



3DEXPERIENCE®

BUSINESS-BASED OPTIMIZATION TO ORCHESTRATE DISRUPTED SUPPLY CHAINS

Enabling the Future of Innovation in Aerospace and Defense





THE CHALLENGES IN FOCUS

The concept of “supply chain management” has been known for decades but the ability to effectively implement a strategy that meets business goals has been continually challenged, especially since the start of the global pandemic. The unprecedented disruption has shone a spotlight on critical weaknesses that need to be addressed.



SUPPLY CHAIN RESILIENCE:

Even mature organizations were caught off guard. Shortages of material, people and demand led to a complete breakdown of the supply chain in many cases.



RELIANCE ON EXTENDED NETWORKS:

With very few truly vertically integrated supply chains, global organizations suddenly found that overseas supply and manufacturing were suddenly cut off leaving them starved of critical components and assemblies.



DISRUPTION AS A CONSTANT:

Although minor disruption is perpetual, potential “compounding” disruption was not anticipated. The pandemic impact was historic but adding events like the blockage in the Suez Canal and Brexit is exaggerating the challenges, and others will follow.



LACK OF VISIBILITY:

Knowing where you are and what is happening across the supply chain in real time is needed to know how to try and course correct. Very few companies had visibility to the overall operational status in order to effectively develop a contingency plan with any confidence.

DELMIA has always been at the forefront of addressing these business challenges and supporting integrated business planning. By enabling customers to model the intricacies of their supply chains and consider the trade-offs between operational and business goals using advanced optimization, we provide unique ways for organizations to weather the storm of disruption and variability and emerge as leaders in their industries.

The path each organization can take in reimagining the supply chain of tomorrow depends on their industry, maturity and goals but it is possible to see some key trends emerge and the changes in thinking and process being considered and adopted.

KEY CAPABILITIES NEEDED IN THE AEROSPACE & DEFENSE INDUSTRY



DIGITALIZATION:

The imperatives for building and sustaining a culture of continuous innovation are just as applicable to the multitude of small aerospace enterprises as they are for large original equipment manufacturers (OEMs). On a playing field where customization counts, small scale and narrow scopes can be turned into decisive advantages. This is where digitalization can make a significant difference.

With an estimated \$14 trillion in cost disruption across the value chain over the next decade, according to Accenture, organizations can ill-afford to miss any opportunity to rapidly adapt to changing market conditions or customer demands. Many successful manufacturers are discovering the key to becoming an agile enterprise is integrating information technology (IT) and operations technology (OT), whether it's in the production of a physical product or some other facet of running their business.

Consumer demand for on-time delivery at the price and quality they were promised, is at an all-time high. Companies need to become adept at combining cost-reduction strategies with innovative-ready derivatives for next-generation products. Defense contractors can create value and manage risk effectively by becoming more "risk intelligent", for example, by leveraging the power of modern 3D design and engineering software to validate structural components and help deliver efficiencies throughout the product's lifecycle.



VIRTUAL TWIN:

There is no greater opportunity for competitive advantage than delivering new products to market faster than rivals. Customers are also demanding that manufacturers shorten product-development cycles. Digital-to-physical manufacturing technologies, such as automation and the use of a virtual twin can dramatically speed up the design process, as well as the production and delivery of end-use products.

For example, Airbus has integrated digital mock-ups into production environments, giving assembly workers access to complete 3D models of aircraft in production. This has reduced the time required to inspect from three weeks to just three days.



ADDITIVE/AUTOMATED MANUFACTURING:

As aerospace suppliers of all sizes decide how and where to invest in new technologies, and which technologies will create the most benefit, additive manufacturing (AM) should be at or near the top of the list. Traditional manufacturing probably will never go away, but any supplier that doesn't have a core competency in 3D printing, as the process also is known, could find itself at a serious competitive disadvantage.

An increasing number of suppliers are using AM to develop complex components one layer at a time, providing a creative canvass for imaginative engineers. It allows production of parts with complex geometries with fewer tools and permits multiple parts of an assembly to be made in one integrated space. Of course, it's not just the machinery of 3D printing that allows the process to produce many parts more efficiently and, in some cases, parts that otherwise would be unattainable; no less important is the design software, which also can be used with more traditional processes such as milling, casting and forging. It allows a designer to capture all of a part's functional specifications, like geometrical and analysis inputs.



