DELMIA

3DEXPERIENCE®

HOW OPTIMIZATION AND EXECUTION DRIVES INDUSTRY-LEADING MANUFACTURERS

INTRODUCTION

Global manufacturing faces significant operational challenges that have accelerated rapidly to the point that many companies have struggled to adapt. One of the root causes of this is rising consumer demand for instant gratification and experiences that are customized to meet consumer needs. Products and services have become far more integrated into consumers' lives, which drives up the complexity and cost in supply chains everywhere. With manufacturers scrambling to shift from product-centric to customer-centric operations, what can companies do to not just survive, but build a competitive advantage?

DASSAULT SYSTEMES

BUSINESS CHALLENGES

There are many operational levels that could be focused upon adapting to the new normal. For example, at the highest level, sales and operations planning plays a role for larger organizations in long term planning; the ability to optimize both known and forecasted demand with potential material and capacity constraints in the value network is critical.

Regardless of organization size, all manufacturing companies need:

- **Full supply chain visibility to conceive optimal plans**
- **Synchronized systems to execute operations efficiently**
- **Agility to react to sudden changes in demand and operations**

But despite the multitude and maturity of planning systems available, many are still unable to take full advantage of what these systems have to offer to deliver realistic execution plans that reflect real-world constraints. Companies hoping to seize market leadership will need purpose-built solutions to meet tomorrow's challenges.

CRITICAL SYSTEMS FOR FUTURE-READY SUPPLY CHAINS

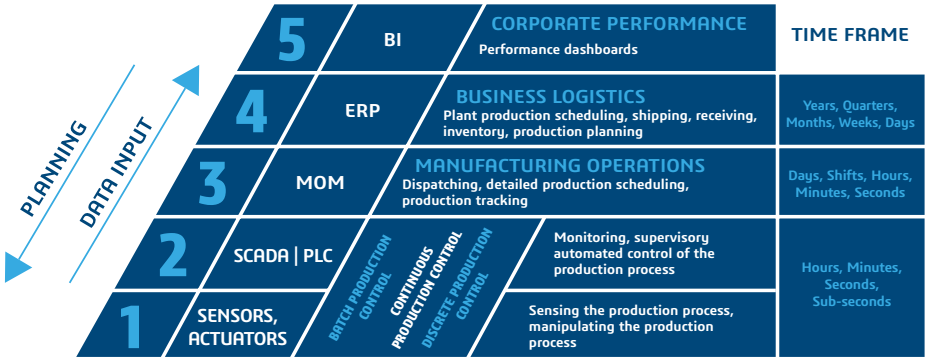
Inherent to the phrase "planning and executing efficiently" are the two types of systems that need to be considered.

- The execution and management system needs to deliver visibility into, control over and synchronization across ALL operations. This includes not just production but quality, warehousing, plant maintenance and potentially field operations. This system is Manufacturing Operations Management (MOM).

- The planning and scheduling system needs to be able to develop a realistic schedule of future production taking into consideration ALL constraints that will have an impact on meeting demand. These constraints includes not just material and capacity but also labor (skills), tools/setup time, inventories, supplies, etc. This system is Advanced Planning & Scheduling (APS).

Moreover, the two systems need to be working together in harmony so that we are executing what we plan and we can update and re-plan based upon execution.

Neither of these systems' capabilities are effectively captured by ERP but neither are they designed to replace ERP in any way. Rather, they complement the capabilities and extend and enhance the overall solution. In terms of industry standards, the ISA-95 hierarchy shows us clearly where ERP, MOM and APS reside. Based upon this, it becomes possible to identify and evaluate what's needed and what's possible in each area.



ISA-95 Enterprise Systems Hierarchy Representation.

UNDERSTANDING MANUFACTURING OPERATIONS MANAGEMENT (MOM)

MOM is a key part of the solution needed by manufacturers because the ability to meet customer demand efficiently depends upon all aspects of the operational process. Without consideration of these dependencies it becomes difficult to execute effectively.

Example 1: electric vehicle (EV) battery manufacturing
Integrating quality planning and product traceability into execution can minimize costs from scrap and waste, as well as reduce recalls and warranty expenses.

Example 2: full material synchronization
An expanded view of production that covers WIP, warehousing and material management supports Lean methodology, enabling just-in-time manufacturing for significant cost savings.

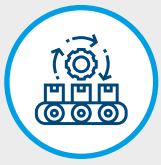
Comparing Manufacturing Execution Systems (MES) with MOM

MES: Smaller scope; only tracks and documents the transformation of raw materials into finished products.

MOM: Covers the end-to-end flow of activities involving people, processes, materials and production machines (e.g. logistics, warehouse management, quality, labor tracking, field maintenance, supply chain).

