **that deliver safe, smart and sustainable vehicles.**

Market differentiators that were advantageous in the past may not work today because customer needs and industry requirements are evolving much more quickly.

Those who rely on current practices and tools that promote organizational silos are less likely to achieve their goals. They need to **rethink their production agility to achieve more sustainable transportation,** and this is possible by digitalizing their operations planning in a connected and collaborative environment.

Transforming production agility requires end-to-end digital connectivity that's supported by the following four pillars:

- Agile execution
- Agile planning and scheduling
- Lean and collaborative manufacturing
- The virtual twin experience

Manufacturers who can integrate and automate their operations, from one pillar to the next, are better positioned to satisfy customers and lead the market.

This ebook demonstrates how to drive agility across operations with an integrated platform, allowing mobility manufacturers to quickly adapt to sustainable transportation demands.

CHAPTER 1

AGILE EXECUTION WITH MANUFACTURING OPERATIONS MANAGEMENT

Fine-tuning operations to meet fluctuating market demand can help mobility manufacturers reduce operational costs, increase localization, drive efficiency across business areas and enhance profitability.

For example, transportation in major cities may have stricter regulations on greenhouse gas (GHG) emission levels, vehicle restrictions and safety requirements. Instead of employing a one-size-fits-all approach, agile manufacturers can execute with excellence regardless of the demand because their operations can flexibly meet different requirements.

"As a result of this, the ability for a manufacturer to succeed using previous generations' tools is quickly becoming impossible," says Fred Thomas, DELMIA's Strategic Business Development and Marketing Director at Dassault Systèmes.

Delivering successful and sustainable transportation requires manufacturers to gain end-to-end connectivity from virtual manufacturing definition to physical operations execution.

This is where digital capabilities that support integrated, agile operations can help.

Agile execution with Manufacturing Operations Management

LEVERAGING MOM

Manufacturers need to go beyond manufacturing execution systems (MES) and implement manufacturing operations management (MOM) to achieve more standardized and integrated operations.

> “Disparate legacy environments cannot offer the agility, flexibility and resiliency that a well-crafted, connected and collaborative manufacturing environment provides.”

Fred Thomas
DELMIA Strategic Business Development and Marketing Director, Dassault Systèmes

Fred continues, “MES and MOM are both used to track and document the transformation of raw materials into finished products. However, MOM extends the control scope to cover operations related to warehouse management, quality, labor tracking, field maintenance and supply chain visibility.”

When employed on a unified and platform-based model, MOM can integrate multidisciplinary 'as built' and execution information in a single and global collaborative environment.

Synchronized and secure information flowing from the platform approach breaks down silos so that manufacturers can achieve complete visibility and control over disparate manufacturing processes.

THE VALUE OF AN AGILE GLOBAL SOLUTION

By implementing MOM for agile execution, manufacturers can reap the benefits in six areas:

Production
Achieve global visibility and control across multiple sites.

Quality
Monitor quality performance in real time to make adjustments rapidly.

Warehouse
Synchronize material flows and improve operational performance.

Resources
Maximize resource usage for increased productivity and cost and time savings.

Maintenance
Integrate machine maintenance activities on the shop floor to minimize downtime.

Best practices
Efficiently standardize and deploy best practices and processes globally.

Fred elaborates that the benefits achieved by a MOM solution are derived from the integrated nature of the shop floor applications operating from a common approach — both in terms of user experience and data acquisition.

He says, "The resulting benefit is a comprehensive solution for global manufacturing that provides agility and flexibility at the plant level while supporting standard process enforcement and continuous improvement across all plants from an enterprise level."

Ultimately, MOM enables an end-to-end flow of activities, people, processes, materials and machines related to production.

CHAPTER 2

AGILE PLANNING AND SCHEDULING

Henri Beringer, Transportation and Mobility Industry Solution Experience Director at Dassault Systèmes, states that mobility manufacturers need to take fast and decisive actions to face continuous challenges that come their way.