TRANSPARENCY:

Another aspect that could benefit from significant improvement is the transparency between suppliers and OEMs. Suppliers need to transform their interactions in order to provide higher visibility for OEMs and create a tighter and seamless integration. Currently identified as a siloed and linear ecosystem, the supply chain needs to change before it can become a value network – a network which can ensure full access to any required knowledge, know-how, skills and talents, as well as real-time social collaboration between individuals, groups or organizations.



WORKFORCE:

The aerospace industry is experiencing a job crisis. Numerous positions across aerospace are coming online that job seekers aren't equipped to fill – lacking the job-ready skills needed on the factory floor.

Memo to suppliers: Establish your own apprentice and training programs while investing in joint programs with vocational schools, which need far more support and guidance from businesses to train and educate. That's what Space Exploration Technologies and some other aerospace companies are doing in association with Utah-based Davis Technical Institute, which offers a hands-on composites materials technology program that's uniquely aligned with the industry's needs. SpaceX has hired many of Davis Tech's students upon completion of the program, and some aerospace companies have hired students before they finish.



INDUSTRIAL INTERNET OF THINGS (IIOT)/DATA:

Aerospace is undergoing a massive collective shift towards seamless integration of the digital and physical worlds, with the goal of digitally interconnecting all the information essential to a product's lifecycle – from conceptual design to product support – and establishing digital continuity across the enterprise. Digital continuity creates a consistent source of data from connected systems that your teams can access and leverage across the product lifecycle.

Many aerospace OEMs are in advanced stages of implementing IIOT, and they're expecting their suppliers to follow their lead. Think of IIOT as an ecosystem involving all participants who are interconnected and derive tangible benefits from working together, advises top Airbus manufacturing executives. For its part, The Boeing Co., calls its IIOT digitalization strategy its "second-century enabler", which will secure its foothold as a global industry champion.



MODEL-BASED ENTERPRISE (MBE):

As aerospace systems and subsystems become more integrated and their systems more interconnected, decisions that can determine whether a new-product cycle can be successful are often made long before production gets underway or a contract is even won.

An increasing number of companies are embracing model-based enterprise, which includes model-based systems engineering. MBE is built around a core set of annotated product models that replace traditional 2D design drawings. In this environment, a 3D computer-aided model of the product is created and used throughout the product's development.

As Bell Helicopter discovered in its phased approach to implementing a model-based enterprise, the company improved its agility and its overall efficiency. MBE reduced the number of touch-labor hours required to engineer and build aircraft and made quality assurance easier. In another example of the power of digital technologies, Boeing credits model-based systems engineering with helping the company "break the cost curve" in preparing its winning bid for the T-X aircraft-development program.





