Supply Chain Metrics That Matter: A Focus on the Chemical Industry

Using Financial Data from Corporate Annual Reports to Better Understand Chemical Supply Chains

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Research

*Supply Chain Metrics That Matter* is a series of reports published intermittently throughout the year by Supply Chain Insights LLC. Within the world of Supply Chain Management (SCM), each industry is unique. To help companies understand the differences, we share deep analysis in each report.

While we find it useful to understand the evolution of supply chain excellence by comparing industries, we feel the true stories of supply chain excellence can only be really understood by comparing what happened within a period by peer group. The goal of this series is to share these insights.

Your trust is important to us. This independent research is 100% funded by Supply Chain Insights. As such, we are open and transparent about our financial relationships and our research process. These reports are intended for you to read, share and use to improve your supply chain decisions. All we ask for in return is attribution when you use the materials in this report. We publish under the Creative Commons License Attribution-Noncommercial-Share Alike 3.0 United States and you will find our citation policy here.

Research Methodology

The basis of this report is publicly available information from corporate annual reports from the period of 1995-2011 for chemical manufacturers. We use this financial data to learn from past trends, better understand the current operating environment, and provide recommendations for the future. We augment the financial data analysis with information from our quantitative and qualitative research studies.
Executive Overview

Chemical companies were early supply chain leaders; and as an industry, they have a strong supply chain understanding. They were quick to automate their supply chains and have deep investments in Enterprise Resource Planning (ERP) and Advanced Planning Systems (APS); but their progress has stalled.

Their supply chains were not resilient during the Great Recession of 2007-2009, and in the last five years, most companies have lost ground on gross margin and working capital. The industry has remained stuck on Days of Inventory and gone backwards on Days of Working Capital.

Does this mean that it is time to throw in the towel and admit defeat? We sincerely hope not. Instead, we would like for this report to be a wake-up call to the industry. We would like for leaders to see that supply chain matters more than ever, and that it is time to rethink the path forward.

We believe that the industry has lost its way believing that there are industry best practices that can be implemented through continuous improvement programs. At the beginning of the last decade, there was a flurry of major ERP rollouts with a project-based focus. These IT projects then rolled into continuous improvement initiatives. The issue is a lack of a clear understanding of supply chain strategy and alignment to holistic objectives. To reverse current results, the industry needs to align to drive year-over-year balance sheet objectives on the Supply Chain Effective Frontier with a multi-year road map.

This requires:

- **Reorientation.** Mapping the supply chain outside-in to take advantage of new demand signals and rethinking push-based supply chains.
- **Clear Strategy.** Aligning the myriad of approaches (e.g., Lean, flow, theory of constraints, vendor managed inventory) more holistically to supply chain strategy.
- **Accountability.** Increasing accountability for balance sheet and income statement metrics. While industry benchmarking on supply chain metrics is possible, for multiple reasons, this is problematic. The rubber meets the road on the balance sheet.
Growth Through Mergers and Acquisitions

As growth has flattened, Mergers and Acquisitions (M&A) activity has increased in the chemical industry. In table 1, we show the sales growth of major industry players by three periods:

- 2008-2011: Post-recession recovery.

Table 1. Year-over-Year Chemical Sales Growth Averages

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<tr>
<td>BASF SE</td>
<td>5%</td>
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<td>E I Du Pont De Nemours And Co.</td>
<td>-1%</td>
<td>3%</td>
<td>7%</td>
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<td>Eastman Chemical Company</td>
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<td>4%</td>
<td>3%</td>
</tr>
<tr>
<td>Huntsman Corporation</td>
<td>80%</td>
<td>10%</td>
<td>6%</td>
</tr>
<tr>
<td>The Dow Chemical Company</td>
<td>4%</td>
<td>13%</td>
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Source: Supply Chain Insights LLC, Corporate Annual Reports 2000-2011

With the slippage of double-digit growth, mergers and acquisitions have been one of the most common methods for chemical companies to drive growth and increase global presence. This trend seems likely to continue. In figure 1, we show a condensed timeline of Dow’s recent M&A activities:

Figure 1. Dow Chemical Company Merger and Acquisition Timeline
In 2011, chemical company M&A transactions totaled 17 deals with a value of more than $1 billion for a total value of $82 billion completed in deals. As a result, the average company is awash with technology systems and Information Technology (IT) assets. Companies are trying to sort out future direction.