"The industry is seeing many key evolutions. For example, changing technologies in powertrains — from internal combustion to electric hybrid and hydrogen — greatly impact the design of vehicles," Henri explains, adding, "And these vehicles need to be in the market very quickly because there is great pressure from regulators on minimizing GHG emissions."

In this aspect, manufacturers must make confident planning decisions fast and respond agilely to disruptions.

> "Relying on a solution that provides a single source of data lets you create accurate, robust plans. You can also regenerate plans that react optimally to changed circumstances."

Camilo Gaviria
DELMIA Technical Sales Vice President,
Dassault Systèmes

For agile planning and scheduling, manufacturers must rely on an integrated platform that gives a holistic view of their operations while considering all constraints, rules and assumptions.

More than that, manufacturers need to understand the consequences of various planning decisions to ensure that all plans are optimized before execution. This calls for the ability to perform what-if scenario planning based on defined KPIs and evaluate the impact of decisions across all production sites and resources such as materials, workers and machines.

Because every process and activity happens in the platform's single digital environment, manufacturers can re-optimize plans quickly and efficiently even when disruptions hit.

Digital solutions that allow you to investigate the scope of possibilities in real time give you the ability to immediately adapt to disruptive events.

AGILE VALUE NETWORK MANAGEMENT

To achieve a competitive edge, manufacturers need to extend agile planning to include their value network. Faced with constant, volatile changes that can have a domino effect in the network, manufacturers require end-to-end connectivity to make optimized decisions.

For example, if business conditions change in one region, manufacturers can shift production to other locations. If import tariffs are imposed on materials from certain countries, they can look for a different supplier.

Making crucial decisions with speed and accuracy requires manufacturers to know their impact on the global network structure. Only then can manufacturers improve their value network performance based on considerations such as:

- Feasibility of the total car program to determine what can be produced and at which locations
- Optimized costs and resource usage
- Impact on environmental footprint

Here is where an integrated platform can also help. It digitally connects the entire value network and empowers manufacturers to swiftly analyze different planning outcomes to arrive at the optimal decision.

AGILE FORECASTING WITH COMPLETE DATA

"No forecast is 100 percent accurate," Camilo affirms. "That's why manufacturers need the ability to quickly incorporate changes and respond to disruptions in a dynamic manner."

To improve forecasting effectiveness, manufacturers need to bring together advanced planning and scheduling (APS) and sales and operations planning (S&OP).

While APS helps manufacturers find the best plan, it is driven by mathematics. What is missing for smarter decision-making is human reasoning and creativity that comes from the S&OP process.

By employing both APS and S&OP on an integrated platform, manufacturers can evaluate the first-cut production plan generated by APS, make improvements and execute the optimal plan.

Manufacturers can also shape demand for more efficient use of manufacturing resources by leveraging S&OP's collaborative process and APS's ability to simultaneously plan materials and capacity.

As a result, manufacturers can:

Achieve an optimum mix of inventory and production resource usage to meet demand

Minimize inefficient operations

Prevent excess inventory

Furthermore, an integrated platform that provides a constant feedback loop and reflects changes and constraints in real time will help manufacturers rapidly improve plans.

CHAPTER 3

LEAN AND COLLABORATIVE APPROACH

Lean and collaborative approach

For mobility manufacturers to survive and thrive in this changing climate, their operations have to be cost-competitive, efficient and responsive to market demands. They need to combine Lean principles and agile production to minimize waste in manufacturing while maximizing productivity.

The Lean manufacturing approach is not new; it has driven methods such as just-in-time (JIT) production and automation to help manufacturers improve their operations' efficiency.

However, this approach can be enhanced for even better results. While Lean processes have proven to be useful in stable manufacturing environments, they need to be enhanced to cope with today's increasing demand for customized and sustainable vehicles.

SOLVE PROBLEMS EFFICIENTLY AND SUSTAINABLY

By leveraging a collaborative and integrated platform, manufacturers can optimize their Lean strategy because it improves collaboration, minimizes disconnected information and enables enterprise-wide visibility.

