



EXECUTIVE BRIEF

Top supply chain challenges of chemical manufacturers

To maintain a competitive edge in the chemical industry, manufacturers need to sustain a high level of operational productivity. Challenges like rapid commoditization, complex supply chains, aging assets, and increased need for dynamic operations planning—not to mention the ongoing pandemic—make it more difficult for manufacturers to achieve a level of productivity that drives differentiation and innovation. Manufacturers can become locked into patterns where they're implementing shortsighted cost-cutting measures that adversely affect operational productivity and decrease overall market responsiveness.

To ensure chemical manufacturers don't fall into these traps, they need to understand the industrial challenges they face and recognize the **top trends that are reshaping manufacturing**. Gaining this knowledge is the first step toward building a foundation of digital transformation—followed by additional steps that are designed to solve current problems, start showing value immediately, and help evolve a stronger business strategy.

And by doing this while embracing the latest technologies, including secure cloud-based solutions, predictive asset management, and artificial intelligence (AI)/machine-learning-based analytics, manufacturers can better position themselves for optimizing the demand-supply-inventory-operations process.

Understanding supply chain complexities

Chemical manufacturing differs from discrete manufacturing in that chemical manufacturing can run as continuous and batch productions; various streams and chemical processes can merge, demerge, produce intermediate (bulk) material or finished goods, and be made-to-stock (MTS) or made-to-order (MTO) on different asset combinations with different starting points. This makes planning, costing, formulation, and quality management complicated, as it all must be managed while working under the constant pressure of minimizing asset downtime and maximizing asset utilization.

On top of that, chemical companies often struggle to understand the full reach of their products because their products and molecules often represent only an intermediary step toward the final product (which is typically produced downstream). In addition, due to the nature of the materials they work with and produce, chemical manufacturers are under constant regulatory scrutiny, while dealing with unique supply chain demands.

Such complications can result in poor productivity, which often go undetected because the workforce is often just trying to keep things working with outdated, generic, or poorly integrated software solutions. Our fast-paced technology landscape has changed the way business is done. In fact, Accenture states in a 2019 report: **“As a result of all the technological disruption, the typical sequence of activities from sensing customer demand to fulfilling an order will soon look very different from today.”** The very nature of many chemical industry challenges has changed—and will continue to evolve.

Supply-demand predictability

The supply chain can be mercurial. Disruptions anywhere in the supply ecosystem regularly cause ripple effects up and down the value chain.

For instance, the rapid commoditization of the chemical industry means that customers often have numerous sources from which they can procure the materials they need. If you don't have what they need, in the right quantity, at the price, when they want it, they can go to one of your competitors.

Today's customers have also come to expect specialized products. Accenture states, “We're entering an age where mass production is giving way to mass customization—delivered with omni-channel ease and ever faster lifecycles.” Trying to meet these expectations and increase in demand might seem feasible; but trying to do this for every customer that requests it quickly becomes a huge challenge for the overall supply chain—and especially the manufacturers themselves.

And because chemical manufacturers (and their customers) are often so high up in the value chain, they can be victims of the **“bullwhip effect”**—*small* changes that happen at the “grip-handle” (end-market) translate into major changes by the time they reach the “tip of the tail” (producer).

All of this takes place amid overarching global economic cycles that are tied to one another. In such a dynamic environment, it can be difficult to provide accurate forecasts. Many chemicals customers operate using blanket orders; but even confirmed purchase orders are frequently moved around, making it problematic for manufacturers to satisfy the most profitable demands at the ideal times.

To understand true demand, manufacturers should employ powerful supply chain planning tools that analyze leads for products, category, business, and sales. These tools use logic and statistical methods, such as **Bayesian analytics**, to leverage multiple forecasting methodologies to combine historical data, market indicators, competitive intelligence, and internal sales forecasts to run simulations and project concrete demand forecast. Collaboration tools embedded within these solutions allow various stakeholders—demand planners, product managers, sales and account managers, internal and external customers, etc.—to contribute to the forecasts, making internal decisions easier. To help ensure the reliability of the information, stakeholders' forecasting accuracy should be implemented as a manufacturing KPI.

Supplier seasonality and promotions

Not everything about supply and demand is unpredictable—materials in the supply chain in different parts of the world follow their own, predictable seasonal patterns. For instance, cotton prices from India (the largest producer of cotton in the world, according to **Statista**) plunge when the harvesting begins in November, and stay low through when harvesting ends in March of the following year. This, obviously, has a significant impact on the fiber-garment industry.

Another example is oil and gas production—where production slowdowns in the Gulf of Mexico are anticipated during hurricane season. The *extent* to which weather actually impacts production, however, is not predictable. In fact, gulf production took a massive hit in 2005, when the oil and gas industry lost over 100 million barrels of oil and more than 500 billion cubic feet of natural gas production due to a total of 12 hurricanes (including Katrina and Rita)—according to the **US Energy Information Administration (EIA)**. More recently in 2017, **Hurricane Harvey and Hurricane Nate led to a loss of 12 million barrels of oil and 18 billion cubic feet of natural gas production.**

Supply variations have a bearing on availability, quantity, cost, and lead times of raw material across the chemical supply chain—making the job of the procurement team extremely arduous. This can be further exacerbated when various players in the supply chain employ last-minute promotions and discounts that can have industry-wide impact on cost, availability, and inventories. But procurement doesn't have to be a guessing game. There are ways manufacturers can implement levels of flexibility in formulations that afford them more options with production. For instance, a product lifecycle management solution that integrates with a manufacturer's ERP system can help procurement and sourcing professionals find true bills of materials of existing and alternative formulas to correctly forecast the need of each material required (whether primary or substitute) and avail the opportunity to buy cheaper materials in the spot market.