The value created by MOM is both in efficiency and costs. Successful companies have been able to increase product mix and volume without capital expense by running existing manufacturing and assembly lines more effectively. By intelligent allocation and distribution of tasks and immediate updating of material requirements these companies have reduced cycle and takt times and reduced inventory levels.

LEAN MANUFACTURING



PRODUCTION

QUALITY

PLANT MAINTENANCE

WAREHOUSE

MAINTENANCE & FIELD OPERATIONS

ASSET TRACKING

SERVICE EXECUTION

DELIVERY MANAGEMENT

In short, as manufacturers are expected to increase agility and flexibility without adding capital intensive capacity, MOM provides a solution that can maximize productivity and efficiency of existing facilities and assets to truly synchronize capacity with demand.

How the Industrial Internet of Things (IIoT) is at the heart of industrial transformation

IIoT-enabled MOM provides critical operational data such as:

- **Machine data**
  - to mitigate the impact of equipment failure
- **Asset data**
  - to maximize plant asset availability
- **Operational data**
  - to improve operational performance and product quality

UNDERSTANDING ADVANCED PLANNING & SCHEDULING (APS)

ERP and its planning functions can be thought of as "what if" simulations in the most basic sense. The projected results reflect what might happen if things are executed according to plan, but there is no comparison of different scenarios. The development of advanced planning software was a major milestone for ERP; systems could now consider multiple factors using real situational intelligence to make recommendations instead.

Today's APS solutions have evolved significantly since their inception. In addition to continuous improvements in the speed and scope of optimization algorithms (important to be able to rapidly run multi-scenario simulations considering real-world constraints) there are new complexities in today's industry to consider. For example, multi-level bill of materials for complex assemblies, the ability to be able to understand the dependencies in operations and synchronize material appropriately has been a key development.

The value provided by APS is the ability to quickly and proactively identify potential manufacturing challenges such as bottlenecks and the impact on customer demand. By running simulations (proactively and on demand) successful companies have been able to deliver on customer due dates and increase customer service levels while simultaneously reducing inventory and cycle time.

INTEGRATING MOM & APS FOR OPERATIONAL EXCELLENCE

Planning and operational execution solutions are essential in helping manufacturers break down organizational silos so that they can overcome the challenges of modern supply chains. However, both are potentially constrained if not used together as part of a larger strategic evolution.

There are two well-known axioms that point out the need for this conjunction:

1. **No plan is resilient to real-world disruption without tactical adjustments.** Due to the nature of increasingly customized orders and shortened lead times it is inevitable that the production plans will need to be revised. This happens within tactical operational timeframes e.g. dropping in a priority customer order or a sudden shortage of raw materials. It is impossible to eliminate this variability (even with higher level planning processes) so the important capability to add is the ability to react to changes and to quickly re-plan production. This allows us to see the impact and, if necessary, evaluate trade-offs to settle on a compromise between (for example) cost and customer service levels.

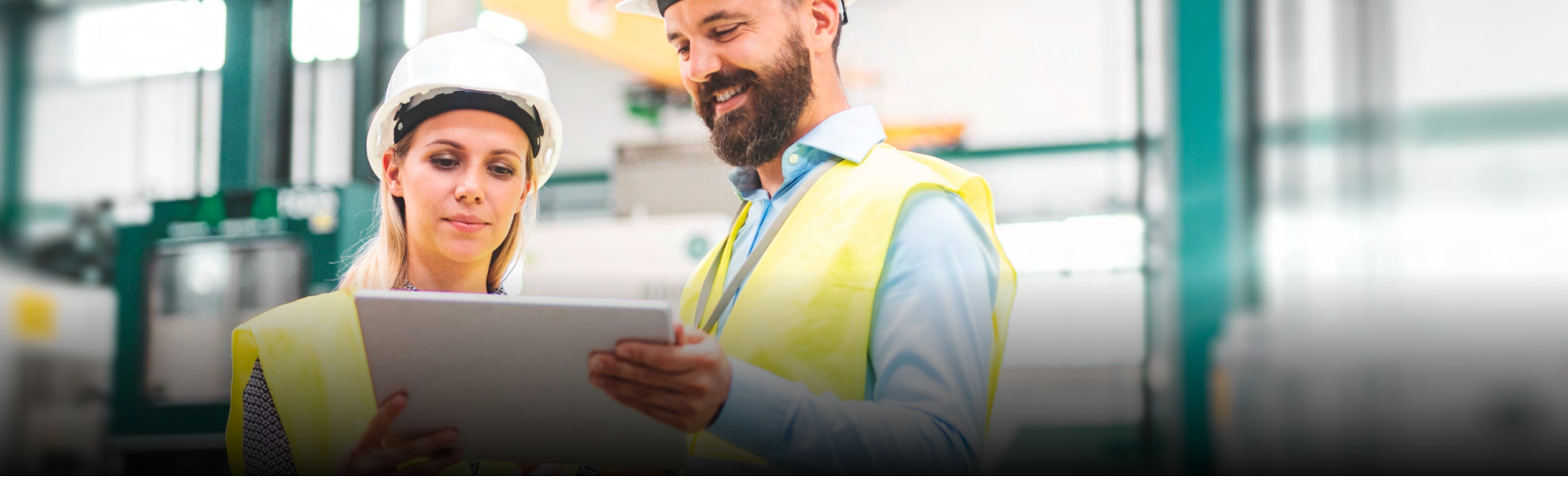
2. **Your preparations aren't good enough if you're inadequately equipped to face your challenges.** Spreadsheets are still a common tool in this process but are woefully inadequate in supporting a scalable and reliable planning process. The end result is a lack of agility and a production capability that becomes very reactionary. Perhaps manufacturers in this state may still able to meet customer demand but they would do so at the expense of skyrocketing costs of inventory and expedited logistics. Few companies today have the luxury of high customer service levels at any cost.