This platform connects teams across departments, factories and warehouses. It allows teams to capture, monitor and track operational meetings and problem solving, thereby providing the ability to aggregate relevant and critical information from different operational areas.

Camilo says, "In an S&OP process, for example, demand planning that is driven by increased collaboration among teams provides a collaborative S&OP environment, resulting in better accuracy in demand signal."

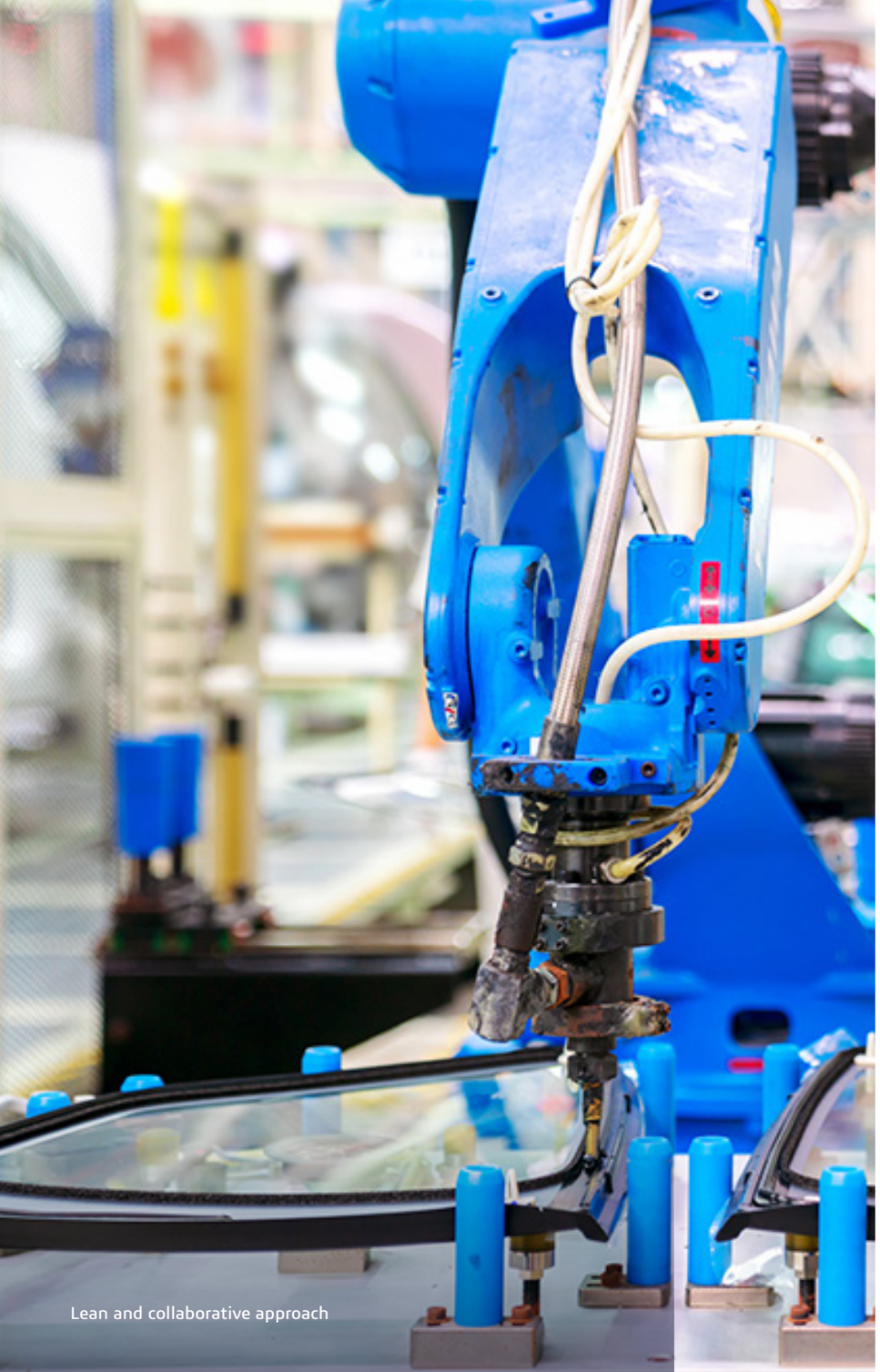
He continues, "This collaboration-enabled Lean approach empowers anyone in the team to solve any issues instead of relying on the purview of, say, a chief engineer."

