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[see page 3]

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[see page 11]



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JANUARY / FEBRUARY 2025 | ISSUE 305

INDUSTRY INSIGHTS

- 03** Exploring the Future of Supply Chain in 2025
- 11** Enhancing Operational Visibility with MOM & MES Synergy

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ISSUE 305



EXPLORING THE FUTURE OF SUPPLY CHAIN IN 2025

Many of the changes that will impact supply chains in 2025 are not new, but the frequency and intensity have the potential to bring new levels of strain to already stretched supply chains. So, what can companies do to prepare for 2025 and beyond?

We've been discussing supply chain issues here at the Gateway since we began writing industry features years ago (with heightened coverage during the pandemic). Thus, we're excited to present this take provided by Adrian Wood, Director of Strategic Business Development at DELMIA.



What is the future of supply chain in 2025?

According to Darwin's Theory of Evolution, adaption happens over millions of years. Today, it seems like business is being forced to adapt on a scale of minutes vs. millennia. So, from a supply chain perspective, what can we expect from 2025 in terms of potential changes—both good and bad?

There are many areas where companies are already thinking about potential impacts and strategies:

Global Economic Relations (Particularly US-China)

The relationship between the United States and China will continue to be a critical factor shaping global supply chains in 2025. With the 2024 US presidential election now decided, we may see a continuation or even escalation of trade tensions between the two economic superpowers which could lead to further tariffs and trade restrictions and potential decoupling of supply chains.

But restrictions in one geosphere could also lead to opportunities in others, potentially creating opportunities for countries like India, Vietnam, Mexico, and Poland to emerge as alternative manufacturing hubs.

Regional Trade Agreements and Protectionism

Global supply chains are also likely to be impacted by “protectionist” measures and new trade agreements such as the EU's Carbon Border Adjustment Mechanism and national efforts to curb inflation. These efforts tend to form “gated globalization” which will limit the flexibility of supply chains within smaller geographic areas of “friendly” trade partners.

Unfortunately, we also cannot forget also about ongoing global disruption from tensions and conflicts in key areas of the globe. These geopolitical hotspots may necessitate the diversification of trade routes and the development of more resilient supply chain networks.

Material Impacts

Many supply chains are dependent upon resources that continue to be critically constrained. For example, increasing demand for lithium and other materials crucial for electric vehicle batteries. Industries, such

as semiconductor, also rely upon rare earth elements as well as increasing cost and effort to build critical manufacturing capacity.

On a positive note, these same challenges are also driving new innovation in material science and recycling technologies, as well as investments in new extraction and processing facilities.

Climate Impact and Sustainability Pressures

Environmental concerns will continue to shape supply chain strategies due to the natural and human impact. This year's weather patterns have already caused significant disruption, and companies are making an assumption that next year will probably be similar.



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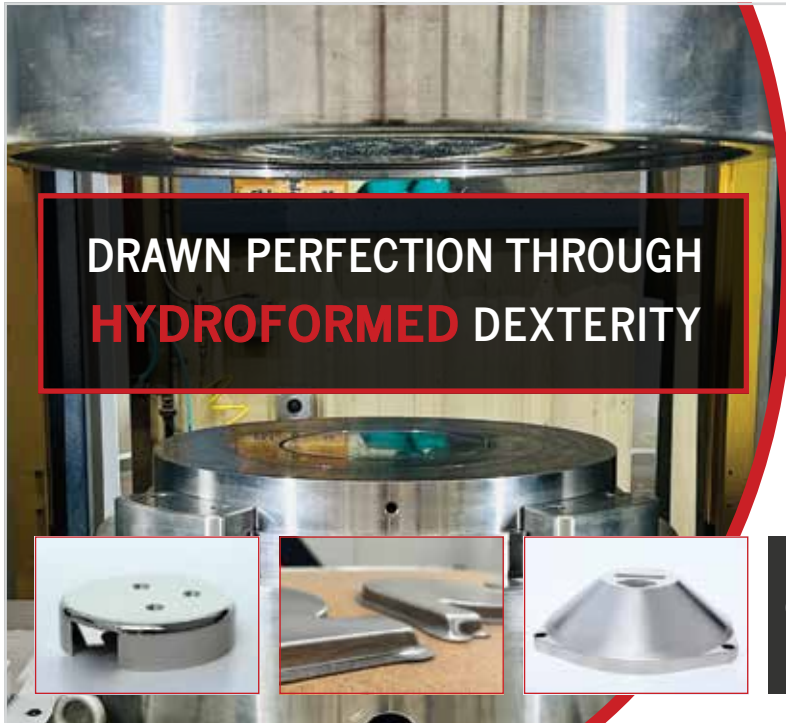
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Additionally, consumers and investors are applying growing pressure for sustainable and low-carbon supply chains which may lead to new regulations and reporting requirements related to environmental impact.