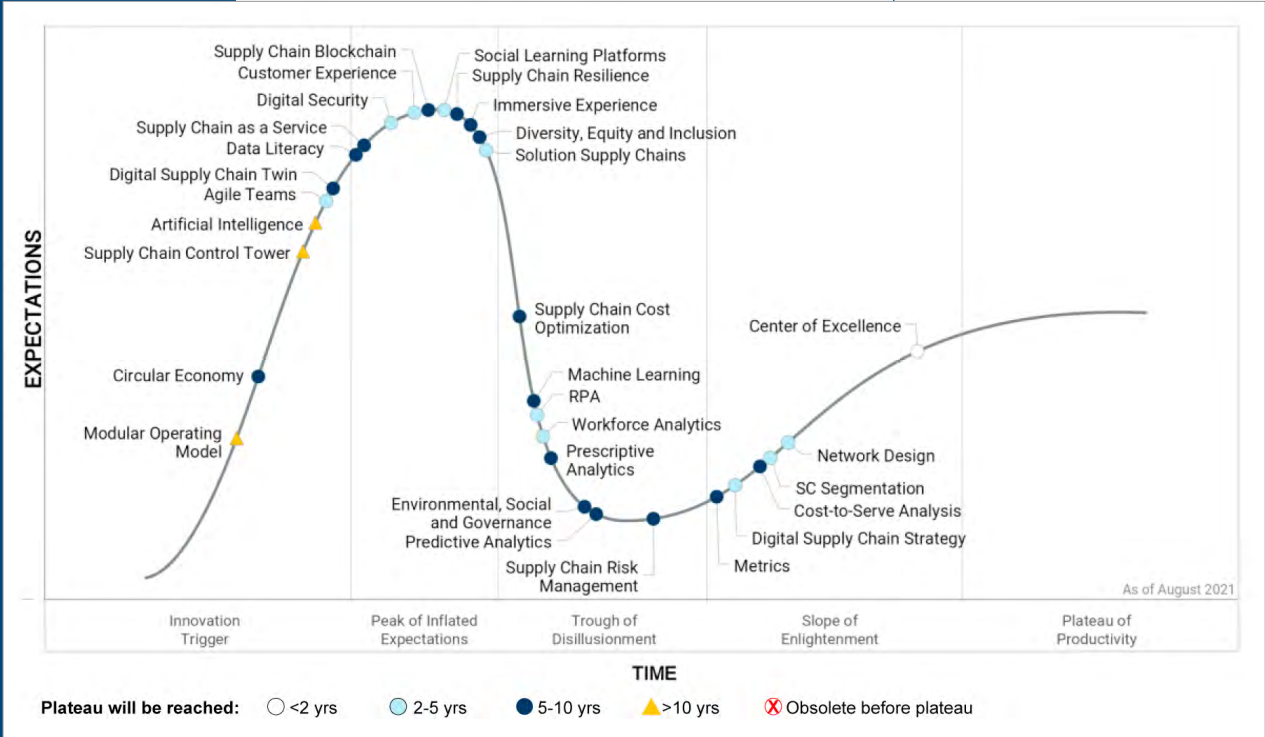
IMPORTANT SUPPLY CHAIN TRENDS

Responding to the new normal has seen companies undoing previous operational strategies as well as adopting new innovation and technology. Although potentially beneficial, each trend offers challenges to overcome.

Considerations	Supply Chain Trends	Challenges																																			
<p>What is the value of re-integrating the supply chain?</p>	<p>Larger OEMs have certainly felt the need to nearshore or re-shore supply chain operations, with some even considering the extra step of bringing manufacturing and other operations back “in-house” to (re)create a vertically integrated supply chain. The belief behind this is bringing operations closer, meaning better control and management.</p> <div style="border: 1px solid black; padding: 10px;"> <p>Figure 6 In a recent Kearney survey on reshoring, many executives perceive nearshoring to Mexico or Canada as more advantageous than reshoring manufacturing to the United States</p> <p>● Strongly agree ● Agree ● Somewhat agree ● Somewhat disagree ● Disagree ● Strongly disagree</p> <table border="1"> <thead> <tr> <th>Category</th> <th>Strongly agree</th> <th>Agree</th> <th>Somewhat agree</th> <th>Somewhat disagree</th> <th>Disagree</th> <th>Strongly disagree</th> </tr> </thead> <tbody> <tr> <td>Overall</td> <td>9%</td> <td>21%</td> <td>24%</td> <td>21%</td> <td>14%</td> <td>11%</td> </tr> <tr> <td>Small and medium-size enterprises</td> <td>6%</td> <td>11%</td> <td>24%</td> <td>26%</td> <td>20%</td> <td>13%</td> </tr> <tr> <td>Large companies</td> <td>14%</td> <td>34%</td> <td>24%</td> <td>14%</td> <td>6%</td> <td>8%</td> </tr> <tr> <td>Manufacturers with offshore facilities</td> <td>3%</td> <td>37%</td> <td>34%</td> <td>18%</td> <td>8%</td> <td></td> </tr> </tbody> </table> <p>(100% = 120 respondents; 70 small and medium-size enterprises and 50 large companies)</p> </div> <p><i>(Source: Kearney 2020 Reshoring Index)</i></p>	Category	Strongly agree	Agree	Somewhat agree	Somewhat disagree	Disagree	Strongly disagree	Overall	9%	21%	24%	21%	14%	11%	Small and medium-size enterprises	6%	11%	24%	26%	20%	13%	Large companies	14%	34%	24%	14%	6%	8%	Manufacturers with offshore facilities	3%	37%	34%	18%	8%		<p>Companies still suffer from disparate systems and organization silos.</p>
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<p>How do “control towers” add value?</p>	<p>Having a snapshot view of the overall supply chain status is key to being able to formulate decisions and plans. Realizing this “control tower” capability is quickly becoming a top priority for many organizations.</p>	<p>There are still challenges in obtaining and centralizing information to realize the “control tower” capability.</p>																																			

