Supply Chain Index:

Evaluating the Consumer Value Network

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Research

Supply Chain Metrics That Matter is a series of monthly reports published by the Supply Chain Insights LLC research group. These reports are a deep focus on a specific industry. This was preparatory work to understand the patterns of supply chain ratios for supply chain leaders.

The Supply Chain Index is a methodology to evaluate supply chain improvement for a time period for companies within a peer group. In this report, we apply the Supply Chain Index to companies and industries that are part of the consumer value network.

Disclosure

Your trust is important to us. As such, we are open and transparent about our financial relationships and our research process. This independent research is 100% funded by Supply Chain Insights.

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Research Methodology and Overview

The basis of this report is publicly available information from corporate annual reports from the period of 2006-2012. To complete this analysis, and understand the patterns, we partnered with a research team from the School of Computing, Informatics and Decision Systems Engineering at Arizona State University during January-May, 2014 to develop a methodology to analyze trends. Details on this methodology are outlined in the appendix.

For this analysis, we use supply chain financial ratios as opposed to absolute numbers. These ratios allow us to compare large companies to small entities, and also compare the progress of companies operating in different countries using differing currencies. It also allows us to track progress over time. In Table 1, we share the ratios that we have been mining to understand the trends.

The Supply Chain Index methodology assumes that supply chain progress takes time. In our research, we find that it takes at least three years to drive change, and that the best improvements take at least five years. It is for this reason that we analyze the progress of companies for the period of 2006-2012.

Table 1. Financial Ratios Considered in the Determination of the Supply Chain Index
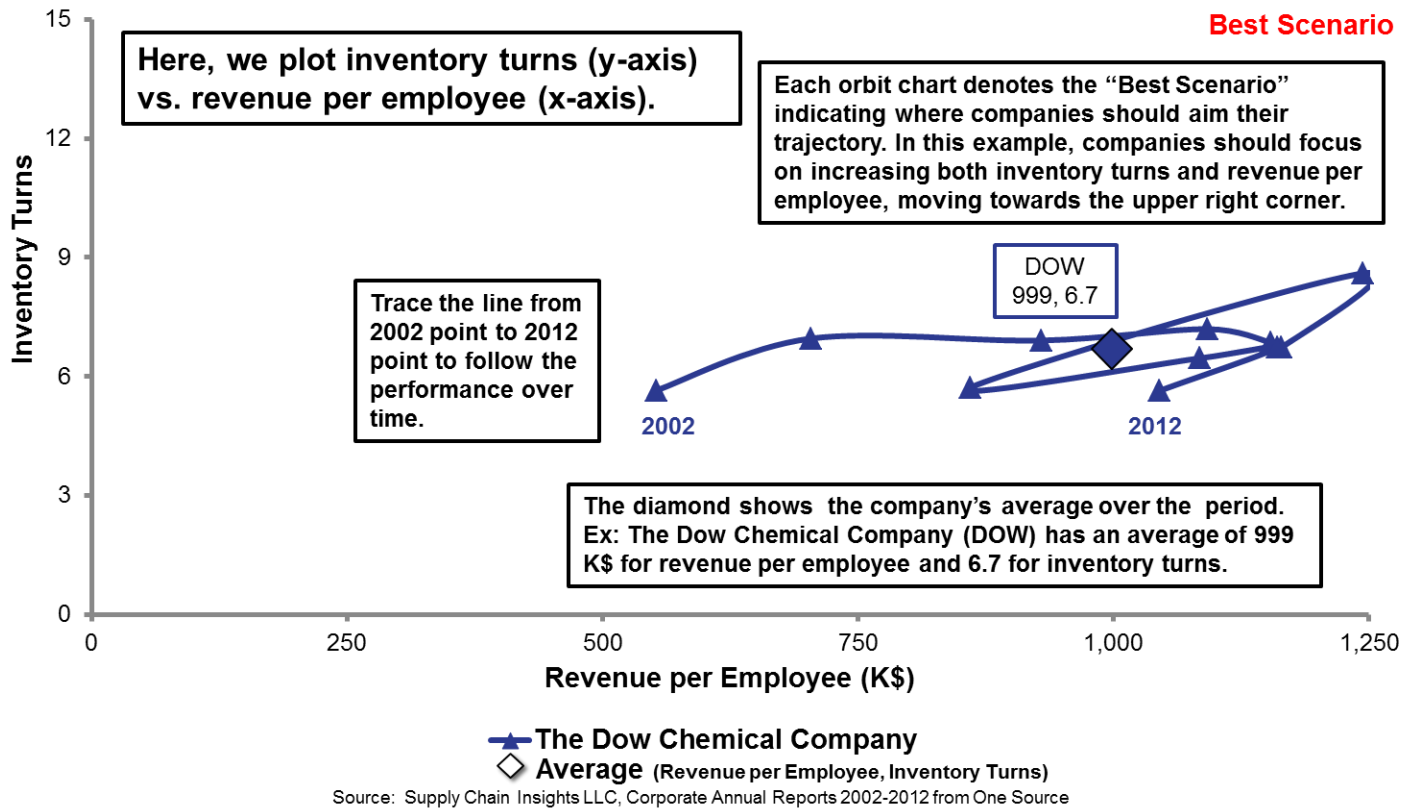
Financial Metrics			
Growth	**Profitability**	**Cycle**	**Complexity**
Common Shares	Cash	Cash-to-Cash Cycle	Altman Z
Employee Growth	Cash Change in Period	Days of Finished Goods	Capital Turnover
Employees	Cash on Hand	Days of Inventory	Current Ratio
Market Capitalization	Cash Ratio TTM	Days of Payables Outstanding	Quick Ratio
R&D Margin	Cash Ratio Quarter	Days of Raw Materials	Return on Assets
R&D Ratio	Cash Ratio Year	Days of Sales Outstanding	Return on Equity
R&D to COGS Ratio	Cost of Goods Sold	Days of Work in Progress	Return on Invested Capital
Revenue	EBITDA	DPO/DSO	Return on Net Assets
Revenue Growth	Free Cash Flow Ratio	Finished Goods Inventory	Revenue per Employee
Revenue Growth TTM	Gross Margin	Inventory	Working Capital Ratio
Revenue TTM	Gross Profit	Inventory Turns	
SG&A Margin	Net Profit Margin	Receivables Turns	
SG&A Ratio	Operating Cash Flow Ratio	Raw Materials Inventory	
SG&A to COGS Ratio	Operating Margin	Work in Progress Inventory	
	OPEX Ratio		
	Pretax Margin		

Source: Supply Chain Insights LLC

The methodology is also based on the belief that the supply chain is a complex system with increasing complexity. We believe that it is the role of the supply chain leader to build and manage supply chains that can drive year-over-year performance improvements that are balanced, strong and resilient.