Again, there is an opportunity for positive reactions to these challenges, including driving new investments in green technologies and more localized production.

Preparing for the Future

Many of the changes that will impact supply chains in 2025 are not new, but the frequency and intensity have the potential to bring new levels of strain to already stretched supply chains. So, what can companies do to prepare for 2025 and beyond?

Leveraging Technology for Adaptation

Just as the physical and natural world are changing around us, so is technology. This brings its own set of advantages and cautions, but it is certainly one area that companies are turning to in order to develop supply chain agility, resilience, and even some “crystal ball” capabilities. Let’s explore:

Supply chain planning software is certainly not new, but it has evolved quite significantly over the last decade, with the latest evolutions gaining critical capabilities that companies are going to leverage in the near future:

- **Scientific Accuracy:** Accuracy in supply chain planning is critical because it ensures decisions are based on precise data analytics, reducing the risk of errors and inefficiencies. High accuracy allows companies to forecast demand accurately, optimize inventory levels, and minimize disruptions, ultimately enhancing operational efficiency and competitiveness.
- **Enterprise-Wide Collaboration:** Collaboration across the product lifecycle, including supply chain, manufacturing, and engineering, is critical for supply chain efficiency because it ensures seamless integration and alignment of processes, which minimizes disruptions and reduces time-to-market. By fostering cross-functional communication, companies can swiftly address potential issues, optimize resource allocation, and maintain a competitive edge in rapidly changing markets.
- **AI:** AI and machine learning (ML) will become increasingly crucial to supply chain planning and optimization because their ability to process vast amounts of data and provide real-time insights, allowing companies to respond swiftly to market changes and unforeseen disruptions. Additionally, these technologies enhance predictive analytics capabilities, enabling more accurate demand forecasting and inventory management, which are essential for maintaining supply chain resilience and efficiency.





This last bullet has become an extremely hot topic in industry – perhaps because we see such innovation and impact from AI on our personal lives? The average person may know little about ERP or procurement systems, but almost everyone now has access to a digital assistant, speaks with a chatbot, or relies upon Google or Apple maps to recommend their route and departure time.



AI optimization has been a cornerstone of supply chain, inventory and logistics planning for many years. With increases in computing power and the ability to connect planning systems to real-time data sources, companies now have an unprecedented ability to react to disruptions and evaluate multiple possible business trajectories using precision virtual twin models of their supply chain.

And, just as we are automating many personal tasks and trusting the map application to not guide us into gridlock, companies are facing the same possibilities in the office. But do we trust the AI with the same level

of confidence and are companies willing to automate complex tasks that previously required significant human oversight? I think this will be something that we will learn a lot more about in 2025!

The Bottom-Line for 2025

Certainly, the geopolitical landscape of 2025, climate, constrained resources (material and people) will likely all continue to present complex challenges for global supply chains next year. However, these challenges also create opportunities for innovation, diversification, and the development of more resilient and sustainable supply chain models, with virtual twin at the heart of this development.

We will continue to learn and train staff and skilled workers to help, but it is clear that companies are going to have to continue to invest in evolving technology to effectively navigate this landscape. Technology advancements are accelerating in attempt to keep pace, but that in itself brings potential challenges like having the trust and security to adopt and allow new technology (especially generative-AI) to guide business decisions in the right direction.

I believe that companies leveraging new technologies and adapting to changing geopolitical realities, will be best positioned to succeed in the evolving global economy. However, it's important for companies to work in partnership with technology vendors that have the right experience and knowledge, in order to ensure the best route towards digital transformation.