Working Capital and Inventory Stagnation

The chemical supply chain leaders are not new to supply chain. In this industry, supply chain leadership runs deep. They have led the development of processes and systems with strong participation in APICS, SCOR Council and SAP’s Industry Council. Their understanding of supply chain excellence is superior to those in the Food and Beverage and Pharmaceutical industries and they stand toe-to-toe in their understanding of supply chain excellence with the large giants in the Consumer Packaged Goods (CPG) industry.

Despite massive IT investments, training and skill building, the chemical industry working capital values nearly doubled over the course of the last decade. As shown in figure 2, the results are far worse than the CPG industry. One of the major challenges has been the focus on “projects” or “technology implementations” without holistic thinking or a leader that is focused on managing the end-to-end supply chain.

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Figure 2. Industry Comparison of Days of Working Capital (DWC) Progress

The industry, as a whole, has deep roots in manufacturing, and struggles to maintain balance between Return on Assets (ROA) and Days of Working Capital (DWC). It is only when DWC becomes a cross-functional metric, or a bonus target across the supply chain, that we see individual company improvement. Without an understanding of the future direction and Supply Chain 2020, the industry focus is on the efficient supply chain with the lowest cost-per-pound versus the more mature effective supply chain that maintains the right balance between the financial ratios of growth, profit, cycle and complexity at the Supply Chain Effective Frontier. (For a deeper understanding of these concepts, reference Supply Chain Insights’ Report: Conquering the Supply Chain Effective Frontier).

The skeptics reading this report might argue that there were many reasons for this trend. These would include longer supply chains, increased product complexity, lower cost of capital, and rising organizational complexity. It is our strong belief that the chemical companies have not made this a priority. The business dynamics are just not the same as a High-tech supply chain with declining margins. In the High-tech supply chain, organizations weathered these impacts and reduced working capital by over 50 percent.

Days of Working Capital is an important metric to understand the underlying financial efficiency of a corporation. By definition, this is the number of days it will take a company to convert its working capital into sales. The faster this can happen (or the lower the number), the better.
Due to the limitations and high value asset structure of the chemical industry, and the fact that the industry is three to five steps back in the supply chain, chemical companies have unique challenges in controlling working capital. For example, upstream partners, located closer to the end consumer often shift costs and backward in the supply chain. As a result, a low or negative working capital value is likely impossible to achieve; nevertheless, after two decades of focus, most chemical leaders are surprised there is not more progress in DWC as shown in figure 3.

The supply chains were not resilient in the economic downturn in 2007 and 2008 and the recovery has been slow. Although there has been recent stabilization of DWC values, companies have significantly higher DWC values than they did at the beginning of the decade, illustrating the need for a holistic end-to-end supply chain focus to keep inventory low and working capital at manageable levels.
A look at industry leaders in figure 4 shows a close-up of year-over-year progress in DOI or the lack of it. One of the issues is industry stagnation on Days of Inventory. This industry has more deployments of deep analytics for multi-tier inventory optimization, and some of the strongest deployments of Enterprise Resource Planning (ERP) than any other industry, yet the Days of Inventory have remained constant. With a decade-long perspective, we are able to see there has been little sustained improvement in managing working capital and inventory. This is often a surprise to the supply chain leader.

Unraveling the Cash-to-Cash Cycle

The Cash-to-Cash Cycle (C2C) is one of the single best measures of supply chain efficiency; and while it does provide a snapshot method to understand management of cash flow through an organization, there is more than meets the eye. The C2C is made of three inputs: (+) Days of Inventory, (+) Days of Receivables, and (-) Days of Payables.

With the goal being a decreasing C2C value, priority is focused on minimizing values for Days of Inventory and Days of Receivables while increasing Days of Payables. In short, this means that any improvement in C2C can be driven by up to three different levers. As seen below, DuPont has driven their C2C cycle through extending payables terms, weakening the value chain by
forcing suppliers to cope with difficult payment terms. Dow Chemical has had the most consistent inventory management. Figures 5 and 6 below illustrate the evolution and stagnation of the C2C cycle’s three components over the past twelve years.

Figure 5. Cash-to-Cash Cycle Components (2000-2003)

![Bar chart showing C2C values for BASF SE, E. I. du Pont de Nemours and Co., and The Dow Chemical Company.]

Compare the C2C values at the beginning of the decade with more recent results demonstrated by the same three companies and we observe lower C2C values. However, one company, DuPont, exhibits increasing C2C values and more worryingly, increasing Days of Payables values; in essence, jeopardizing the supply chain for short-term gain.
Companies must ensure that C2C improvement is driven organically by improving Days of Receivables and Days of Inventory values, as opposed to pushing longer payment terms onto suppliers. Although this can be an effective way to decrease the C2C value, it is not a holistic way of engaging with up- and downstream supply chain partners and has the long-term effect of weakening the value chain.