WHY CAPABILITIES NEED TO BE DEPLOYED IN AN INTEGRATED PROCESS

For organizations to break down departmental silos and achieve operational excellence, new technology must be deployed in collaboration with staff, process and data changes, or it will show no real benefit. Since manufacturing issues can impact partners, customers, subcontractors and suppliers, it's important to share Key Performance Indicator (KPI) data with the entire value network based on levels of responsibility.

The **3D**EXPERIENCE Twin represents the next step in the evolution of manufacturing by connecting the real world (MOM) and virtual world (optimized planning) to unlock new levels of agility and efficiency.

The Dassault Systèmes **3D**EXPERIENCE® Twin is a virtual model of business process with digital transformation that spans engineering and manufacturing. It is generated from a single data model on a unified platform.



THE PROVEN VALUE OF HAVING INTEGRATED MOM/APS

From a planning perspective, visibility into the manufacturing process dramatically improves the ability to balance demands from sales (inventory availability), purchasing (supplier lead times), manufacturing (operational efficiency), and finance (cost). By always considering the real-time status of the shop floor the planning team can confidently answer delivery date questions because its response is based on real resources, real process capabilities, real material availability, and real constraints – all leading to a real delivery date.

From a production perspective, the tactical execution will be oriented to specific and realistic goals. When the need to adapt and change inevitably occurs, the issues can be evaluated immediately and with visibility to the impact on both customers and cost. By being able to rapidly play out "what-if" scenarios, manufacturers are able to make intelligent "course corrections" that are essential to managing variability.

In numerous case studies manufacturers have initially found that the limited visibility to shop floor activities and poor planning led to problems with over scheduled machinery and equipment. Using spreadsheets to try and manage the process was neither reliable nor efficient. Unforeseen bottlenecks and constraints were constantly delaying production. Even when bottlenecks were "fixed" the problem would simply re-appear elsewhere. In order to ensure on-time delivery, the short term solution has typically been to expedite material, or add labor overtime, or overstock inventory and increase WIP at great expense.

Fast forward to case studies where MOM and APS have been deployed successfully and the change is dramatic. Thanks to material synchronization and optimal planning, inventory is typically reduced by 40% or more and cycle times have been reduced by 50%. Not only have customer service levels been increased; the ability to meet increasing and changing demand has been met without additional costly capital investment. In other words, best-in-class manufacturers are able to unlock the previously wasted potential in their manufacturing processes.

The independent value statements for each solution remain the same but together they are amplified and provide an overall level of agility which is rapidly becoming a necessity in order to stay ahead of competition. Success today is all about exceeding customer expectations. That means right first time, on-time and meeting quality standards. To achieve this profitably, knowing that variability in supply and demand are a constant, companies have to change their operational models. They must connect the real and virtual worlds and include both MOM and APS together.

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Transportation Industry Example

- Increased manufacturing throughput by 25% while increasing product mix
- Reduced OEM quality claims by 90%

High-Tech Industry Example

- 50% reduction in time-to-volume (general availability to mass production)
- 50% efficiency improvement in configure-to-order operations
- Dramatically shorter rollout times for new product groups

WHAT ABOUT YOUR INDUSTRY?

All manufacturers perform the same critical tasks across operations, and the advanced scheduling and dynamic management outlined in this paper applies to manufacturers in every industry worldwide.