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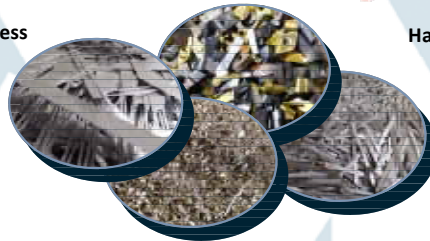
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ENHANCING OPERATIONAL VISIBILITY WITH MOM & MES SYNERGY

The integration of MOM and MES offers a transformative potential for manufacturing operations. By integrating these systems, companies can achieve enhanced operational visibility, improved efficiency, and better decision-making capabilities.

In today's fast-paced manufacturing environment, achieving operational visibility is crucial for maintaining competitive advantage. The integration of Manufacturing Operations Management (MOM) and Manufacturing Execution Systems (MES) offers a powerful synergy. It enhances operational visibility, drives efficiency, and supports informed decision-making. This article explores the state-of-the-art developments in MOM and MES, examining how their synergy can transform manufacturing operations.

Understanding MOM and MES

MOM encompasses a broad range of activities that support production, including quality management, logistics, materials management, time and labor, and maintenance.

MOM solutions provide a comprehensive approach to managing all aspects of manufacturing operations across an enterprise. This enables companies to optimize processes, ensure compliance, and improve overall efficiency. Manufacturing Execution Systems

(MES), on the other hand, are focused on the shop-floor level. MES directs the activities of labor resources and materials, collects real-time production data, and provides the necessary information to guide operators in their tasks. MES plays a critical role in monitoring, managing, and optimizing day-to-day processes within a facility, providing visibility and control over shop floor execution.

Why MES is Integral to MOM

While MOM and MES can operate independently, its true potential exists when operating as part of a broader MOM framework.

This integration offers several key benefits:

1. *Enhanced Real-Time Data Collection and Analysis:* MES systems provide real-time data collection and analysis, which is crucial for making informed decisions quickly. When integrated with MOM, this data can be leveraged across the entire organization. It allows you to optimize production planning, resource allocation, and process improvements. MES collects data on production status, machine performance, and operator activities. This information is fed into the broader MOM system which then uses it to coordinate enterprise-wide activities.

2. *Standardization and Consistency:* MES helps standardize production processes within a facility, ensuring consistency and efficiency. MOM extends this standardization across multiple facilities, enabling global enterprises to implement best practices and maintain consistent operations. The ISA95 standard, for instance, maps MES capabilities to the production dimension, emphasizing its role in achieving consistent operational practices.
3. *Improved Quality Control:* MES provides real-time monitoring and automated alerts to maintain product quality. MOM enhances this by integrating quality control into the overall manufacturing process, reducing defect rates, and ensuring compliance with industry standards. MES captures detailed genealogy and traceability data, which MOM systems utilize to ensure compliance and quality across the enterprise.
4. *Optimized Resource Utilization:* By integrating MES with MOM, companies can gain a comprehensive view of all operations, allowing for optimal resource utilization. This reduces costs and improves energy efficiency, leading to significant savings. MES systems optimize day-to-day resource use, while MOM leverages this data to optimize broader logistics and supply chain activities.
5. *Scalability and Flexibility:* MOM systems are designed to be scalable, allowing companies to replicate successful processes across multiple plants. This scalability is enhanced by MES. It provides the detailed, real-time data needed to support continuous improvement and agile responses to changing market demands. MOM solutions, such as DELMIA's Apriso, extend MES capabilities across global operations, providing a unified platform for managing complex manufacturing networks.

6. *MES as a Subset of MOM:* It's important to recognize that MES is essentially a subset of MOM. MES focuses on the production aspect, dealing with the granular, day-to-day execution on the shop floor. In contrast, MOM covers a broader spectrum, including not only production but also quality management, logistics, maintenance, and labor management. This hierarchical relationship allows MOM to utilize the detailed data from MES to enhance overall operational strategies. For example, while MES handles real-time production tracking and machine integration, MOM uses this data to manage and optimize the entire production lifecycle, from raw material procurement to final product delivery.