To understand progress over time, the Supply Chain Index is based on the measurement of improvement or resiliency when two supply chain ratios are plotted over time in an orbit chart. As shown in Figure 1, the orbit chart enables the visualization of industry patterns. In this case, the company is Dow Chemical. The average values for the two financial ratios of revenue per employee (K$) and inventory turns are shown in the box, and the points of improvement are shown as points on the chart. The best scenario is notated in the upper right-hand corner.

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Figure 1. Definition of an Orbit Chart Using The Dow Chemical Company as an Example

Best Scenario

Here, we plot inventory turns (y-axis) vs. revenue per employee (x-axis).

Each orbit chart denotes the "Best Scenario" indicating where companies should aim their trajectory. In this example, companies should focus on increasing both inventory turns and revenue per employee, moving towards the upper right corner.

DOW
999, 6.7

Trace the line from 2002 point to 2012 point to follow the performance over time.

2002

2012

The diamond shows the company's average over the period. Ex: The Dow Chemical Company (DOW) has an average of 999 K$ for revenue per employee and 6.7 for inventory turns.

Inventory Turns

Revenue per Employee (K$)

The Dow Chemical Company
Average (Revenue per Employee, Inventory Turns)

Source: Supply Chain Insights LLC, Corporate Annual Reports 2002-2012 from One Source

Executive Overview

Supply chain management is a balancing act. It requires alignment. This is easier said than done. The terms lack definition. What is balance? How can companies judge alignment? What defines improvement? In this series of reports, we want to help.

Day by day leaders are forced to make decisions on priorities and trade-offs like growth, profitability, cycle, and complexity. The supply chain leader is charged with improving the potential of an organization at the intersection of operating margins, inventory turns and case-fill rate[1]. But are the choices that are made conscious or unconscious? This is a strong factor in determining supply chain excellence. It is our hope that through this series of reports the choices can be made consciously, based on an improved knowledge of what is possible.

In our research, we find that laggards are held hostage and struggle to balance disparate demands with the threat of throwing the supply chain out of alignment. Success requires a nuanced approach using a portfolio of carefully selected metrics to ensure success.

While supply chain excellence does not make a company, it is hard for a company to succeed without it. While the discrete industries are more focused on cycles, the consumer value network is more focused on the optimization of flows.

Progress on the Supply Chain Index

The Supply Chain Index is a new methodology to measure corporate performance on the Supply Chain Effective Frontier. It was defined by the Supply Chain Insights team based on 30 months of research.

We find that supply chain practitioners struggle to manage conflicting priorities. To visualize this, we built the Effective Frontier Model. As shown in Figure 2, the Effective Frontier visualizes the competing priorities of every supply chain leader. Growth and profitability should be maximized, cycle time should be reduced, and complexity should be managed. However, an overweighed focus on any one of the four categories can wreak havoc on the operations of a supply chain. A focus on a singular metric can throw the supply chain out of balance.

The Supply Chain Index is designed to measure progress on balance, and metrics alignment. To build the Index, we chose the metrics of year-over-year growth, return on invested capital (ROIC), operating margin and inventory turns.

Figure 2. The Supply Chain Effective Frontier
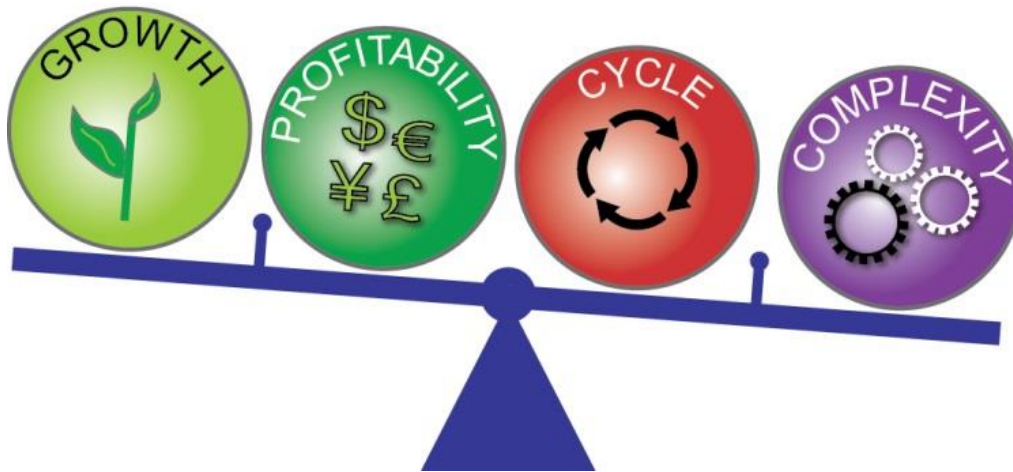
The Index assumes that the three components of balance, strength and resiliency should be valued equally. Balance tracks the rate of improvement on growth and ROIC, while strength and resiliency factors are based upon progress in profitability and inventory turns. Together, we believe that these three factors provide an effective tool to measure supply chain performance and improvement over a set time period.

Each industry has different potential. It is a mistake to place companies in a spreadsheet and shake them up without understanding industry potential. In Table 2, we show the average performance for 5 industries in the consumer value network for balance, strength and resiliency. The maturity and potential of each industry within the consumer value network is very different.

Table 2. Supply Chain Index Consumer Value Network Performance (2006-2012)

Industry	Balance	Strength	Resiliency
Retail	0.05	0.00	1.40
Apparel	-0.13	-0.04	**0.57**
Food & Beverage	0.09	0.06	1.09
Consumer Packaged Goods	**0.34**	0.06	0.74
Chemical	-0.11	-0.03	0.85
Paper	-0.09	**0.10**	0.78

Source: Supply Chain Insights LLC, Corporate Annual Reports 2006-2012

In the Index, the highest performing supply chains will record high scores on balance and strength and low scores on resiliency. For the period of 2006-2012, the consumer packaged goods industry demonstrated the most improvement on balance (representing high growth rates and utilization of assets), while paper manufacturers improved strength and apparel performed the best on resiliency.

The consumer packaged goods industry is often cited as a leader in supply chain maturity, but our research illustrates that there are lessons to be learned from each industry.

In this report, we present the methodology of the Index and detailed results for companies in six industries comprising the consumer value network. At the end of the report, we summarize some of the companies that we admire. In future repots, we will take a similar detailed view of the healthcare and industrial value networks.

Progress From 2006

In this period, the times were good for consumer packaged goods companies and food manufacturers. Through the recession, more and more consumers abandoned luxury goods for the basics of CPG. This was also the time of global expansion. However, note that while this industry is known for the adoption of 'collaborative practices' that the total industry has not reduced total costs or inventory.