For environmentally-focused manufacturers, they can rely on digital simulation capabilities to increase sustainability initiative results with Lean.

> "By fully simulating manufacturing processes throughout the product lifecycle — from design engineering to production to end-of-life care — manufacturers can evaluate the product's environmental impact and build best practices in sustainability."

Guillaume Vendroux
DELMIA Chief Executive Officer,
Dassault Systèmes

In essence, manufacturers can leverage virtual universes to simulate, optimize and rework processes before performing them in the real world.



Lean and collaborative approach

TEAM ENGAGEMENT AND OPERATIONAL EXCELLENCE

A shared, comprehensive and up-to-date view of operations helps manufacturers drive continuous improvements such as reducing waste and inefficiency.

Lean initiatives become successful when they are embedded directly into manufacturing processes. This is enabled by an integrated platform that provides real-time visibility of operations.

The integrated platform provides manufacturers with the ability to:

- Digitalize and easily deploy Lean practices
- Collaborate digitally in operational meetings
- Contribute between meetings in a centralized environment to ensure everyone remains informed and involved
- Innovatively solve problems by leveraging visualized data and evidence
- Capture and retain institutional knowledge, intellectual property and know-how

Manufacturers who can realize Lean principles collaboratively on an integrated platform report that more than 85 percent of their teams feel more involved, have better access to information and become more positively engaged in their work.

All of this helps manufacturers identify opportunities for improvement and drive operational excellence.

CHAPTER 4

THE VIRTUAL TWIN EXPERIENCE

Operating across different regions and countries, mobility manufacturers need to adhere to diverse regional rules and regulations that can change over time. To ensure utmost compliance, they can use advanced visualization capabilities included in the virtual twin experience.

Fred explains, "As an executable model of a physical system that brings in learnings and experiences from the physical world, the virtual twin expands the digital twin's static model.

"Dynamic virtual twin experiences enable manufacturers to visualize, model and simulate sophisticated experiences, not only of the product but the manufacturing environment as well."

Manufacturers can scan their facilities, create 3D layouts and see how workers move and interact with equipment. The virtual twin facilitates what-if experimentation in the virtual factory so that teams can evaluate the impact of different decisions and be confident in implementing new configurations.

The 3D plans that have been validated in the virtual world can be automatically shared with teams in charge of execution on the shop floor. This creates a responsive environment that allows companies to implement changes much more quickly.

When embedded in an integrated platform, the virtual twin experience helps enforce standard quality processes, support global and local regulatory requirements and manage all quality events, such as corrective and preventive actions, product nonconformance and audits.

"The closed-loop environment enabled by the platform provides the full realization of understanding of what's possible, thereby driving innovations across your organization while empowering your workforce and creating a new resiliency in your manufacturing operations," says Fred.

The virtual twin experience

REVEALING AND ADVANCING MANUFACTURING VALUE

The applications of the virtual twin in mobility manufacturing are vast. Its value can be derived in three areas:

1. Planning and scheduling optimization
Gain insights through the visualization of various planning scenarios and their impact on critical metrics. Simulate the factory's virtual twin using actual capacity planning data to adjust and re-optimize plans multiple times, ensuring all critical performance and customer delivery metrics can be met.

The certainty gained from knowing what is possible in the real-world operations based on performance validation in the virtual world drives operational resiliency while ensuring that sustainability KPIs are met.