State-of-the-Art Developments in MOM and MES

Recent advancements in MOM and MES technologies have further enhanced their capabilities and integration potential. These developments include:

- *Industrial Internet of Things (IIoT) Integration:* IIoT technologies enable the collection of vast amounts of data from connected devices and machines. This data can be integrated into MOM and MES systems to provide deeper insights, predictive maintenance capabilities, and enhanced process optimization.
- *Cloud-Based Solutions:* The shift towards cloud-based MOM and MES solutions offers greater flexibility, scalability, and cost-effectiveness. Cloud platforms facilitate easier integration with other enterprise systems, support remote access, and provide robust data security.
- *Advanced Analytics and AI:* The use of advanced analytics and artificial intelligence (AI) in MOM and MES systems allows for more sophisticated data analysis, predictive modeling, and automated decision-making. These capabilities help manufacturers identify trends, optimize processes, and reduce downtime.



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- **Composable MES Architectures:** As highlighted in Gartner's research, the trend towards composable MES architectures allows manufacturers to tailor their systems to specific needs and integrate various functionalities more seamlessly. This flexibility supports a more agile and responsive manufacturing environment.

Overcoming Implementation Challenges

Despite the clear benefits, integrating MOM and MES can present challenges. Common obstacles include resistance to change, integration with existing systems, and data security concerns. Addressing these challenges requires a strategic approach:

- **Stakeholder Engagement and Change Management:** Engaging stakeholders early in the planning process and clearly communicating the benefits of MOM and MES integration can help overcome resistance to change. Implementing structured change management programs is also essential for a smooth transition.
- **Compatibility Assessments and Gradual Integration:** Conducting thorough evaluations of current systems and opting for a phased rollout can minimize disruptions and ensure a smoother integration process.

- **Robust Security Protocols and Regular Audits:** Implementing advanced security measures and conducting regular audits can address data security concerns and ensure compliance with industry regulations.

The integration of MOM and MES offers a transformative potential for manufacturing operations. By integrating these systems, companies can achieve enhanced operational visibility, improved efficiency, and better decision-making capabilities. The state-of-the-art developments in MOM and MES technologies further support this integration. It provides manufacturers with the tools they need to stay competitive in a rapidly evolving industry.

Investing in the integration of MOM and MES is a strategic move that can yield significant long-term benefits. These range from cost savings and improved quality control to greater scalability and flexibility. As manufacturers continue to embrace digital transformation, the synergy between MOM and MES will play a crucial role in driving operational excellence and achieving sustainable growth.

This article was written by Louis Columbus, senior industry marketing manager at DELMIA. If you'd like to share your company's story or have a unique take on industry trends and topics, please submit your article to chris@thegatewaymag.com with "Gateway article submission" as the subject line.

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Vermont Tech Hub Awarded Nearly \$24M For Semiconductor Innovation

Federal investment will make Green Mountain State a national leader in microchip technology and workforce development

The Vermont Gallium Nitride (V-GaN) Tech Hub—a consortium led by the University of Vermont (UVM) and including GlobalFoundries and the State of Vermont—has been awarded \$23.7M in federal funding. The investment from the U.S. Economic Development Administration is the largest research award in UVM history.

The Vermont Tech Hub will create a comprehensive technology ecosystem in the Green Mountain State and New England to drive semiconductor design and

manufacturing of high-power and high-frequency gallium nitride (GaN) semiconductors. Pairing GlobalFoundries' semiconductor leadership with UVM's world-class researchers, the Tech Hub will fuel business growth and workforce development to enhance the region's and state's economic and social vitality—bringing new cutting-edge facilities and computing technology to Vermont.

The Tech Hub will train over 500 new employees in the semiconductor workspace and engage over 6,000 K-12 students across Vermont in STEM participation in the next five years.



Learn more and connect with the V-GaN Tech Hub at vgan.tech.

UNH Experts Forecast Key Industry Trends for the New Year

Insights on agriculture, manufacturing, space, climate change and the economy

Biomanufacturing will see more growth over the next several decades as technological advancements continue. New opportunities within the health care system will be created, e.g., tissue engineering, enabling researchers to take human cells and grow human organs, benefiting patients in need of organ transplants.

Additionally, in-space manufacturing will continue to advance in the coming years. The International Space Station has already facilitated manufacturing initiatives, and future developments will address how components

can be produced in space, considering the differing environmental factors and the effects on the component's durability. The issue of sustainability of space manufacturing will also be a key focus point as it continues, e.g., addressing space debris.