**Free Cash Flow Ratio**

Hand in hand with inventory management is the management of free cash within the enterprise. Although a healthy amount of cash flow is important for a company, too much can indicate a lack of focus or strategic thinking for the company. In table 2, we show current values. Companies are at very different levels due primarily to merger and acquisition activities.
Free cash flow has been on the rise for the past decade and chemical companies are missing the opportunity to invest in themselves and reorient the supply chain for a demand-driven and pull-based operating environment. Although they are using their money more effectively than CPG companies, which report average free cash flow ratio upwards of 0.10, there is still lost opportunity for greater utilization of the cash on hand and better management of inventories.

**Commodity Pressure**

Commodity price pressure is the new normal. As a growing global population demands more goods and an increased quality of life with limited resources, the orchestration of revenue management and price optimization is critical. Due to their placement within the supply chain, located farther from the end consumer and much more closely tied to raw materials, the use of demand sensing technologies to reduce the bullwhip effect can be especially advantageous for chemical companies.

As shown in figure 7, only Eastman Chemical and Huntsman Corporation have been able to buck rising prices to improve gross margin values. DuPont, BASF and Dow Chemical have struggled to maintain gross margin while balancing cash-to-cash cycles. When compared to CPG or High-tech, these companies’ supply chains show less resiliency. For the purposes of this report, supply chain resiliency is defined as the ability to have reliable results at the intersection of financial ratios on the Effective Frontier. The more resilient CPG companies demonstrate a smaller locus of movement and less extreme and randomized year-over-year results.

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**Table 2. Free Cash Flow Ratio**

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<tr>
<td>BASF SE</td>
<td>0.02</td>
<td>0.05</td>
<td>0.06</td>
</tr>
<tr>
<td>E I Du Pont De Nemours And Co.</td>
<td>0.06</td>
<td>0.07</td>
<td>0.09</td>
</tr>
<tr>
<td>Eastman Chemical Company</td>
<td>0.05</td>
<td>0.04</td>
<td>0.04</td>
</tr>
<tr>
<td>Huntsman Corporation</td>
<td>-0.04</td>
<td>0.01</td>
<td>0.03</td>
</tr>
<tr>
<td>The Dow Chemical Company</td>
<td>0.02</td>
<td>0.04</td>
<td>0.02</td>
</tr>
</tbody>
</table>

Source: Supply Chain Insights LLC; Corporate Annual Reports 2000-2011
Free Cash Flow Ratio = Free Cash Flow / Revenue
Figure 7. Year-over-Year Progress of Chemical Supply Chain Leaders on Gross Margin and Cash-to-Cash Cycles

While companies have wanted to push year-over-year improvements, they have lost their way. Most of this failure is leadership. The industry has misstepped by focusing on “projects” and “process” without a clear understanding of supply chain strategy and holistic thinking on driving end-to-end supply chain performance. They have been sluggish to adapt from slow, push-based supply chains to better use market signals and drive a more adaptive and balanced response.

Many companies run their supply chain like oil is still $10/barrel. It is not. Recent annual reports from several food & beverage companies, located downstream of chemical companies, indicate that the squeeze is happening. Cost pressures are already being felt further down the supply chain. For the chemical company, this is an opportunity to build a more demand-driven, pull-based value network to reduce total supply chain costs.
The final event making a notable impact on the chemical industry, as well as the general macroeconomic environment, was the Great Recession of 2007-2009 and the continuing economic stagnancy that lingers. The chemical industry as a whole was unprepared for the economic slowdown and caught off-guard by falling demand levels. Some of the top chemical companies in the world were forced to not only reduce production levels, but shut down significant portions of their manufacturing footprints. This should have been a wake-up call to build a guiding coalition for change. Excerpts from Annual Reports below illustrate the severity of the Great Recession and the drastic steps chemical companies were forced to take.

“Net sales and other operating income increased $19.0 billion, or 31%, to $80.7 billion. Net sales and other operating income increased $14.2 billion due to higher average selling prices, primarily related to higher underlying commodity costs, and increased $4.8 billion due to increased sales volumes, including sales volumes from acquisitions.”

• Archer Daniels Midland 2011 Annual Report, page 23

“[2010] operating profit grew 9%, reflecting lower commodity costs, primarily cooking oil.”