Table 3. Supply Chain Index Consumer Value Network Performance (2009-2012)

Industry	Balance	Strength	Resiliency
Retail	-1.46	-0.22	1.24
Apparel	**1.10**	0.00	**0.51**
Food & Beverage	0.19	0.00	0.92
Consumer Packaged Goods	-3.22	0.07	0.62
Chemical	-0.40	**0.15**	0.77
Paper	-2.36	-0.11	0.82

Source: Supply Chain Insights LLC, Corporate Annual Reports 2009-2012

The time period changes the view. In Table 3, notice how different the performance is for these industry subgroups in a more recent timeframe. Based upon the shorter period of 2009-2012, apparel has led on both balance and resiliency improvement while chemical has made the most gains on strength. This picture is significantly different than the longer perspective in Table 2. What explains this? The Index is a measurement of supply chain improvement. The starting year and the duration of the analysis matter. Industries, like chemical, that struggled significantly during the Great Recession have rebounded with greater gains in more recent years.

Retailers and consumer packaged goods companies are struggling for growth, and the paper sector that is highly dependent on these industries is also experiencing a lower growth rate. It is harder to balance ROIC in volume downturns. To stimulate growth, the consumer packaged goods companies

have added products at a record rate. This introduction of new products may drive small growth rates, but uncontrolled complexity has an adverse effect on performance on the Effective Frontier.

Impact of Complexity

Complexity is present at every level of the supply chain. In that regard, we feel that it is not about single metrics or single components of the Supply Chain Index. The best company at balance on the Supply Chain Index is rarely the best at strength or resiliency. We believe a wider perspective on supply chain excellence, incorporating several different metrics, provides a more holistic measuring tool when it comes to supply chain improvement.

Supply chain complexity is like cholesterol in the body. In the measurement of cholesterol, the blood work will determine good and bad cholesterol. The goal is to decrease the sticky, small drops of bad cholesterol in your bloodstream through diet, exercise and stress reduction. Some people are naturally predisposed to not have cholesterol problems. The analogy holds for supply chain. Bad complexity lowers the performance on the Effective Frontier by raising costs and increasing inventory without improving growth, while good complexity adds growth to the topline without a major impact on operating margin and inventory turns. Some supply chains are naturally more complex than others. The more that the supply chain leader can reduce bad complexity and improve good complexity, the better the expected performance will be on the Index and Effective Frontier.

What Is a Value Network?

A value network is a collection of companies across multiple industries that are aligned to drive value for a common customer. In the consumer value network, the customer is the shopper in the retail store, or the buyer on the Internet, or the consumer in the home. The value network is composed of many industries that are interconnected through physical, information and cash flows. As shown in Figure 3, the consumer value network definition for this report is the aggregate supply chain improvement for the supply chain network composed of retailers and manufacturers in apparel, consumer packaged goods (CPG), food and beverage, chemical, and paper processing industries.

In a value network there are multiple tiers or flows. It is not linear. The further back the trading partner is in the network, the more difficult it is to get good demand data. The passing of order signals drives what is known as the bullwhip effect. In the bullwhip effect, the order signal is distorted both in amplitude and frequency while passing between parties in the value network.

Figure 3. Consumer Value Network Industries Studied in This Report
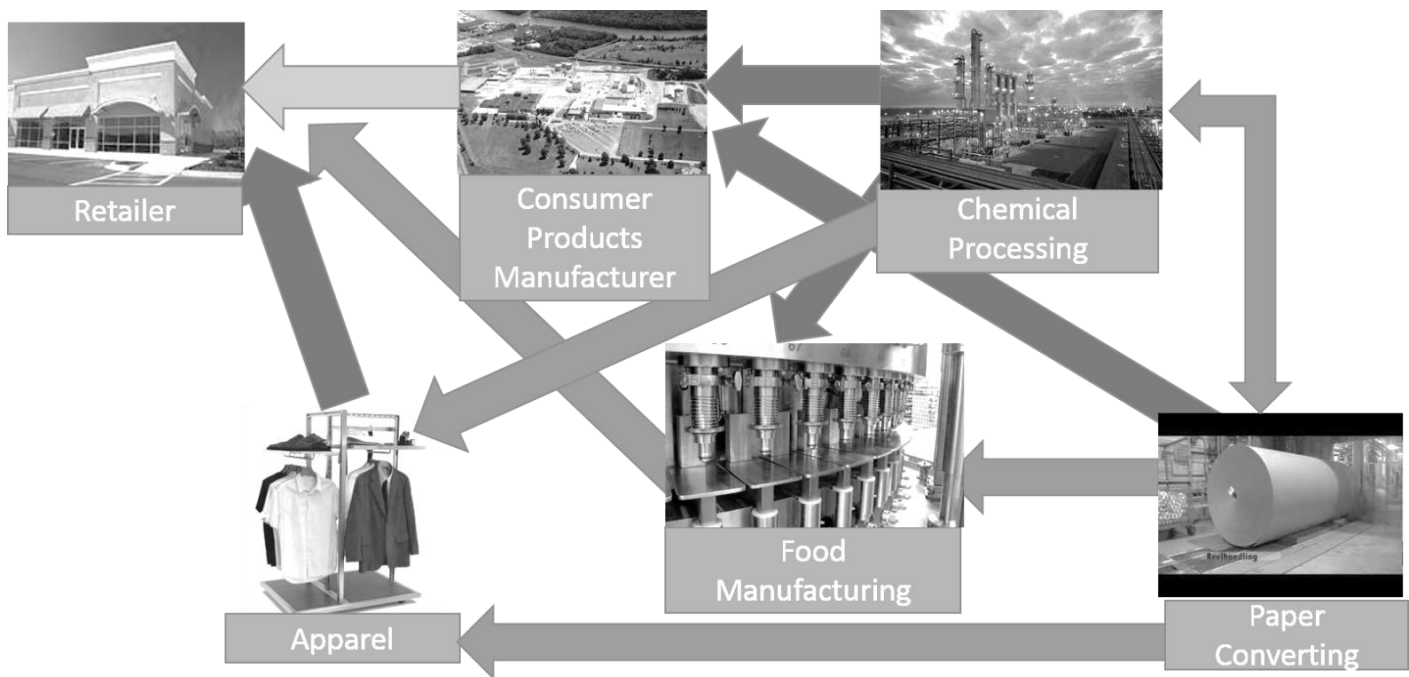
The industries shown in Figure 3 are not equal partners. They have different profiles for margin, cycles, velocities, and asset strategies. It is for this reason that we apply the Index to evaluate industry sectors on an individual basis within the consumer value network.