<p>How can optimization help?</p>	<p>Optimization and artificial intelligence (AI) are areas that organizations are investigating as a method of automating analysis in complex supply chains so that decision-making can be expedited both rapidly and confidently.</p>	<p>Optimization is a complex discipline and organizations are struggling to determine what the real-world benefits would be compared to the marketing hype.</p>
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<p>How to leverage the virtual world?</p>	<p>Digital twins of products and facilities are already a valuable tool, and the same value can be applied to the supply chain. By having a connected model of the end-to-end operations from supplier to customer, organizations can have a unique ability to analyze and experiment with new strategies across the supply chain.</p>	<p>The full realization of this is not a trivial task and organizations are attempting to understand the first steps along the path to this virtual experience.</p>
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(Example of Key Supply Chain Market Trends.
Source: Gartner 2021 Supply Chain Planning Hype Cycle)

<p>How to combine product innovation with the supply chain?</p>	<p>As above, digital twins of the product already exist. Decisions in the product digital twin affect the supply chain digital twin and vice-versa. Therefore, connecting the two provide a unique advantage to enable truly holistic supply chain and product planning.</p>	<p>Having a consolidated vision and technology platform to support this is possible but requires a strategic commitment across the organization.</p>
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All these major trends, along with many other initiatives are supporting two overarching goals:

- 1 enable agility
- 2 resiliency across all supply chain operations

THE ESSENCE OF SUPPLY CHAIN INNOVATION

Organizations must not only survive disruption—they must also thrive and innovate. Agility and resiliency are two fundamental competencies that all future supply chains need to achieve.

- ✔ **Agility applies to production processes, workforce and equipment utilization and the decision-making process. It depends upon an understanding of what is happening and evaluating possible plans to determine the best course of action moving forward.**
- ✔ **Resiliency adds an ability to endure disruption and then recover quickly. It also requires understanding and the knowledge to create longer term strategies so that viable options are available when challenges occur.**

HOW DO ORGANIZATIONS BECOME AGILE AND RESILIENT?

These competencies need to be developed through effective application and implementation of people, process and technology. When all three are considered together, organizations can not only provide a foundation for the new normal but also unlock new levels of innovation and develop a truly sustainable business environment.





UNDERSTANDING SUPPLY CHAIN PROBLEMS

Every organization would be supply chain “masters” if the problems were easy to solve, but thanks to the ever-increasing complexity of operations the problems are both numerous and convoluted.



HOW DO YOU MANAGE A DISTRIBUTED VALUE NETWORK OF FACILITIES, SUPPLIERS AND CUSTOMERS?

To effectively manage this type of supply chain, it is first necessary to be able to fundamentally represent it logically so that information and process can be applied to all elements that impact operations.



CAN TRADITIONAL TOOLS DEAL WITH TODAY'S PLANNING COMPLEXITIES?

The ever-increasing product mix and launches, combined with complexity of manufacturing and suppliers, means that existing planning systems and manual spreadsheets are no longer effective. The ability to develop a single plan (let alone multiple scenarios or re-planning on demand) can be a monumental task.



WHAT DATA IS NEEDED?

Supply chain plans need to be informed with real-time data from inventory, manufacturing and logistics in order to analyze multiple scenarios and develop feasible action plans that can be made with confidence. This requires connectivity and data input at multiple levels and locations across supply chain operations.



HOW DO YOU COLLABORATE AND INCLUDE THE RIGHT STAKEHOLDERS?