Finally, artificial intelligence will create more opportunities in data and analytics across manufacturing. By collecting data from manufacturing processes, AI will analyze and detect trends to help identify any potential defects or issues that can be created in typical production. This ability to refine processes through collected data will help improve accuracy and efficiency as manufacturing progresses into the future.

Brad Kinsey, Associate Dean For Research, College of Engineering and Physical Sciences

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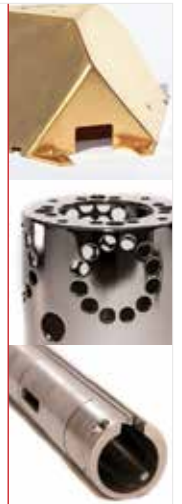
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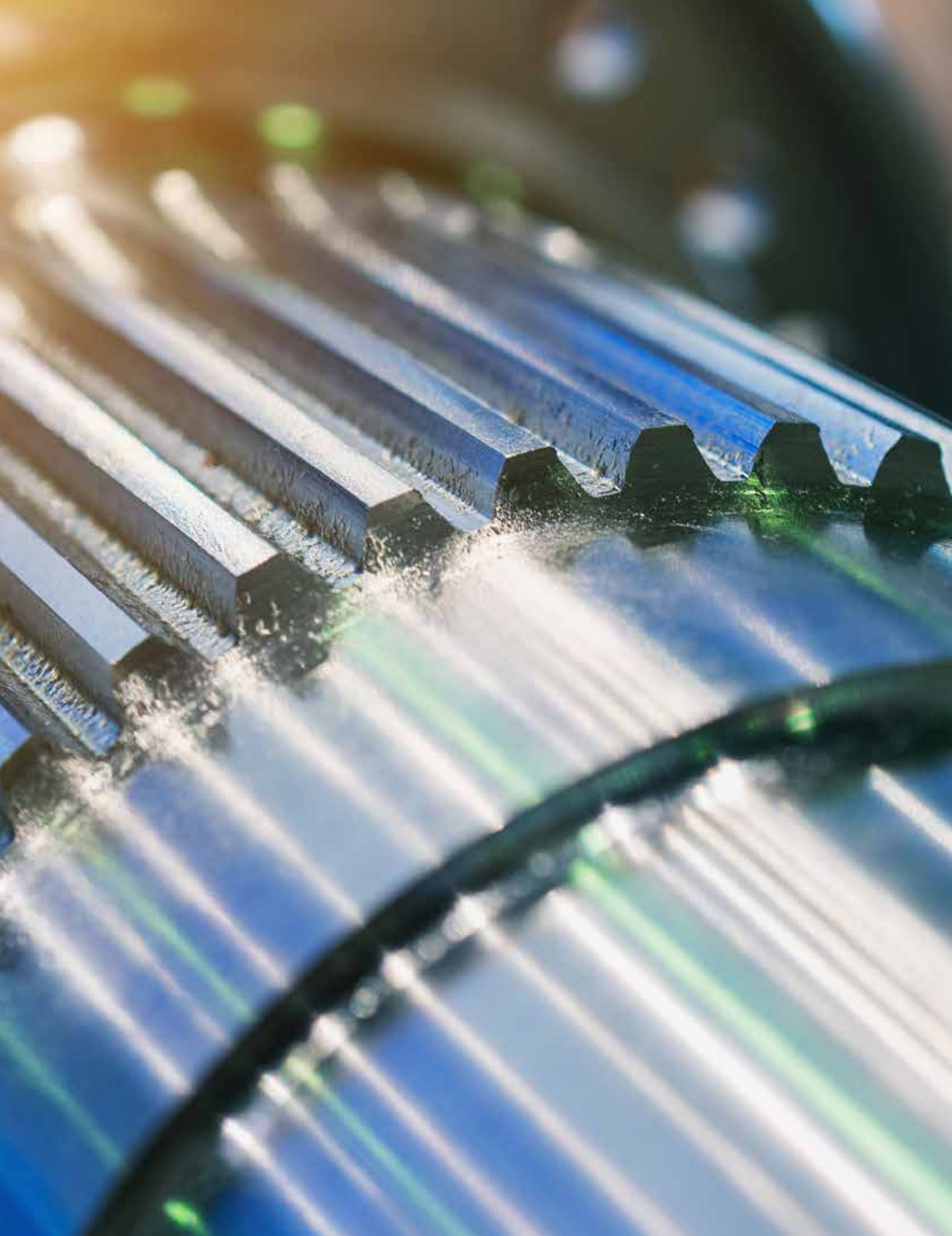
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EXPLORING THE FUTURE OF SUPPLY CHAIN IN 2025