> *We live in a world where supply chains, not companies, compete for market dominance. But companies often have diverging incentives and interests from their supply chain partners, so when they independently strive to optimize their individual objectives, the expected result can be compromised."*
>
> Hau L Lee, Triple-A Supply Chains, Harvard Business Review, October 2004

The Index is also based on the principle that it takes time to drive supply chain improvement. When we interviewed companies on how long it takes to drive improvement, we learned that it takes at least three years. In parallel, as shown in Table 4, we learned through the analysis of financial ratios, that it is difficult for companies to sustain year-over-year improvements at the intersection of operating margin and inventory turns for more than two consecutive years. Notice the drop-off in periods of 3 or 4 consecutive years.

When members of the consumer value network are contrasted in aggregate on an orbit chart, as in Figure 4, it is clear that no company is making linear progress towards the goal of improved inventory turns and operating margin.

It is also clear that each company operates in its own zone, or operating potential, at the intersection of operating margin and inventory turns. This group represents some of the best performers. The patterns for lower performers are more erratic.

Table 4. Consecutive Improvement of Companies at the Intersection of Operating Margin and Inventory Turns on the Effective Frontier

Percentage of Companies Demonstrating Consecutive Improvement on Both Inventory Turns and Operating Margin (2000-2012)			
Morningstar Sector	2 years only	3 years only	4 years only
Chemical (n=22)	32%	9%	0%
Communications Equipment (n = 94)	33%	13%	2%
Consumer Electronics (n=11)	18%	0%	9%
Drug Manufacturers- Major (n=17)	12%	6%	0%
Household & Personal Products (n=27)	37%	7%	0%
Packaged Food (n=48)	25%	6%	2%
Packaging & Containers (n=19)	26%	0%	0%
Semiconductors (n=76)	33%	5%	1%
Specialty Chemical (n=48)	31%	8%	2%

Source: Supply Chain Insights LLC, Corporate Annual Reports 2000-2012

It is also clear that despite years of collaborative efforts in this value network, that the aggregate levels of inventory did not improve, nor did the value network achieve an improvement in margin. Progress requires focus, vision and discipline. It cannot be an ever-changing program of inventory this month and a margin focus the next. As most supply chain leaders know, there are finite trade-offs between operating margin, inventory turns and customer service. Supply chain planning and continuous improvement initiatives improve the potential of these set points, but they remain interconnected. In the journey for improvement, most companies will go through periods of transition like those shown for **BASF SE**, **The Hershey Company** and **VF Corporation**. It is very rare to see the continuous improvement in operating margin like we see for **Colgate-Palmolive Company**.

Figure 4. Orbit Chart of Companies in the Consumer Value Network for the Period of 2006-2012
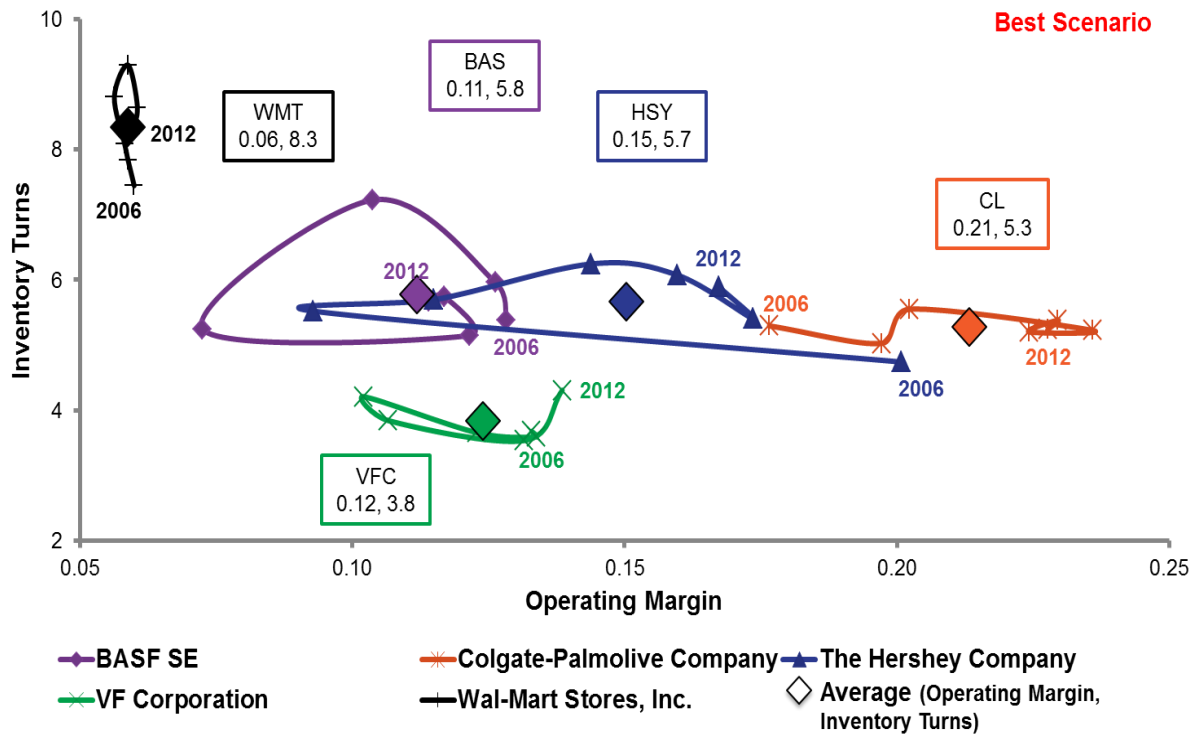
Source: Supply Chain Insights LLC, Corporate Annual Reports 2006-2012

Table 5. Aggregate Performance of Companies within an Industry on the Effective Frontier

Consumer Value Chain (2006-2012)					
Industry	Operating Margin	Inventory Turns	Cash-to-Cash Cycle	Revenue per Employee (K$)	SG&A Ratio
Retail (n=33)	0.05 ↓14%	8 ↑19%	51 ↓79%	552 ↑16%	19% ↓2%
Apparel (n=6)	0.14 ↑7%	4 NC	49 ↓2%	377 ↑1%	28% ↓17%
Food & Beverage (n=32)	0.12 ↓17%	8 ↑11%	42 ↓19%	532 ↑63%	19% ↓11%
Consumer Packaged Goods (n=14)	0.13 ↑8%	5 NC	39 ↓25%	373 ↑25%	33% ↓13%
Chemical (n=7)	0.10 ↓50%	5 ↓3%	83 ↓9%	527 ↑29%	13% ↓17%

Source: Supply Chain Insights LLC, Corporate Annual Reports 2006-2012
Industry Average comprised of public companies (apparel: 31522% & 44812% where % is any number from 0-9), (chemical: 325188 & 325998), (consumer packaged goods: 3256% where % is any number from 0-9), (food & beverage: 3112% where % is any number from 0-9, 311320, 311821, 312111, 311520, 311941), (retail: 452% where % is any number from 0-9) reporting in One Source with 2012 annual sales greater than $5 billion
NC=no change

On average, the parties in the consumer value network have made different levels of progress in delivering improvement on the Effective Frontier. For reference, the average improvement for the period of 2006-2012 is shown by industry in Table 5. While companies have improved efficiency (average revenue per employee performance), they are struggling at the intersection of inventory

turns and operating margin. The improvement in cash-to-cash has been largely driven by increasing payables and squeezing the upstream supplier. There are few companies in our analysis that have made true improvement on the Effective Frontier.