Developing effective supply chain plans means including sales, operations, finance, procurement as well as the executive team. There needs to be an expedient and standardized process whereby the stakeholders can collaborate effectively and inclusively so that all viewpoints and priorities are considered.



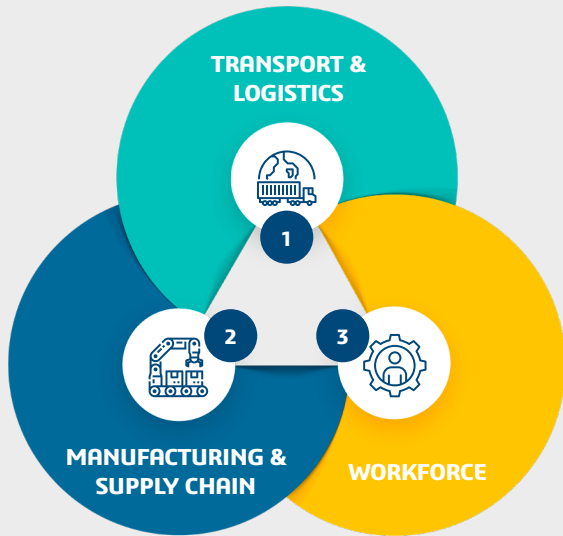
WHAT IF THERE ARE COMPETING COMPANY GOALS?

Traditional supply chain planning has considered typical constraints such as material and capacity, but sustainable business in the new normal means organizations must include operational goals with financial and corporate goals as part of the holistic plan.

There are many other tactical problems that should also be considered and each industry will have unique variations and distinctions. These add to the challenge of finding solutions that can be effectively applied to enable benefit and value.

CRITICAL CAPABILITIES

DELMIA offers robust supply chain solutions that can help organizations in different industries to address the challenges and problems to operate with greater agility, efficiency and operational excellence. DELMIA provides planning, scheduling and optimization for complex integrated business planning processes within supply chain, logistics and workforce operations across all planning horizons.



- 1 Optimize your logistics and transportation network; gain full control over the fleet, align transport with production plans and collaborate more closely with customers across the supply chain.
- 2 Model and optimize your supply chain network performance from inbound supply to manufacturing and distribution. Gain control, visibility and lasting resiliency across your value network.
- 3 Improve staff utilization and employee productivity by striking the right balance between operational efficiency, regulations, and employee and customer satisfaction.

The DELMIA supply chain solution delivers innovation and value with key differentiation:



END-TO-END SUPPLY CHAIN MODELING

DELMIA Planning & Optimization provides optimized planning for operations execution across your entire value network. Taking a holistic but modular approach, DELMIA enables intelligent supply chain planning and optimization for every stage of your supply chain journey and time horizon. Tactical supply chain issues can often be the root cause of missing major business goals: single supplier shortages leading to end product delays or key workforce disruptions delaying product distribution. It's important to model all aspects of the supply chain as the details matter.

Important challenges & trends addressed:

- ✓ Control tower visibility across extended networks
- ✓ Evaluating options for reconfiguration of the supply chain



BUSINESS-BASED OUTCOMES

Efficiency is more than throughput and can be quite complex. It's about being able to model and optimize the right mix in your operations and supply chain network to maximize efficiency based on different business metrics and ever-changing constraints. As business metrics, such as sustainability, become higher priorities, the integrated business planning process must include these as a part of supply chain planning.

Important challenges & trends addressed:

- ✓ Managing sustainability and customer fulfillment
- ✓ Balancing profitability and efficiency



WORLD-CLASS OPTIMIZATION AND ANALYTICS

Recognized as a leading company in optimization technology, DELMIA provides world record-breaking optimization to drive the best course of action in your operations on a continuous basis, which directly translates to increased efficiency, asset utilization and ROI. DELMIA offers a broad set of industry standard and proprietary optimization technologies and experience to optimize your world and provide the right level of automation.

Important challenges & trends addressed:

- ✓ Providing agility despite disruption
- ✓ Enabling autonomous decision-making

These capabilities are provided using a collaborative environment that allows all stakeholders to be included in the decision and analysis process to arrive at optimized consensus plans.



