Managing Chaos in the Chemical Sector

Building a new business model to overcome current market forces and compete long-term

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EXECUTIVE SUMMARY

The chemical industry has been a driver of global growth for decades; indeed, many of the world’s largest and most profitable companies are chemical manufacturers. Yet the global economic crisis has challenged chemical manufacturers as never before, with pressures including:

- Volatile feedstock pricing,
- Dramatically declining customer demand, and
- Increased regulatory oversight.

Fortunately these are issues, even though market-driven, that can be successfully managed. This paper outlines how the industry’s leading operators are already:

- Improving integration and collaboration with supply-chain partners both upstream and downstream,
- Establishing business processes and using management systems to better identify and manage both customer demand and volatile supply channels,
- Innovating both new products and feedstock sources, and
- Upgrading operations and optimizing processes with improvement methodologies such as Lean.

It’s a uniquely challenging moment in the chemical industry — but it’s also a time when those companies that transform quickest may achieve competitive advantage for decades to come.
CHEMICAL MANUFACTURERS FACE
DIFFICULT, COMPLEX BUSINESS ENVIRONMENT

Few industries have been spared the fallout from distressed economies around the globe. Managing this volatility has been exceptionally difficult for the capital- and oil-intensive chemical industry, which faces not only fluctuating prices and demand from both suppliers and customers, but also the threat of increased regulatory oversight. These factors will slow the $3 trillion sector's global growth to just 1.5% in 2009 (vs. a 2.2% rise in 2008), according to the American Chemistry Council; the $664-billion U.S. chemical industry will actually shrink by 3.6% in 2009 (on top of a projected decline of 3.1% in 2008).¹

Volatile feedstock pricing and declining customer demand

Chemical manufacturers were initially hit with rising feedstock costs early in 2008, dramatically changing the financial picture for most firms. At the time, Andrew N. Liveris, Dow Chemical chairman and chief executive officer, reported, “The surge in oil prices from first to second quarter [ending June 30] added another $1 billion of cost sequentially, and we reacted quickly by announcing two broad-based price increase initiatives, adjusting plant operating rates and implementing additional cost-cutting measures.”²

Other chemical manufacturers did not react as quickly, and many had difficulty obtaining feedstock — at any price — just to keep operating. Some of this was due to hurricane-related shortages along the U.S. Gulf Coast, which also impacted the production capability of plants in affected areas. Then feedstock pricing collapsed as oil prices slumped and demand for chemical products dipped (e.g., U.S. ethylene spot prices fell sharply in November³). Demand for chemicals has weakened in virtually all markets and in all regions, including China, which had previously helped chemical companies offset falling U.S. demand. Chemical and plastic shipments slipped 5% in November 2008 (vs. November 2007), and chemical companies were holding fuller inventories than they had in the same period last year, according to consulting firm Accenture.⁴ As the New Year rang in, many chemical manufacturers were closing or idling plants.

² "Dow reports second quarter results,” Dow Chemical, July 2008.
Fuel-price volatility also posed supply-chain problems for the industry. Amid rising prices and with more than 10% of world’s oil consumed as chemical feedstock, biofuel (from renewable sources such as corn and switchgrass\(^5\)) has emerged in recent years as a viable feedstock option. The recent slump in oil prices, however, has dampened investor enthusiasm for biofuel and could trim the long-term capacity of biomanufacturers — and the feedstock flexibility of chemical manufacturers.\(^6\)

**Increased regulatory oversight**

The new administration in the U.S. will likely pose more regulatory challenges for the industry in the States. The Chemical Security 101 report from the Center for American Progress, a Washington, D.C. think tank, outlines chemical security reforms and previews regulatory proposals that may emerge in 2009. The current law on national chemical security, passed as a temporary bill in 2006, is due to expire in October 2009. Many Democrats and President Obama have criticized the interim bill for lacking stringent standards and enforcement power.\(^7\)

U.S. chemical firms are already feeling the effect of tighter regulations from overseas markets. The European Union (EU) issued new regulations — Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), to be phased in over the next decade — that require companies to demonstrate that a chemical is safe before it enters commerce, unlike the U.S., where products must be proven harmful before restriction or removal. The EU regulations could add billions to chemical manufacturer costs, because only a small fraction of U.S. chemicals have come under scrutiny of the Environmental Protection Agency as harmful.\(^8\)


TAKING CARE OF BUSINESS AMID ECONOMIC CHALLENGES

Often lost amid the size, complexity, and volatile nature of the chemical industry are the very real stresses imposed on the sector by old-fashioned supply and demand. Chemical industry customers — automotive and auto parts manufacturers, high-tech and electronics firms, pharmaceutical companies, etc. — continue to lean on their chemical providers for more value, improved responsiveness, innovations and lower pricing. How chemical manufacturers address these issues is as important as how they deal with volatile feedstock markets.

