Chemical industry: Navigating US supply chain disruptions

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As recently as 2008, the North American energy and petrochemical industries were considered mature, and many observers assumed the United States (US) would be a net oil and gas importer for years to come. But since then, the US has become awash with inexpensive gas and petrochemical feedstocks, a result of the shale-drilling revolution.

This shift has made petrochemical-related capital investment in the US an attractive proposition for both domestic and foreign investors. In plastics derivatives alone, polyethylene (PE) capacity is expected to increase 33 percent between 2015 and 2018, primarily in the US Gulf Coast (USGC) region (Figure 1)—and this only includes the expansion that is currently underway. However, it is unlikely that the US domestic market will be able to absorb most of this capacity increase.

US producers will thus have to look abroad for customers, which comes with its own difficulties because development and upgrades to the relevant infrastructure in the US have lagged behind the growth of the manufacturing base. As a result, constrained capacity is likely to create transportation bottlenecks—and many US producers’ supply chains are not nimble or dynamic enough to deal with those bottlenecks, which will affect their ability to move product to overseas customers.

The need for change is becoming increasingly urgent, with more chemical plants expected to come online in the next few years. Companies will need to redesign their supply chains to accommodate the resulting growth in global trade. The winning companies will be those that increase the flexibility, speed and effectiveness of their supply chains to satisfy their customers abroad. Chemical companies that do not do so will find it difficult to capture the returns they expect from their North American capital investments, as their revenues and operating costs both come under pressure.

To improve their supply chains, chemical companies should keep three key strategies in mind:

- Developing integrated global operating models
- Enhancing logistics capabilities
- Employing digitally-enabled supply chain management

84% of new bulk resin capacity will be located in the US Gulf Coast.
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Developing integrated global operating models

Accenture projects that the US could improve its international net trade position in major petrochemicals and plastics by up to 18 million metric tons by 2020—an upsurge that started in 2016—and much of this volume will be exported. Methane-based chemicals, such as methanol, ammonia and urea, are expected to make major gains, narrowing or eliminating historical trade deficits. Ethane-based chemicals, such as ethylene glycol (EG) and PE, will also see significant increases in net trade.

Figure 2 shows the expected change in the US net trade balance (exports less imports) for select major chemicals. By 2020, exports of PE are expected to increase by at least 4.6 million metric tons—the equivalent of more than 255,000 twenty-foot equivalent unit (TEU)\(^4\) containers, or about 51 full container ships per year.\(^5\) This shift marks the first time the industry has needed to export PE on such a large scale.

Many chemical companies are international in scope, but they often operate in geographic, product, market or functional silos. However, with the need to transport large amounts of product overseas, companies must adopt more globally aligned operating models. If regional units continue to operate autonomously, they stand to lose out on opportunities in export markets in other regions. And separate functional silos will not be privy to a full suite of timely information, which is critical when dealing with the long lead times and significant transportation costs involved in exporting products.
To succeed in the new US petrochemical export market, companies need to act as integrated global operators. Streamlined communications from the local level to the global level are necessary, along with strongly aligned functional integration. The organization’s structure, processes and supporting technologies will need to work in concert across functions and geographies. Companies must also align their metrics so that one team’s successful performance optimizes the performance of other teams and, ultimately, the entire company.

Companies that fail to integrate their operations internationally will miss out on much of the petrochemical export boom because their actions will be impaired by regional boundaries and misaligned metrics. And they will not have the visibility or capability to effectively manage issues throughout the supply chain, from local customer needs to larger macroeconomic events.

**People, processes, systems**

To implement a global integrated operating model, companies must reexamine their key business functions (marketing, product management, supply chain, manufacturing, finance, etc.) to support cross-functional and cross-geography organizations and processes. Monitoring mechanisms should support adherence to the new operating model, and performance measures by region and function must support each other.

Advanced technologies coupled with new processes can help eliminate silos and provide greater transparency for all relevant parties. They can improve the ability to monitor macroeconomic changes, currency fluctuations, trade flows, shifts in regional product supply, varying demand and pricing, and transportation capacity changes, among other things. Altogether, they can enable people to work more efficiently and make decisions based on real-time visibility into global supply chain operations—and help the chemical company as a whole to anticipate, plan and respond to change.
Enhancing logistics capabilities

In planning for export markets, petrochemical producers and shippers should prepare to negotiate two major potential supply chain choke points—delays at the Panama Canal and insufficient USGC infrastructure. Companies will need to enhance their logistics capabilities in order successfully deliver the right product at the right time to the right place for export customers, while achieving higher netbacks than their competitors. Companies that fail to do so are likely to see increased costs and delays, and ultimately the loss of customers due to unreliable service.

The Panama Canal

The Panama Canal is expected to see a significantly increased level of chemical transits to and from Asia in refined products, hydrocarbon gases and petrochemicals. In fact, petroleum, petroleum product, chemical and fertilizer canal transits have already increased 6.8 percent between 2013 and 2016, compared to a 3.5 percent decrease in total canal transit (encompassing all products/merchandise) during the same period.6

By 2016, those chemical products made up 32 percent of Panama Canal transit volume—and this was before most of the new ethane, propane and plastics exports from the US began. (Figure 3)

These growing exports are likely to encounter delays at the Panama Canal. The canal has been expanded significantly, a project completed in June 2016. However, the effort began in 2007, before the era of low gas prices in North America. As such, the increase in US chemical exports was not factored into expansion plans, leading to uncertainty as to whether the new structure will be able to handle the increase in petrochemical exports from the USGC.