Many of the changes that will impact supply chains in 2025 are not new, but the frequency and intensity have the potential to bring new levels of strain to already stretched supply chains. So, what can companies do to prepare for 2025 and beyond?

We've been discussing supply chain issues here at the Gateway since we began writing industry features years ago (with heightened coverage during the pandemic). Thus, we're excited to present this take provided by Adrian Wood, Director of Strategic Business Development at DELMIA.



What is the future of supply chain in 2025?

According to Darwin's Theory of Evolution, adaption happens over millions of years. Today, it seems like business is being forced to adapt on a scale of minutes vs. millennia. So, from a supply chain perspective, what can we expect from 2025 in terms of potential changes—both good and bad?

There are many areas where companies are already thinking about potential impacts and strategies:

Global Economic Relations (Particularly US-China)

The relationship between the United States and China will continue to be a critical factor shaping global supply chains in 2025. With the 2024 US presidential election now decided, we may see a continuation or even escalation of trade tensions between the two economic superpowers which could lead to further tariffs and trade restrictions and potential decoupling of supply chains.

But restrictions in one geosphere could also lead to opportunities in others, potentially creating opportunities for countries like India, Vietnam, Mexico, and Poland to emerge as alternative manufacturing hubs.

Regional Trade Agreements and Protectionism

Global supply chains are also likely to be impacted by “protectionist” measures and new trade agreements such as the EU's Carbon Border Adjustment Mechanism and national efforts to curb inflation. These efforts tend to form “gated globalization” which will limit the flexibility of supply chains within smaller geographic areas of “friendly” trade partners.

Unfortunately, we also cannot forget also about ongoing global disruption from tensions and conflicts in key areas of the globe. These geopolitical hotspots may necessitate the diversification of trade routes and the development of more resilient supply chain networks.

Material Impacts

Many supply chains are dependent upon resources that continue to be critically constrained. For example, increasing demand for lithium and other materials crucial for electric vehicle batteries. Industries, such as semiconductor, also rely upon rare earth elements as well as increasing cost and effort to build critical

manufacturing capacity.

On a positive note, these same challenges are also driving new innovation in material science and recycling technologies, as well as investments in new extraction and processing facilities.

Climate Impact and Sustainability Pressures

Environmental concerns will continue to shape supply chain strategies due to the natural and human impact. This year's weather patterns have already caused significant disruption, and companies are making an assumption that next year will probably be similar. Additionally, consumers and investors are applying growing pressure for sustainable and low-carbon supply chains which may lead to new regulations and reporting requirements related to environmental impact.

Again, there is an opportunity for positive reactions to these challenges, including driving new investments in green technologies and more localized production.

Preparing for the Future

Many of the changes that will impact supply chains in 2025 are not new, but the frequency and intensity have the potential to bring new levels of strain to already stretched supply chains. So, what can companies do to prepare for 2025 and beyond?

Leveraging Technology for Adaptation

Just as the physical and natural world are changing around us, so is technology. This brings its own set of advantages and cautions, but it is certainly one area that companies are turning to in order to develop supply chain agility, resilience, and even some “crystal ball” capabilities. Let's explore:

Supply chain planning software is certainly not new, but it has evolved quite significantly over the last decade, with the latest evolutions gaining critical capabilities that companies are going to leverage in the near future:

- **Scientific Accuracy:** Accuracy in supply chain planning is critical because it ensures decisions are based on precise data analytics, reducing the risk of errors and inefficiencies. High accuracy allows companies to forecast demand accurately, optimize inventory levels, and minimize disruptions, ultimately enhancing operational efficiency and competitiveness.