Improved integration and collaboration with supply-chain partners

Given the reliance of chemical manufacturers upon their supply bases and their corresponding need to remain keenly aware of customer demand, you’d expect a high degree of integration among these manufacturers with their supply-chain partners. But that’s not necessarily the case.

Data on North American chemical manufacturers indicates they’re slightly less integrated with suppliers than other North American industries, and on par with other industries when it comes to being integrated with their customer bases. What’s surprising, though, is that more than one-quarter of chemical manufacturers (27%) aren’t integrated at all with suppliers and 20% are not integrated with customers — and that 17% are not integrated with either customers or suppliers. Failure to develop shared information systems and collaborative best practices with supply-chain partners puts many in the industry at a competitive disadvantage in improving supplier management or satisfying customers. It’s not as if chemical manufacturers can quickly shift their feedstock supplies or redirect railroad tankers of chemicals to customers in different corners of the country.

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9 North America data on 84 chemical manufacturing plants from The IndustryWeek/Manufacturing Performance Institute 2007 Census of Manufacturers; 2007 Canada Manufacturing Study, conducted by Advanced Manufacturing and the Manufacturing Performance Institute; and Estudio De Manufactura Mexico 2007, conducted by the Manufacturing Performance Institute with support of CS Events.
### Integration with Suppliers and Customers (% of chemical plants)\(^\text{10}\)

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<thead>
<tr>
<th></th>
<th>Chemical manufacturers</th>
<th>Other manufacturers</th>
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<tbody>
<tr>
<td><strong>With Suppliers</strong></td>
<td></td>
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</tr>
<tr>
<td>No integration</td>
<td>27.3%</td>
<td>24.0%</td>
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<tr>
<td>Some integration</td>
<td>55.8%</td>
<td>58.8%</td>
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<tr>
<td>Extensive integration</td>
<td>16.9%</td>
<td>17.2%</td>
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<tr>
<td><strong>With Customers</strong></td>
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<tr>
<td>No integration</td>
<td>19.5%</td>
<td>23.7%</td>
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<tr>
<td>Some integration</td>
<td>59.7%</td>
<td>53.0%</td>
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<tr>
<td>Extensive integration</td>
<td>20.8%</td>
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### Seeing and managing volatile demand

Even in the traditional big batch world of chemical manufacturing, forecasting customer demand is a forward-looking function. Using historical data for production planning may be easier than using tightly honed forecasts, but doing so is like driving a car by looking in the rearview mirror.

Firms that focus on past performances miss huge opportunities to leverage insights, expertise and market knowledge from their sales forces and customers — intelligence that can make customer demand more visible, forecasts more accurate, product development more nimble, and supply chains more efficient. Amid the current economic climate, in which customer orders (and even customers) can disappear overnight, it’s more important than ever to link true demand to actual production.

You might assume that chemical firms would be more likely than firms in other industries to have the business management tools that enable coordination of demand with supply, avoiding the glut of inventories currently on many company books. But that, too, isn’t necessarily the case.

The percentage of North American chemical plants using enterprise resource planning (ERP), supply-chain management (SCM), and customer relationship management (CRM)

\(^{10}\) Ibid.
applications is comparable to that in other industries — 31% vs. 32%, 10% vs. 13%, and 22% vs. 19%, respectively — with only demand-planning/forecasting applications in wider use among chemical plants (32% vs. 20%).

**Innovations for long-term benefits**

Chemical manufacturers must innovate for many reasons. Existing customers may develop new products, requiring new formulas. Or chemical manufacturers themselves may discover entirely new market opportunities through technological advances. For example, TFL Ledertechnik, Switzerland, recently developed a Cool technology that prevents the warming of leather. The patented technology consists of Cool dyes to dye the leather and Cool transparent pigments for the finish coat, allowing near-infrared (NIR) waves to pass through. The leather’s natural collagen then reflects the NIR rays back through the finish coat, without absorption or heat build-up. TFL is targeting shoes, garments, and leather seating markets.\(^{11}\)

Many in the industry also innovate to augment their traditional supplies of feedstocks, potentially allowing chemical manufacturers more control over costs and pricing. Dow Chemical’s Alternative Feedstock Program (AFP), for example, features the “Methane Challenge” — an exploration of methane (derived from natural gas) as an alternative to petroleum. More broadly, the AFP addresses near-, intermediate- and long-term options for raw materials: the Methane Challenge is a long-term project while others, such as a sugarcane-to-polyethylene project in Brazil, are more immediate.\(^{12}\)