The more complex or volatile the value network is, the greater the advantage these tools have over spreadsheets and traditional ERP systems.

From discrete manufacturing sectors (industrial equipment, aerospace, transportation) to consumer goods and process manufacturing (food and beverage, pharmaceutical, chemicals, metals), each industry faces varying degrees of challenges in different areas—but all stand to gain significant value from operations that are well-planned and executed.

Autoliv, a Fortune 500 Tier 1 supplier of airbags and safety systems to all major automotive OEMs worldwide, wanted to improve quality, material flows and traceability across all of its manufacturing plants.

CHALLENGE

- Autoliv needed to better manage quality and material flows, achieve greater traceability and drive consistent, lean continuous improvement across all its manufacturing plants.
- The company also wanted to improve and harmonize its operational and commercial business processes into one integrated platform.

STRATEGY

- Autoliv deployed its ERP and MES together in a deployment system internally known as ACE (Autoliv Consolidated ERP) to help standardize and share best practices across its multiple plants.
- The company's operational and commercial business processes were improved and unified in a single system with its ACE rollout deployed together with DELMIA.

RESULTS

- Thanks to DELMIA, Autoliv now has better visibility into materials, workflows and processes, helping to **improve productivity, enhance global traceability and standardize global process improvement**.
- Based on the initial success of pilot deployments, Autoliv is now **rolling out its ACE solution to 30 manufacturing plants** globally.

Laboratoires M&L, the manufacturing division of the L'Occitane Group, implemented DELMIA to improve production planning flexibility and quality consistency of its products.

CHALLENGE

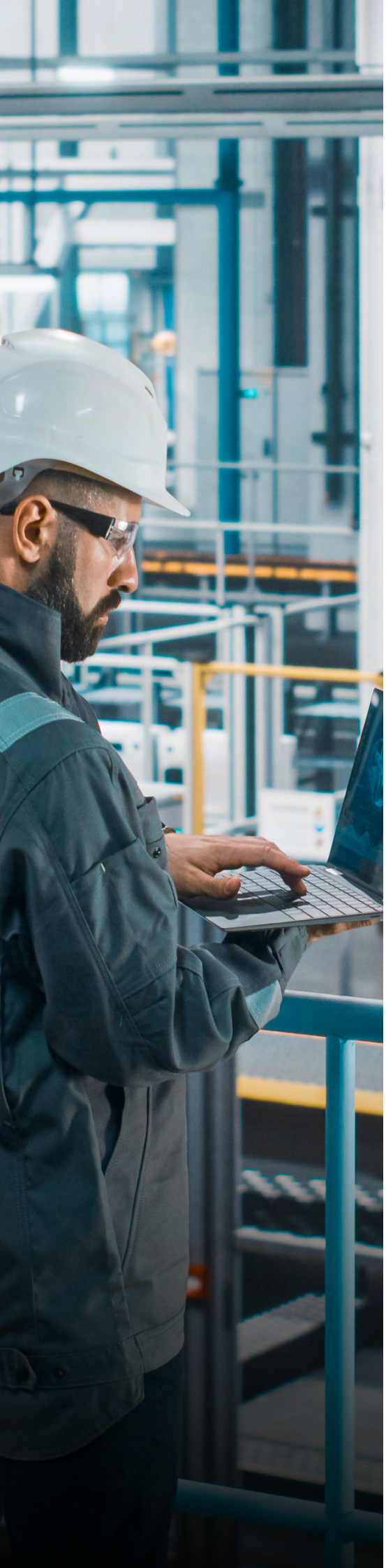
- Laboratoires M&L needed to enhance the flexibility of its production planning to deal with the fluctuations in natural raw materials and to deliver products on time to support the company's sustained growth.
- Traceability and security were also a concern—from raw material procurement to delivery of finished products to its boutiques.
- It also required internal process improvements and employee training to enhance the company's industrial performance.

STRATEGY

- Laboratoires M&L implemented DELMIA to help optimize its global production and logistics operations, including raw material reception, weighing, production, packaging and storage, and to anticipate early issues that can adversely affect the quality and delivery of its products.
- Before switching to DELMIA, Laboratoires M&L created test scenarios with "Go/No Go" decisions along the way, which were executed in two months before the final "Go Live", followed by the training of all staff on DELMIA and its new ERP solution.

RESULTS

- With **real-time availability of information**, the company has more foresight thanks to better planning and the availability of information in real time, which also **improve decision-making**, while **reducing the rate of non-quality, waste by 50% and production interruptions for inventory purposes**.
- **Employees are offered new career opportunities** thanks to improvements in their day-to-day productivity.
- Laboratoires M&L has now enabled **100% paperless operations** with all reports, daily KPIs and operator updates going through the DELMIA system.