Index Methodology

There are four components of a Supply Chain Index score. Objective performance on balance, strength, and resiliency each contribute 30% of the final score. Here we explain each measure in depth. For a more detailed explanation, refer to the Appendix.

Balance

Balance in the supply chain is a constant struggle. Reduced inventory availability wreaks havoc on customer service levels. Excess inventory leads to high carrying cost and obsolescence of product. Excessively long days of payables lead to weakened supplier health. The examples are endless: balance is critical.

Figure 5. Balance

The two metrics that comprise our balance measure are revenue growth and return on invested capital. Return on invested capital is a less well known metric compared to return on assets. Return on assets has a narrower focus. Our research indicates that ROIC has better correlation with stock market capitalization and provides a broad perspective on cash flow generation and profitability based on shareholder equity.

$$Return\ on\ Invested\ Capital = \frac{Operating\ Income + Income\ Tax\ Total}{Total\ Shareholder'sEquity}$$

It is a measurement of the company's use of capital. The goal is to drive higher returns than the market rate of the cost of capital.

The balance measure in the Supply Chain Index is a mathematical calculation of the vector trajectory of the pattern between growth and ROIC for the period of 2006 to 2012. The overall trajectory of this

vector from Year 0 (2006) to Year 6 (2012) is simplified into a single value which represents the company's ability to balance growth and ROIC. Companies that were able to drive improvement in both metrics score the best while companies that deteriorated in both metrics did the worst. A negative score on the balance score translates to a supply chain that lost ground on the metrics compared to the starting year. In this report, we consider two time periods. Our initial analysis considers performance based upon a time period of 2006-2012. Additional analysis focuses on a narrower time period of 2009-2012 to examine corporate performance emerging from the Great Recession.

Strength

A successful supply chain is a strong supply chain. Supply chain leaders deliver year-over-year improvements. Our research over the past two years has uncovered a rich relationship between operating margin and inventory turns. For most supply chain leaders, these are some of the most important measures of their performance. Not only are they important, they are more directly influenced by supply chain decisions than other broader corporate metrics. It is for this reason they are the two components of our strength metric.

Figure 6. Strength

The strength measure in the Supply Chain Index is a mathematical calculation of the vector trajectory of the pattern between inventory turns and operating margin for the period of 2006 to 2012. Inventory turn and operating margin performance is graphed on an annual basis from a point originating at the origin representing performance on the two metrics at Year 0 (2006). The overall trajectory of this vector from Year 0 (2006) to Year 6 (2012) is simplified into a single value which represents strength. Improvement on both metrics simultaneously is graphically shown as movement to the upper right quadrant with increasing values for both inventory turns and operating margin over the period.

The strength metric comprises 30% of the total Supply Chain Index calculation. Sustained improvement on both inventory turns and operating margin indicates a strong supply chain and is reflected in a high strength score.

Resiliency

Resiliency is an adjective easily tossed around as one of the key qualities of a successful supply chain in today's volatile world. However, the concept of resiliency is more difficult to define, and there is rarely clarity among stakeholders as to what resiliency is or should be. Here we provide a clear and concise definition.

As we plotted chart after chart, we could see that some supply chains had very tight patterns at the intersection of operating margin and inventory turns, and that other companies had wild swings. We wanted to find a way to measure this. We turned to the experts at ASU. After evaluating several methods to determine the pattern in the orbit chart, we settled upon the Euclidean mean distance between the points.

Figure 7. Resiliency

In our March 2014 report: Supply Chain Metrics That Matter: Improving Supply Chain Resiliency, we define resiliency as the tightness of the pattern at the intersection of inventory turns and operating margin. These metrics, both critical for any supply chain, are components of both the strength and resiliency metric in our Supply Chain Index model. The tightness of the pattern (mathematically speaking, the Euclidean mean distance) indicates the ability of a supply chain to maintain a tight consistent pattern across these two metrics as the business environment shifts and changes over a seven year period (2006-2012).

The resiliency metric is similar to the cash-to-cash cycle in that companies should work to minimize the value. A lower number for resiliency is an indicator of a tighter pattern and greater reliability in results over the time period.

Peers

The final 10% of the score will be a peer vote contributed by members of the Shaman's Circle. The Shaman's Circle is a group of 350 supply chain leaders from a variety of industries and company sizes that form an informal networking group within the Supply Chain Insights Community. Over the

course of the summer, each of the leaders in the Shaman's Circle will be asked to rank the results by value chain. In September, we will publish the final results for all industries.

The balance, resiliency, and strength values will be populated and stack ranked prior to the vote by the Shaman's Circle. Our intention is to create a voting environment that is open to individual perspective, but also balanced with a full scorecard of objective measures to inform the voting process. The values of a table like that in Table 6 will be created for each industry peer group for the period of 2006-2012.

Table 6. Supply Chain Index Ranking System

Supply Chain Index								
NAICS Code	Balance	Balance Ranking	Strength	Strength Ranking	Resiliency	Resiliency Ranking	Peer Ranking	Overall Ranking

Source: Supply Chain Insights LLC

In the analysis, each industry segment, as defined by NAICS classification codes, will be considered on an individual basis. As a result, **Colgate-Palmolive Company** will not be directly compared against **Ford Motor Company** or **Wal-Mart Stores, Inc.** The definition of a best-in-class supply chain varies by the complexities and realities of the operating environment and it is not a one-size-fits-all business environment.

"Most Improved" Does Not Mean "The Best"

It is important to clarify what the Supply Chain Index is or is not. It is a methodology for ranking supply chains by industry and NAICS code. The measurement is one of relative improvement. It is critical to note that the *most improved* over a specific time period does not mean *best* over that same time period. Industries like medical device, that have historically underperformed on supply chain processes, have greater upside for improvement than companies like consumer electronics who have led the charge for many years. Oftentimes, the results can be surprising and this distinction is critical.