• PepsiCo 2011 Annual Report, page 41

“During 2011, our aggregate commodity costs increased primarily as a result of higher costs of coffee, dairy, grains and oils, packaging materials, other raw materials, meat and nuts. Our commodity costs increased approximately $2.6 billion in 2011 and approximately $1.0 billion in 2010 compared to the prior year.”

• Kraft Foods 2011 Annual Report, page 6
There is a need to move from a traditional ROA mentality to embrace new definitions of supply chain excellence. In addition, there is a need to return to rudimentary financial metrics and refocus on optimization of supply chain processes.

**Recommendations**

The challenges are clear for the chemical industry, but the opportunities are both diverse and powerful to bring the chemical industry into the future with a pull-based end-to-end supply chain. Our recommendations are based upon the trends and insights gathered from analysis of balance sheet and income statement data and our understanding of the current struggles of the industry as a whole.

- Start with a clear supply chain strategy and align efforts to a multi-year road map.
- Focus holistically end-to-end and hold yourself accountable to balance sheet metrics.
- To ensure alignment, include working capital metrics as part of organizational, cross-functional goals.
- Redefine processes outside-in to improve effectiveness and resiliency.

While these recommendations may sound simplistic, we find that small changes in supply chain organizations can yield great results.
Conclusion

The chemical industry has done a lot of things right over the past decades, but they have lost their way. The Great Recession should have been a wake-up call to improve supply chain resiliency; yet, few have heeded the call. As supply chain leaders read this report, here are our recommendations:

- **Fail Forward. Don’t Make the Mistakes of the Past.** An improved supply chain is more than the latest technology or software purchase. It requires a clear definition of supply chain strategy with a focus on holistic end-to-end measurement. The chemical industry is guilty of trying to implement a “project-based” approach to drive supply chain excellence through multiple, often isolated continuous improvement initiatives. They have largely failed. It is time to rethink this approach.

- **Focus Outside-in.** Macroeconomic data in regards to housing, automobiles, and food trends abound; but despite this information, chemical supply chains primarily run on historic data (orders and shipments). To make substantial progress to reverse these trends, leaders need to map the signals outside-in and realize that the traditional approaches for ERP/APS have not served them well. They need to build strong horizontal processes for revenue management, Sales and Operations Planning (S&OP) and Corporate Social Responsibility focused on a clear vision of supply chain excellence.

- **Step up. Take responsibility.** Chemical companies are in a unique position to act as channel leaders and drive improvements across both their own companies and the entire supply chain. They have a greater impact on renewable resources; and with the rise in importance of Corporate Social Responsibility (CSR), there is a need for greater collaboration with downstream partners to reduce the impact.

Other Reports in this Series:

Check out our other reports in this series:

Supply Chain Metrics That Matter: A Focus on Retail
Published by Supply Chain Insights in August 2012.

Supply Chain Metrics That Matter: A Focus on Consumer Products
Published by Supply Chain Insights in September 2012.
About Supply Chain Insights LLC

Supply Chain Insights LLC (SCI) is a research and advisory firm focused on reinventing the analyst model. The services of the company are designed to help supply chain teams improve value-based outcomes through research-based Advisory Services, a dedicated Supply Chain Community and Web-based Training. Formed in February 2012, the company is focused on helping technology providers and users of technologies improve value in their supply chain practices.

About Abby Mayer

Abby Mayer (twitter ID @indexgirl), Research Associate, is one of the original members of the Supply Chain Insights LLC team. She is also the author of the newly-founded blog, Supply Chain Index. During the week, you will find Abby busy in the Supply Chain Insights Community answering questions and helping supply chain professionals obtain financial data for their own analysis.

Abby brings a diverse list of experiences, both academic and professional, to the team. She has a B.A. in International Politics and Economics from Middlebury College and is completing her master’s thesis, focused upon the utility of the C2C cycle in shipping & transport companies to complete the requirements for a M.S. in International Supply Chain Management from Plymouth University, located in the U.K.

Previously, Abby worked as an operations associate at Peabody Energy in the Powder River Basin, a restaurant manager in Montana, and a stone staircase builder along Maine’s portion of the Appalachian Trail. A believer in an active lifestyle, she has also completed a thru-hike of Vermont’s 280 mile Long Trail, the oldest long distance hiking trail in the United States. As part of the planning and food prep process, she became interested in supply chain management when she was asked to predict hunger pangs for the entire three-week trip before departure. If that isn’t advanced demand planning, what is?!?!