2. Digital iterations
Rapidly explore various engineering design and manufacturing operations scenarios related to warehouses, material flows, production schedules, energy consumption, waste management and more in the virtual world, then execute optimized decisions in the real world.

3. Worker safety
Virtually simulate and validate safe working experiences. For example, perform an ergonomic analysis of worker movements on the production line by simulating various line configuration changes to ensure social distancing and optimal machine placements.

When complemented with augmented reality, virtual twin experiences can support new worker training programs prior to actual production line assignment. This helps acclimate new hires to job responsibilities and significantly reduce the risk of accidents.

CONCLUSION

Production agility needs to be advanced through the optimal integration of processes, people and tools on the **3D**EXPERIENCE® platform.

It supports mobility manufacturers to accelerate the delivery of sustainable transportation by synchronizing more agile production and operations for efficiency gains at every step.

The platform's end-to-end digital connectivity is the key to advancing agility and profitable results for your enterprise. It enables manufacturers to achieve:

- **Agile execution**
  Execute agile manufacturing operations management from end to end through a single, integrated platform.

- **Agile planning and scheduling**
  Generate and maintain an optimized production plan that considers a wide range of constraints to respond to changing demands.

- **Lean and collaborative approach**
  Drive long-term growth in sustainable transportation by adopting a mindset of continuous improvement.

- **Virtual twin experience**
  Simulate, evaluate and iterate in the virtual world to ensure successful sustainable real-world execution.

Inceptra

Inceptra supports engineering and manufacturing organizations with best-in-class solutions to digitally design, simulate, produce, and manage their products and processes, enabling enhanced innovation and productivity.

As the largest Platinum partner in North America, Inceptra is dedicated to Dassault Systèmes' product development software portfolio, complementary solutions, and related services, including training, implementation, integration, support, consulting, and automation services. For more information, please visit Inceptra.com.

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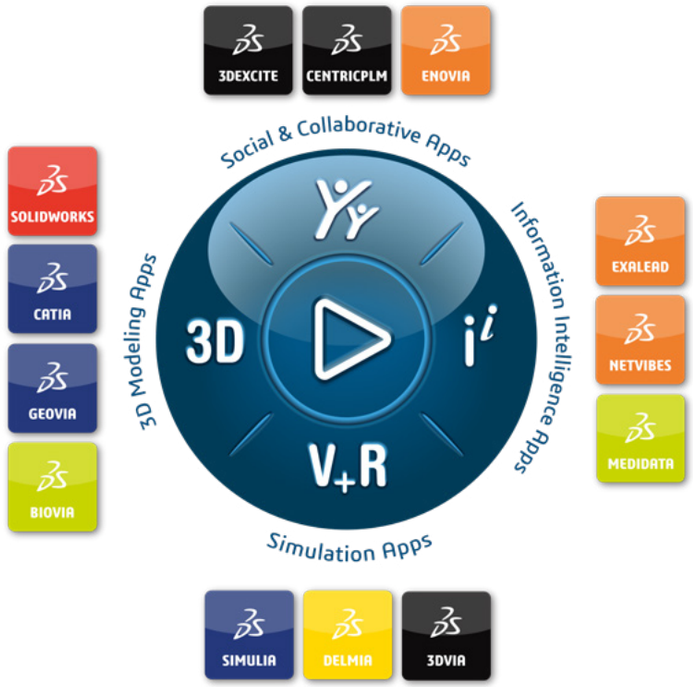
Our **3D**EXPERIENCE® platform powers our brand applications, serving 11 industries, and provides a rich portfolio of industry solution experiences.

Dassault Systèmes, the **3D**EXPERIENCE Company, is a catalyst for human progress. We provide business and people with collaborative virtual environments to imagine sustainable innovations. By creating 'virtual experience twins' of the real world with our **3D**EXPERIENCE platform and applications, our customers push the boundaries of innovation, learning and production.

Dassault Systèmes' 20,000 employees are bringing value to more than 270,000 customers of all sizes, in all industries, in more than 140 countries. For more information, visit **3ds.com**.



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