VALUE & BENEFIT

Leveraging these critical DELMIA capabilities provides significant benefits for organizations:

- Balance and optimize financial objectives with operational and sustainability goals
- Reduce planning cycle times with effective collaboration
- Decrease lost sales and better serve high-margin demand
- Improve capacity utilization and productivity across the supply chain
- Gain global supply chain control and visibility

Together, these benefits allow for new levels of agility and resilience to realize real-world value:

“ DELMIA Quintiq’s streamlined approach to scheduling gives us full visibility of our present situation, enabling us to better anticipate demand, lead time and potential bottlenecks. This allows us to be more resilient against unforeseen disruptions. Increased assurance of on-time, in-full (OTIF) deliveries also enables us to maintain the trust and satisfaction of our customers. ”

Dobra Gheorghe, General Director, Alro



“ Our ability to react has significantly improved through the implementation of this collaborative scheduling solution—our people can work much more effectively. ”

Gerd Refflinghaus, Manager Production, Aleris



“ The DELMIA solution supports us in managing our complex supply chain process requirements. It empowers us by delivering full transparency regarding essential KPIs as well as material flows and inventory data. Optimized weekly schedules at each facility and interaction of company planning and scheduling strengthen an in-depth information flow. Thus, it supports us to immediately handle improvements or deteriorations in delivery performance to focus on our customers’ requirements. ”

Tobias Neitzel, Head of Process Management SCM, Thyssenkrupp Steel Europe



CONNECTING SUPPLY CHAIN PLANNING TO OPERATIONAL SUCCESS

As previously mentioned, digital twins developed for product and operational design are already in use (as seen with the Dassault Systèmes Virtual Twin Experience in the link below). The planning and decision-making in the supply chain essentially follows the same practice of using virtual models to make better real-world decisions.

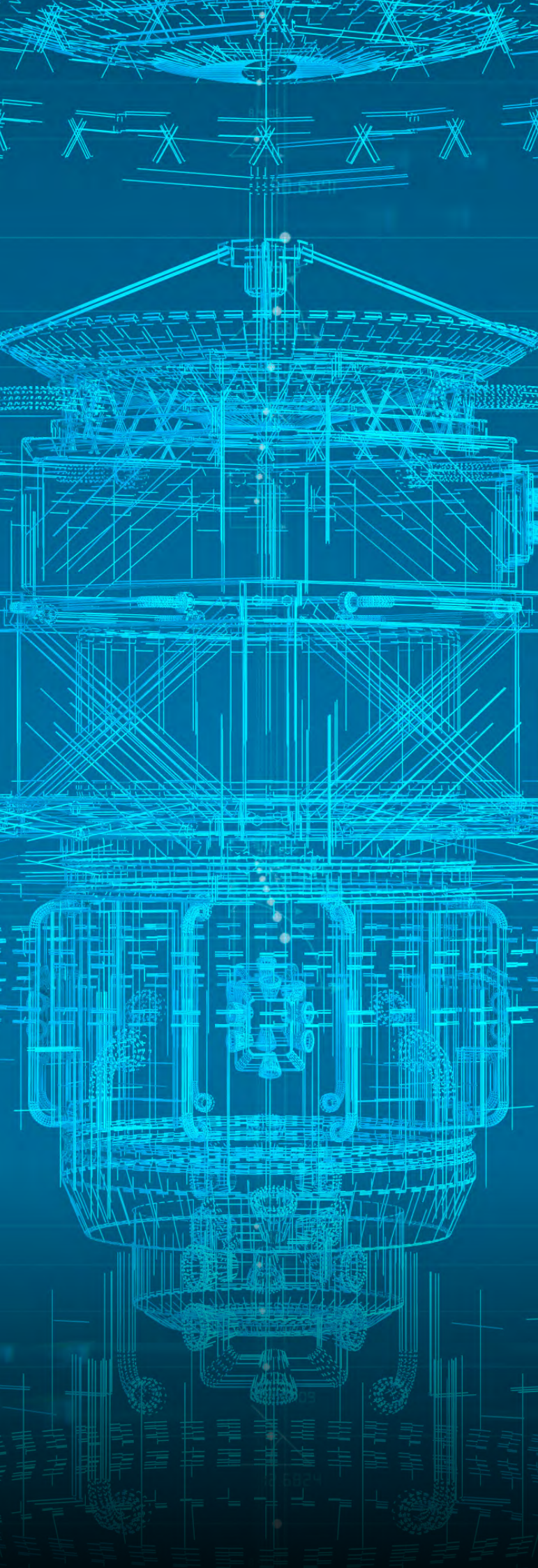
Not only are the two processes similar, but they are also actually entwined. New product designs drive new suppliers and manufacturing operations that need to be planned. Changes in the supply chain drive potential facility and resource planning. The peak of sustainable agility and resilience is achieved when both virtual twins are connected.