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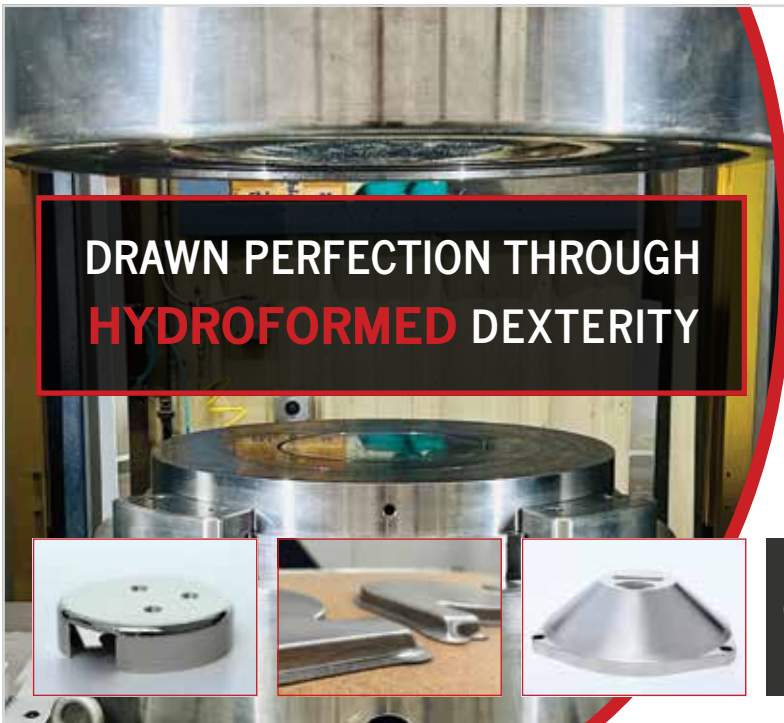


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- **Enterprise-Wide Collaboration:** Collaboration across the product lifecycle, including supply chain, manufacturing, and engineering, is critical for supply chain efficiency because it ensures seamless integration and alignment of processes, which minimizes disruptions and reduces time-to-market. By fostering cross-functional communication, companies can swiftly address potential issues, optimize resource allocation, and maintain a competitive edge in rapidly changing markets.
- **AI:** AI and machine learning (ML) will become increasingly crucial to supply chain planning and optimization because their ability to process vast amounts of data and provide real-time insights, allowing companies to respond swiftly to market changes and unforeseen disruptions. Additionally, these technologies enhance predictive analytics capabilities, enabling more accurate demand forecasting and inventory management, which are essential for maintaining supply chain resilience and efficiency.

This last bullet has become an extremely hot topic in industry – perhaps because we see such innovation and impact from AI on our personal lives? The average person may know little about ERP or procurement systems, but almost everyone now has access to a digital assistant, speaks with a chatbot, or relies upon Google or Apple maps to recommend their route and departure time.

AI optimization has been a cornerstone of supply chain, inventory and logistics planning for many years. With increases in computing power and the ability to connect planning systems to real-time data sources, companies now have an unprecedented ability to react to disruptions and evaluate multiple possible business trajectories using precision virtual twin models of their supply chain.

And, just as we are automating many personal tasks and trusting the map application to not guide us into gridlock, companies are facing the same possibilities in the office. But do we trust the AI with the same level of confidence and are companies willing to automate complex tasks that previously required significant human oversight? I think this will be something that we will learn a lot more about in 2025!

The Bottom-Line for 2025

Certainly, the geopolitical landscape of 2025, climate, constrained resources (material and people) will likely all continue to present complex challenges for global supply chains next year. However, these challenges also create opportunities for innovation, diversification, and the development of more resilient and sustainable supply chain models, with virtual twin at the heart of this development.

We will continue to learn and train staff and skilled workers to help, but it is clear that companies are going to have to continue to invest in evolving technology to effectively navigate this landscape. Technology advancements are accelerating in attempt to keep pace, but that in itself brings potential challenges like having the trust and security to adopt and allow new technology (especially generative-AI) to guide business decisions in the right direction.

I believe that companies leveraging new technologies and adapting to changing geopolitical realities, will be best positioned to succeed in the evolving global economy. However, it's important for companies to work in partnership with technology vendors that have the right experience and knowledge, in order to ensure the best route towards digital transformation.

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