Table 7 illustrates average performance for the six industries comprising the consumer value network over the time period of 2006-2012. It is clear that different industries started at, and progressed at, different rates throughout the seven years. Part of this is explained by the constraints of a business environment; another is the level of focus on supply chain within the companies.

Table 7. Industry Average (2006-2012)

Industry Averages (2006-2012)				
Industry	Year-over-Year Sales Growth	Operating Margin	Inventory Turns	Revenue per Employee (K$)
Retail	8%	0.06	10.1	403
Apparel	12%	0.11	3.6	310
Food & Beverage	5%	0.15	6.4	401
Consumer Packaged Goods	7%	0.15	5.3	545
Chemical	8%	0.11	5.1	628
Paper	8%	0.08	7.2	321

Source: Supply Chain Insights LLC, Corporate Annual Reports 2006-2012

The time period of study can also significantly impact the upside potential of an industry. Earlier, Table 2 illustrated the performance of the chemical industry over the period of 2006-2012. With a strength value of -0.03, the chemical industry ranked 5th out of 6 industries. However, for the narrower period of 2009-2012, the rebound from the Great Recession, the chemical industry demonstrated the most improvement in strength with a score of 0.15. In fact, the degree to which the industry struggled in the intervening years created an opportunity for the industry to strongly recover beginning in 2009. It is for this reason our analysis in this report focuses on two time periods for each industry: 2006-2012 and 2009-2012. For some industries and companies, their comparative ranking is similar across both time periods; for others, the results are starkly different.

Retail

The retail industry occupies a downstream location in the consumer value network enjoying a significant advantage with direct customer interaction. Use of loyalty data, merchandising, and assortment planning creates a distinct advantage for this industry. However, retailers struggle with low margins and a need to turn cycles quickly.

The performance of 14 large retailers from 2006-2012 is shown in Table 8. One might expect economies of scale to drive better supply chain processes in larger companies. However, the revenue values demonstrate that companies of all sizes are ranked widely throughout the Index. The retailers that have defined and adapted new formats perform better on the Index.

Table 8. The Supply Chain Index: Retail (2006-2012)

Company	2012 Revenue (billions USD)	Balance	Balance Ranking	Strength	Strength Ranking	Resiliency	Resiliency Ranking	Index (0.3B + 0.3S + 0.3R)	Ranking
Dollar General Corp.	14.8	0.00	3	0.13	3	0.50	4	3.0	1
Costco Wholesale Corporation	99.1	0.00	4	0.01	6	0.50	5	4.5	2
J Sainsbury plc	35.6	1.31	1	0.27	1	3.33	13	4.5	2
Kohl`s Corporation	18.8	-0.13	11	0.00	7	0.10	1	5.7	4
CVS Caremark Corporation	123.1	-0.05	7	0.18	2	1.69	10	5.7	5
Wal-Mart Stores	447	-0.06	8	0.02	5	0.77	7	6.0	6
Target Corporation	69.9	-0.13	10	-0.02	8	0.26	3	6.3	7
Walgreen Company	71.6	-0.23	13	0.02	4	0.73	6	6.9	8
The Kroger Co.	90.4	0.00	5	-0.03	10	1.55	9	7.2	9
Marks and Spencer Group Plc	15.9	1.13	2	-0.10	13	2.23	11	7.8	10
Safeway Inc.	44.2	-0.16	12	-0.03	9	1.03	8	8.7	11
Sears Holdings Corporation	41.6	-0.82	14	-0.32	14	0.21	2	9.0	12
Tesco PLC	102.2	-0.05	6	-0.04	11	3.81	14	9.3	13
Canadian Tire Corporation Limited	11.4	-0.13	9	-0.08	12	2.88	12	9.9	14

Source: Supply Chain Insights LLC, Corporate Annual Reports 2006-2012

Table 9. The Supply Chain Index: Retail (2009-2012)

Company	2012 Revenue (billions USD)	Balance	Balance Ranking	Strength	Strength Ranking	Resiliency	Resiliency Ranking	Index (0.3B + 0.3S + 0.3R)	Ranking
Dollar General Corp.	14.8	0.42	1	0.26	1	0.19	2	1.2	1
Target Corporation	69.9	0.24	2	0.03	5	0.30	4	3.3	2
Kohl`s Corporation	18.8	-1.78	10	0.04	3	0.07	1	4.2	3
CVS Caremark Corporation	123.1	0.05	3	0.03	4	1.33	10	5.1	4
Walgreen Company	71.6	-0.44	6	0.01	6	0.46	6	5.4	5
Wal-Mart Stores	447.0	-0.06	4	0.00	7	0.56	7	5.4	5
Costco Wholesale Corporation	99.1	-2.88	12	0.05	2	0.31	5	5.7	7
The Kroger Co.	90.4	-0.06	5	-0.13	11	1.18	9	7.5	8
Canadian Tire Corporation Limited	11.4	-0.53	7	-0.01	8	1.50	11	7.8	9
Safeway Inc.	44.2	-1.32	8	-0.84	13	1.01	8	8.7	10
Tesco PLC	102.2	-1.74	9	-0.05	9	3.39	13	9.3	11
Sears Holdings Corporation	41.6	-5.78	14	-2.22	14	0.22	3	9.3	11
Marks and Spencer Group Plc	15.9	-2.87	11	-0.16	12	2.16	12	10.5	13
J Sainsbury plc	35.6	-3.69	13	-0.05	10	4.72	14	11.1	14

Source: Supply Chain Insights LLC, Corporate Annual Reports 2009-2012

To understand the methodology, let's take an example. In the 2006-2012 period, **J Sainsbury plc** ranks first in both balance and strength. However, they faltered in resiliency demonstrating large swings in operating margin and inventory turns over the period. A narrower perspective starting in 2009 indicates that things only got worse for **Sainsbury**. The lack of resiliency in the longer time period is exacerbated in the period of 2009-2012.

Sainsbury falls down the list, and both balance and strength scores are much lower. It's not just **Sainsbury**. UK retailers in general have struggled in the shorter time period with a challenging economic environment. US retailers have done better, but not significantly so.

The Index shows that drug and dollar stores are doing better. A rising tide lifts all boats. With a greater urban population, and growth of the dollar store format, these retailers are growing faster. In periods of growth, it is easier to drive higher ROIC performance.

Apparel

Even within a single industry, all companies are not created equal. The apparel industry is generally bifurcated into two sub industries: fashion and basic commodity goods. The business environment and brand power are significantly different for the two. The strategy is different. Companies in both sub-industries have succeeded, but through different means. Table 10 illustrates performance for the industry for the period of 2006-2012.