THE NEXT STEPS TO TRANSFORMING YOUR OPERATIONS

If the evolution was easy then all manufacturers would have completed it already. There are companies that are seen as industry leaders. Some, such as the automotive industry or aerospace industry, have had the benefit of consistent change and adaptation over longer periods of time. Others, like newer startups in the High-Tech Industry, have the benefit of starting with almost a "blank slate" in terms of process and facilities. The reality is that most companies are somewhere in the middle in terms of current maturity. The challenge of making changes to legacy systems and processes can be daunting but it is possible to achieve results if the right approach is taken.

Step 1: Evaluate your organization's operational maturity.
What are the biggest challenges on the horizon from the perspective of your customers and market? For example, in the High-Tech industry the explosion of product variants and volatility in technology and component supply might be of greatest concern. In the Aerospace & Defense industry, continually shrinking delivery lead times, production rate requirements, and quality requirements are likely to be priorities. These leading indicators will immediately point out potential gaps in operational capabilities and provide a potential roadmap on how to future proof the organization.

Step 2: Assess your technology gaps and process gaps.
Remember, the value in an integrated MOM/APS solution is just as it says: integrated. This means process and data. Take a look at how the roles within your organization responsible for supply chain, planning and production work together (or don't!) and determine what's needed. Technology can help support an integrated process but it can't necessarily force it.

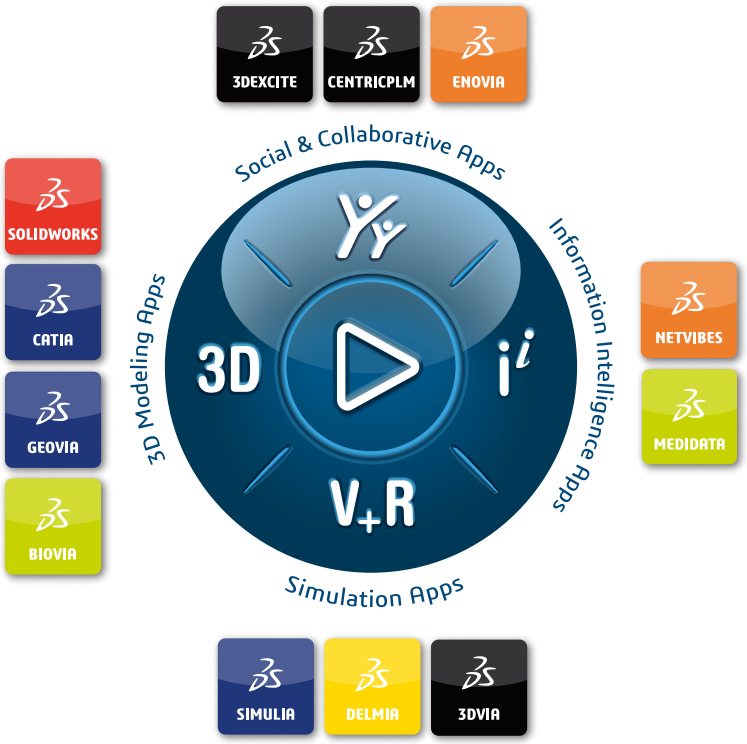
Step 3: Define a strategy based upon value.
Technology for the sake of it is often a recipe for disaster. Set clear KPIs and real world results that you expect to achieve based upon deployment of solutions. These should be measured in terms of cycle times, customer service, inventory, etc. and not just project deadlines. In doing this you also get buy-in from stakeholders across the organization by showing them how they will be beneficiaries of being part of the collaborative process.

Good solution partners will expect to take part in all of the above and even provide a framework and governance to help support the process if it seems challenging.

The one critical thing to not do is wait. Consumers demanding new products and experiences are not going to relent. The question is, which companies will adapt fast enough to keep pace and which will fall behind. The difference between the two will simply be those that decide to take action to meet the challenge.

At Dassault Systèmes we are enabling companies to adapt with our market leading solutions. Our DELMIA® brand portfolio helps industries and service providers connect the virtual and real worlds of global operations to re-imagine business for achieving sustainable excellence and delivering orchestration across value networks. Powered by the **3D**EXPERIENCE platform, DELMIA can transform your Manufacturing & Operations, Planning & Optimization, Industrial Engineering and Collaborative Operations.

For more information visit: http://www.3ds.com/products-services/delmia/



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

Dassault Systèmes, the **3DEXPERIENCE** 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 **3DEXPERIENCE** 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 **www.3ds.com**.

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