The 3DEXPERIENCE platform

Dassault Systèmes provides a broad scope of solutions that help companies innovate from product ideation through planning and manufacturing. Using the 3DEXPERIENCE platform, organizations can unify the critical parts of their business using digital tools and models. This platform is where supply chain and production virtual twins can work together to help organizations achieve their goals.

For more information on the Virtual Twin Experience for operational excellence, [read the eBook here](#).





CONCLUSION & NEXT STEPS

Imagine if you could...

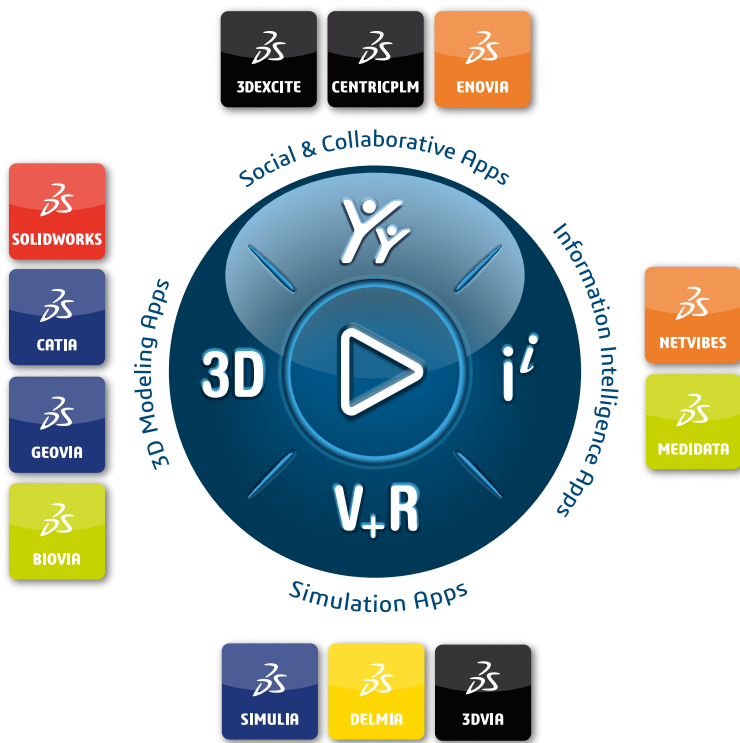
- ✓ **Have an accurate model of all the critical participants and constraints in your value network**
- ✓ **Evaluate unlimited long-term supply chain strategies to meet long-term goals**
- ✓ **Develop optimized consensus supply chain plans with all stakeholders seamlessly**
- ✓ **Replan and adjust supply chain operations rapidly to adapt to changing demand and supply**
- ✓ **Include product development and strategy as a part of the supply chain planning process**

The path to supply chain innovation and integrated business planning is available now for organizations that are seeking new answers and solutions to today's challenges and disruptions. With DELMIA, it is possible to start taking steps to building foundational process and infrastructure within critical areas of business, from high-level supply chain strategy to manufacturing, logistics and for workforce planning.

At DELMIA, we are proud to be helping organizations with their major supply chain initiatives:

- ✓ **Enabling sustainable business operations by optimizing critical resources, people and energy**
- ✓ **Building resilient supply chains by empowering companies to confidently plan for the future and react instantly to disruptions**
- ✓ **Achieving business-based outcomes by enabling integrated business planning that optimizes financial and corporate goals**

[Contact us](#) for more information.



Our 3DEXPERIENCE® 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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