Table 10. The Supply Chain Index: Apparel (2006-2012)

Company	2012 Revenue (billions USD)	Balance	Balance Ranking	Strength	Strength Ranking	Resiliency	Resiliency Ranking	Index (0.3B + 0.3S + 0.3R)	Ranking
VF Corp	10.9	0.11	3	0.04	1	0.36	2	1.8	1
Ralph Lauren Corp	6.9	0.14	2	0.01	2	0.52	7	3.3	2
Nike Inc	23.3	0.15	1	-0.01	5	0.39	6	3.6	3
Hanesbrands Inc.	4.5	-0.14	7	0.00	3	0.36	3	3.9	4
The Gap Inc.	14.5	-0.09	5	-0.03	6	0.39	5	4.8	5
adidas AG	19.1	-0.15	8	-0.06	8	0.32	1	5.1	6
Under Armour Inc	1.8	-0.10	6	0.00	4	0.55	8	5.4	7
PVH Corp	5.9	0.07	4	-0.06	7	0.66	9	6.0	8
Columbia Sportswear Company	1.7	-0.25	10	-0.11	10	0.37	4	7.2	9
Quiksilver, Inc.	2.0	-0.98	11	-0.07	9	0.70	10	9.0	10
True Religion Apparel, Inc.	0.5	-0.21	9	-0.16	11	1.63	11	9.3	11

Source: Supply Chain Insights LLC, Corporate Annual Reports 2006-2012

In 2006-2012, **VF Corp** leads the way in the Index overall with high scores in all three components. Rarely does a single company rank first on all three measures. However in order to rank high overall,

a company must balance all three measures. Notice that **Hanesbrands Inc.** ranks number four behind more brand driven companies like **VF**, **Ralph Lauren** and **Nike.**

A narrower set of years illustrates a slightly different picture. **Hanesbrands** and **Under Armour**, through investments in supply chain planning and downstream data, climb the charts. It is clear that the relatively young supply chain of **Under Armour** is maturing and gaining ground.

Table 11. The Supply Chain Index: Apparel (2009-2012)

Company	2012 Revenue (billions USD)	Balance	Balance Ranking	Strength	Strength Ranking	Resiliency	Resiliency Ranking	Index (0.3B + 0.3S + 0.3R)	Ranking
Hanesbrands Inc.	4.5	-0.27	9	0.13	1	0.40	3	3.9	1
Under Armour Inc	1.8	0.21	5	0.05	4	0.42	5	4.2	2
Columbia Sportswear Company	1.7	-0.16	6	0.00	7	0.32	2	4.5	3
Nike Inc	23.3	1.59	4	0.07	3	0.56	8	4.5	3
adidas AG	19.1	-0.20	7	0.03	5	0.41	4	4.8	5
Ralph Lauren Corp	6.9	2.27	3	0.02	6	0.62	9	5.4	6
VF Corp	10.9	-1.09	11	0.13	2	0.45	6	5.7	7
The Gap Inc.	14.5	-0.30	10	-0.04	9	0.31	1	6.0	8
Quiksilver, Inc.	2.0	7.26	1	-0.14	10	0.66	10	6.3	9
PVH Corp	5.9	2.98	2	-0.01	8	0.93	11	6.3	9
True Religion Apparel, Inc.	0.5	-0.23	8	-0.19	11	0.47	7	7.8	11

Source: Supply Chain Insights LLC, Corporate Annual Reports 2009-2012

Finally, consider the resiliency scores of the apparel manufacturers compared to the retailers profiled earlier. Retail has some of the worst resiliency scores while apparel has some of the best. This is interesting because the retailer has some of the shortest supply chains while apparel has some of the longest. The resiliency metric is arguably the one most directly related to supply chain maturity and complexity, with supply chain leaders exerting significant control over both operating margin and inventory turns performance.

Food & Beverage

Food & beverage manufacturers struggle with the unique challenges of volatility in commodity prices, high seasonal fluctuations from both supply and demand sides, as well as regional food profiles that make global management challenging. Figure 8 illustrates several key commodity price patterns since 1997. Not only are prices rising, but so too is volatility.

Figure 8. Commodity Volatility (1997-2013)

Commodity Volatility

Wheat ↑ 91%
Corn ↑ 156%
Beef ↑ 140%
Coffee ↑ 56%
Cotton ↑ 7%
Sugar ↑ 76%
Crude Oil ↑ 276%