Operations and assets

Lacking accurate demand forecasts, and having to deal with the variability of supply-side changes, planners often have a difficult time determining quantities and whether to utilize MTO or MTS production. This impacts which equipment assets and asset-combinations are needed for production, how long the assets will be needed, and if the assets will be needed to manufacture multiple SKUs. A manufacturer often has flexible assets that can be used in combination to produce different intermediate or finished goods (which in turn might require packaging or need to be temporarily stored for use in another process). These assets also likely have their own constraints, such as needing specialized employee crews, limited filling lines, low flow rates, and so on. This makes planning and scheduling very complex processes.

A modern supply chain planning (SCP) tool can help address these challenges. For instance, it can plan and manage constraints for new products to be applied during the critical launch phase. The right SCP tool can also assist with asset scheduling by considering multiple bottlenecks, including tanks, availability of specialized employee crews, compliance, filling lines, and flow rates. These tools can also be used for finite capacity planning and scheduling that adheres to all relevant constraints across operations (such as production and distribution capacity, distributor and supplier lead times, and batch sizes) to help optimize asset utilization. Sophisticated SCP tools are also capable of connecting multiple production schedules built by different schedulers, and optimizing the separate schedules to achieve maximum efficiency of the entire plant.

Advanced supply chain technology tools can help:

- Run advanced, what-if scenarios with budget and financial reconciliation.
- Use scenario analysis to inform decisions and allow trade-offs as new products are launched.
- Use a collaborative, social platform to help implement significant changes in forecast and orders to be automatically escalated for review and approval.
- Set up, enable, or manage a state-of-the-art sales, inventory, and operation planning (SI&OP) process with clear, common KPIs—and with end-to-end workflow and alerts.
- Detect seasonality and growth trends for accurate predictions using machine learning capabilities.

Modern SCP tools also allow planners to use customizable workflow menus that make configurable spreadsheet-style grids for simulating, editing, filtering items, and highlighting exceptions (like low-stock, short coverage time, expiring stock, etc.). These tools allow planners to edit the material requirements planning forecast, as well as adjust and release manufacturing proposals into manufacturing orders.

Taking this a step further, if a modern SCP solution is augmented by a predictive, enterprise asset management (EAM) system, the confidence level in asset uptime could increase significantly. This allows the operations team to schedule maintenance that minimizes disruption to production—which, in turn, allows planners to build optimized plans.

Deploying such an EAM system offers additional benefits as well, such as helping to reduce indirect material inventory. An EAM system could help enact detailed maintenance plans and develop lists of replacement part requirements for each asset. The replacement parts can be filtered and sorted based on the cost, emergency, lead-times, and distance from the asset, and be designated as stored at a central location or the individual plant level.

Working capital and inventory

Even the best plans enact a price when placed into motion. The cost to serve customers can be the difference between profit and loss for specific regions or products or the company as a whole. To keep costs as low as possible while delighting the customer, it's pivotal for manufacturers to keep the right amount of material at the right place at the right time—whether it's raw material or finished goods.

A modern, integrated inventory optimization system can help balance service level availability versus cost by location. In addition to being able to calculate a balanced inventory plan across the entire supply chain, the system should also be able to optimize labor-need by dynamically adapting to constant change. And with segmentation and scenario analysis, a time-phased safety stock strategy can be enacted—with service, profit, and risk profiles—which can help manufacturers be better prepared for shifting customer requirements. Such a system should even be able to provide a real-time, 3D visualization of inventory per location.

Combining this with the right ERP system could provide an accurate view of goods inventory and accurate costing and invoicing. Ideally, the ERP system should be built specifically for chemical manufacturing, with support for back-flushing, catch-weight, by-product and co-product credits, etc.

Today's challenges will be next year's opportunities

Addressing these challenges doesn't just improve current operational productivity; it also positions manufacturers to pursue future opportunities by opening up capacity, unleashing people's productive time, and increasing working capital. Turning these challenges into opportunities requires a digital transformation of supply, operations, inventory, transportation, and the commercial side of the business.

A cutting-edge solution with the capabilities to address these challenges should be able to calculate a balanced plan for the entire supply chain—from purchasing, inventory, and

production, to sales and transportation, and customer's demand. The solution should have a constraint-based optimization engine that supports optimal use of resources to minimize overall supply chain costs. It should be an integrated business planning tool that brings the entire sales, inventory, and operations planning process together. According to [McKinsey](#), companies that invest in technology enablement for “making and delivering” products, can see as much as a 6% margin expansion.

Digital transformation allows executive management teams to get insightful reports to measure performance results against plans—such as budget versus actual; last year by quantity; revenue; cost; margins; and other KPIs for sales, procurement, and inventory. It also enables executives to track how budgets and revised plans measure against performance, as well as create and amend plans to simulate how plans can be achieved.

Achieving IT excellence

Modern software solutions can give chemical manufacturers the power to evolve their business processes—to achieve greater operational productivity, be more innovative, and increase profitability. Chemical manufacturers considering new investments in IT resources should evaluate if their current business software systems are meeting industry best practices and—most importantly—whether their IT tools are helping them be as productive as possible.

By evaluating the current IT infrastructure and considering future needs, chemical manufacturers can find new opportunities to create operational efficiencies, while also preparing their organizations to remain competitive in a fast-changing business environment. For forward-thinking chemical manufacturers, today's biggest challenge will be next year's opportunity.

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