Dow views these programs not simply as supply-chain innovations, but as key elements for the firm’s long-term survival. “The historical measurements for success in R&D,” explains William Banholzer, executive VP at Dow, “have been: R&D spending (usually expressed as a percentage of sales), new product sales (sales from products introduced in the last five years divided by total sales), and the number of new patents. But I think those metrics are no longer sufficient to judge success. Historically, there was an assumption that spending correlated perfectly with innovation, but that is no longer correct — just look at Bell Labs. They had larger budgets and more Nobel Prizes than any other lab, yet their parent company disappeared. Great science is not enough to ensure business success, and if the business does not succeed, you can’t continue to do science.” He notes that it’s not R&D spending that matters, but R&D effectiveness.\(^{13}\)


\(^{13}\) “Around Dow talks with CTO and Executive VP Bill Banholzer,” Dow Chemical, May 2008.
Operations efficiencies and improved inventory management

The sector will always be subject to supply-chain pressures around pricing and availability, but savvy operators focus on internal improvements to minimize the impact of feedstock volatility. Chemical manufacturers don’t resemble firms in discrete industries (such as automotive or high-tech), yet these differences don’t fully explain why the industry lags so far behind other manufacturers in adopting improvement methodologies such as Lean Manufacturing, the Toyota Production System (TPS), and even the statistically oriented Six Sigma approach. For example, just 39% of North American chemical plants have adopted Lean Manufacturing and/or TPS, compared to 55% of the other North American plants. Six Sigma adoption was 25% in the chemical industry vs. 27% among other plants.14

Why the gap? It’s possible that chemical manufacturing executives have been influenced by the tendency of many Lean consultants to focus on the “tools” of Lean and TPS — e.g., pull systems, 5S housekeeping, one-piece flow — rather than on Lean’s broader organizational impact. Many of those tools don’t translate well into a process manufacturing facility. Yet Lean’s organizational imperatives — strategy deployment, building a problem-solving culture, managing performance via the scientific method — remain highly applicable to chemical manufacturers. Most Lean tools have their place, if not directly in the production environment, then with the many supporting processes used by chemical manufacturers.

While the chemical industry is just as likely as others to use operational best practices such as benchmarking (43% of chemical plants) and a formal continuous improvement program (61% of chemical plants), they’re also just as unlikely to expand improvement efforts beyond their production areas, regardless of the method they rely upon (e.g., Lean, Six Sigma, etc.). Some 88% of chemical plants have applied their improvement methodology or methodologies to the production area, but other departments are far less likely to be addressed: finance and accounting (19% of plants), supplier relations (20%), administration (24%), engineering (30%), and customer relations (35%). It’s hard to imagine that chemical enterprises, frontlines to front offices, are as productive and efficient as they could be.

14 North America data on 84 chemical manufacturing plants from The IndustryWeek/Manufacturing Performance Institute 2007 Census of Manufacturers; 2007 Canada Manufacturing Study, conducted by Advanced Manufacturing and the Manufacturing Performance Institute; and Estudio De Manufactura Mexico 2007, conducted by the Manufacturing Performance Institute with support of CS Events.
BUSINESS MODEL FOR BATTLING CHAOS

McKinsey & Co. consultant Scott Andre writes that global chemical production hasn’t had a sustained decline since the early 1980s, which at that time resulted in an industry-wide restructuring (i.e., lower-cost new plants replacing older, less efficient plants). The current demand downturn could help newer, low-cost capacity in China and the Middle East more quickly displace production in higher-cost operations in Europe, Japan, North America, and South Korea.¹!°

Today’s chemical executives will need to manage their facility networks to take advantage of efficiencies and low-cost capacities wherever they exist — if they exist. And they’ll need to improve the productivity of existing capacities by:

- Streamlining processes from external suppliers through internal production, using state-of-the-art management systems (e.g., ERP applications, demand planning software) to better identify and forecast customer needs and to strengthen relationships among partners to better meet short- and long-term demand patterns.
- Implementing improvement methodologies such as Lean Manufacturing to manage production far more tightly than in years past, optimizing feedstock purchase prices without stockpiling excessive inventories.
- Updating facilities, equipment and systems to make them both more cost-effective and to comply with new regulatory requirements.
- Innovating processes and products to meet emerging customer demands and to reduce reliance on traditional feedstocks.

Amid the current chaos, the chemical industry is on the cusp of radical transformation — one that will require a commitment to change on the part of every chemical manufacturer. Are you ready?

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