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Figure 3. Panama Canal transits, kmt

Chemical & fertilizers

Petroleum products

Containers, all goods

All cargo

Source: Accenture Research analysis of data from the Panama Canal Authority, Statistics and Models Administration Unit (MEEM)
Insufficient US Gulf Coast infrastructure

The second supply chain choke point is insufficient USGC infrastructure, resulting in multiple capacity constraints between plant and port. Companies moving products by container face increasing congestion over road and rail routes, as well as a lack of storage facilities near petrochemical plants and packaging facilities. At the same time, there is a structural container deficit in the USGC, as empty containers tend to collect on the US east and west coasts. This requires the repositioning of containers to the USGC, which adds to the cost of transportation.

Over-the-road issues in the USGC area are compounded by regulations in Texas that limit gross vehicle weights to only 80,000 to 84,000 pounds. This results in resin containers that are only partly filled when they reach their weight limit—that is, the container “weighs out before it cubes out.” Thus, they leave port with room to spare. Legislative efforts are underway to increase the state's weight limit to 97,000 pounds, which would make resin shipments more economical and efficient.

Chemical, or parcel, tankers in the USGC area already face significant delays and inefficiencies. Delays in the Houston area, for example, have been increasing over the past two years, and some estimates say that chemical tankers now spend about twice the time that they should in the Houston port area. Part of the problem is a lack of storage capacity, whether for feedstocks or for export products. The lack of tank storage in the Houston Ship Channel area leads to delays that result in tanker demurrage charges. With average delay times of 10 days and demurrage charges of $16,000 per diem, additional costs of $160,000 are not uncommon.

This problem also has an impact on tanker revenue: Demurrage only covers operating expenses, so tankers are losing revenue opportunities during these delays, putting pressure on margins—which in turn puts upward pressure on the prices they charge chemical companies. In addition, the current Houston Ship Channel system of tendering at the terminals, with its waiting-line rules and other complications, will simply not be effective as export volumes grow.
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**Insight-driven logistics**

As chemical companies work through the various choke points, they will need to maintain service levels to keep their customers satisfied. They must also focus on efficiency and keeping total landed costs down. To balance those two imperatives, they will need to build more flexible supply chains that can adjust quickly to evolving conditions.

The key to doing so will be insight-driven logistics—the use of analytics tools to develop a deep understanding of external supply chain factors and transportation options across multiple providers. For example, companies in the USGC region might collect and analyze data from the Panama Canal, the Houston Ship Channel, carriers, railroads, and storage and port operations to identify trends and forecast the best routes. Armed with those insights, they will be in a better position to maneuver around delays before being caught in them.

If analyses indicate increased delays in the Panama Canal, for instance, companies can quickly turn to alternative export routes via rail, truck and west coast ports.

In general, insight-driven logistics can enable companies to build more-dynamic supply chains that can proactively stay ahead of problems. In contrast, companies that continue to operate with the more traditional static supply chains will struggle to adjust to external changes in a timely manner. As a result, service levels will suffer, and they are more likely to face additional costs in demurrage, detention, storage and penalties, among other things.
Employing digitally-enabled supply chain management

Today’s advancing digital technologies, from analytics to the Internet of Things, are enabling new approaches to supply chain management. One of these approaches, the supply chain control tower, is already being used in other industries, and it offers significant potential for chemical companies to increase real-time visibility.

A supply chain control tower brings together professionals from various supply chain functions, such as order management, transportation, warehousing, compliance and purchasing, to help facilitate the movement of goods from the plant to the customer. Control towers using advanced digital capabilities not only provide increased visibility, but also support ongoing analytics-driven improvements to supply chain processes.

This approach is used by some consumer goods companies, allowing them to see situations that are developing, understand the underlying causes and then determine the best response. Consumer goods control towers provide automatic alerts in the event of unexpected product promotions, production issues, supply disruptions and final-mile transportation disruptions. This visibility enables companies to respond quickly to changes and understand how to avoid similar disruptions in the future.

These “sense and react” capabilities could help US petrochemical producers better manage their complex global supply chains and bring products and services to market in an optimized manner. With such capabilities, they would be better positioned to determine optimal methods to export products to Asia and other markets, or to determine when alternate trade routes should be used.

Traditionally, petrochemical manufacturers have not focused on orchestrating the supply chain. But the kind of visibility provided by the control tower approach could enhance their ability to do so, helping them improve supply chain operations—from the cracker to the customer—and strengthen critical supply chain processes such as forecasting, carrier management and network modeling.

Seize the opportunity

With abundant feedstocks and the growth of exports, US chemical producers must navigate a new set of supply chain challenges. They will need to overcome key supply chain choke points if they are to provide the proper service levels to their customers while controlling their total landed costs. And they will need to build supply chains that are nimble and dynamic, and able to handle growing volumes and evolving strategies. By adopting innovative approaches to managing their supply chain and avoiding disruptions, producers can drive greater efficiency as they pursue growing export opportunities.
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References

4. Twenty-foot equivalent unit (TEU), a standard unit of measure for container shipping; assumes 18 metric tons of resin per TEU.
5. Based on 5,000 TEU container ship.
6. Panama Canal Authority, Statistics and Models Administration Unit (MEEM).
8. Ibid.

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