2008-2013: Higher Levels of Volatility

Source: IndexMundi, based on annual data from January of each year; % increase based on comparison of 2013 vs. 1997
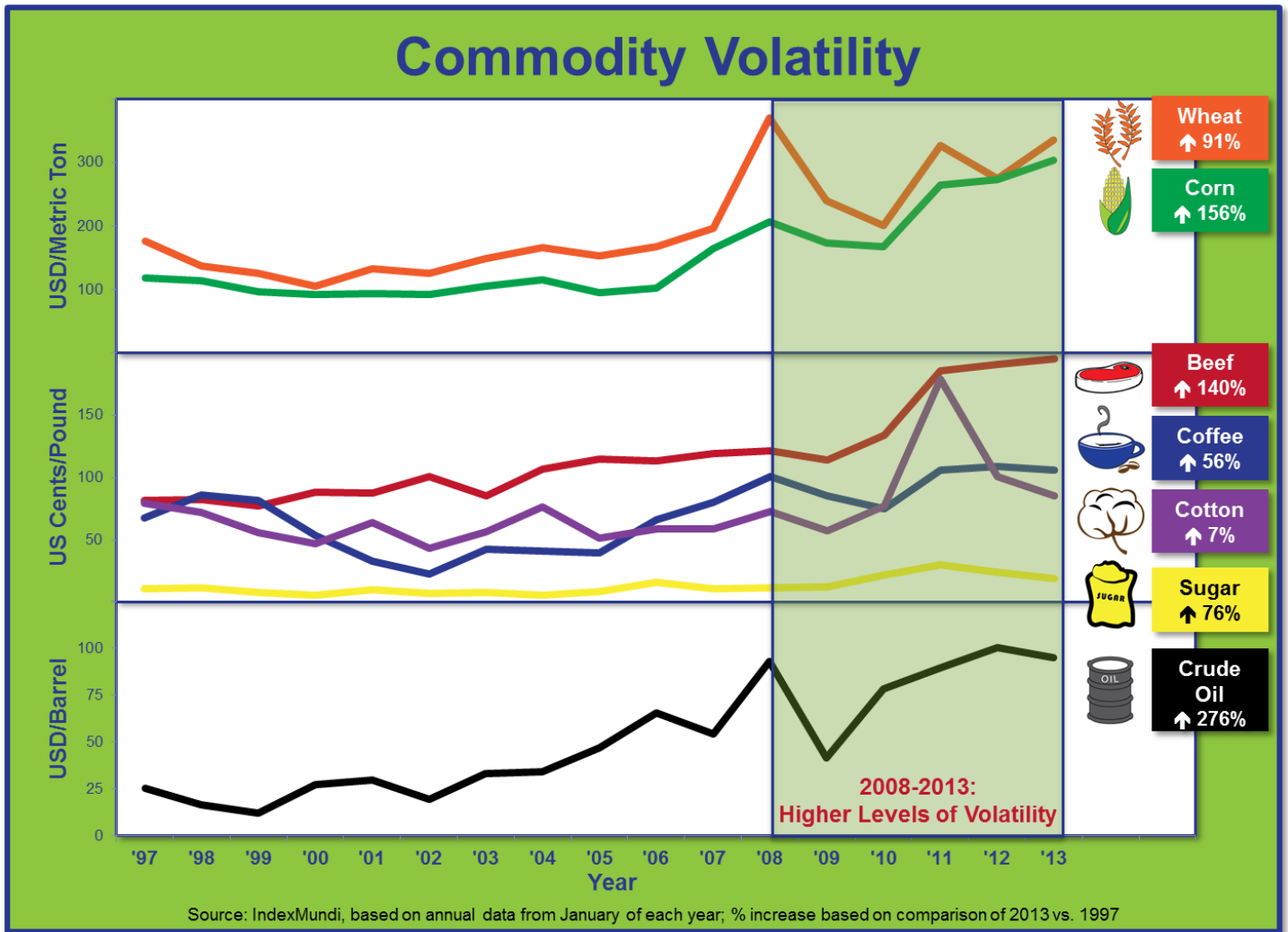
For food & beverage manufacturers, performance across both time periods, 2006-2012 and 2009-2012, is similar at the top of the rankings. **Campbell Soup Company** and **Hershey Co** place one and two respectively in both time periods. Both companies have invested in significant demand-driven initiatives. **Campbell** has focused on improving reliability and decreasing complexity while **Hershey** has focused on the use of downstream data and more advanced demand planning techniques. Further down the rankings, the story is more complex. Table 12 shows performance for the period of 2006-2012.

Economics of scale are nonexistent in the food & beverage rankings. Relatively small companies have ranked high, while larger giants such as **Danone, Kraft, PepsiCo** and **Kellogg Company** have struggled to make improvements. In fact, this is one industry where we find that a smaller company has an advantage on the Effective Frontier.

Table 12. The Supply Chain Index: Food & Beverage (2006-2012)

Company	2012 Revenue (billions USD)	Balance	Balance Ranking	Strength	Strength Ranking	Resiliency	Resiliency Ranking	Index (0.3B + 0.3S + 0.3R)	Ranking
Campbell Soup Company	7.2	0.32	5	0.02	11	0.33	5	6.3	1
Hershey Co	6.6	0.43	2	0.01	12	0.60	8	6.6	2
Diageo plc	17.0	0.18	8	0.00	16	0.08	1	7.5	3
Nestle SA	98.3	-0.09	15	0.04	7	0.32	4	7.8	4
H.J. Heinz Company	11.6	0.09	10	0.03	10	0.51	7	8.1	5
Maple Leaf Foods Inc.	4.9	-0.01	11	0.50	1	1.42	17	8.7	6
Glanbia plc	2.8	0.39	4	0.10	6	1.71	19	8.7	6
General Mills, Inc.	16.7	0.41	3	-0.01	17	0.64	10	9.0	8
Coca-Cola Enterprises Inc	8.1	0.20	7	0.34	2	5.33	22	9.3	9
SABMiller plc	21.8	-0.08	13	0.03	8	0.76	11	9.6	10
The J.M. Smucker Company	5.5	0.28	6	0.01	13	0.79	13	9.6	10
Molson Coors Brewing Company	3.9	0.15	9	0.20	3	1.96	20	9.6	10
Mead Johnson Nutrition CO	3.9	-0.08	14	-0.04	20	0.32	3	11.1	13
The Coca-Cola Company	48.0	-0.11	16	0.01	14	0.61	9	11.7	14
Carlsberg A/S	11.5	-0.18	19	0.17	4	1.21	16	11.7	14
Anheuser Busch Inbev SA	39.8	-0.12	17	0.11	5	1.62	18	12.0	16
Hillshire Brands Co	4.0	1.66	1	-0.03	18	2.48	21	12.0	16
ConAgra Foods, Inc.	13.4	-0.33	21	0.03	9	0.85	14	13.2	18
Kraft Foods Group Inc	18.3	-0.61	22	-0.08	21	0.11	2	13.5	19
PepsiCo	65.5	-0.27	20	-0.03	19	0.39	6	13.5	19
Kellogg Company	14.2	-0.05	12	-0.08	22	0.79	12	13.8	21
Danone S A	26.8	-0.17	18	0.00	15	1.12	15	14.4	22

Source: Supply Chain Insights LLC, Corporate Annual Reports 2006-2012

Note the differences between competitors. While **General Mills, Inc.** scores high on the 2006-2012 Index, its competitor **Kellogg Company** scores poorly. **General Mills** is a company that we admire for their use of technology. The company implemented ERP once and well, while **Kellogg** is undergoing their third implementation of ERP.

A regional focus, as opposed to global governance, can be an advantage for these companies where customer preferences vary so significantly across the globe. Rankings for the 2009-2012 period are shown in Table 14.

Table 14. The Supply Chain Index: Food & Beverage (2009-2012)

Company	2012 Revenue (billions USD)	Balance	Balance Ranking	Strength	Strength Ranking	Resiliency	Resiliency Ranking	Index (0.3B + 0.3S + 0.3R)	Ranking
Campbell Soup Company	7.2	0.10	6	0.05	4	0.38	4	4.2	1
Hershey Co	6.6	0.66	3	0.04	5	0.45	8	4.8	2
The J.M. Smucker Company	5.5	-0.07	7	0.03	6	0.49	9	6.6	3
Nestle SA	98.3	-0.86	18	0.07	3	0.20	2	6.9	4
H.J. Heinz Company	11.6	1.90	2	-0.03	13	0.53	10	7.5	5
Diageo plc	17.0	-0.61	16	0.02	9	0.12	1	7.8	6
PepsiCo	65.5	11.09	1	-0.04	15	0.57	11	8.1	7
SABMiller plc	21.8	-2.01	21	0.12	2	0.39	5	8.4	8
Maple Leaf Foods Inc.	4.9	-0.19	10	0.22	1	1.32	18	8.7	9
Carlsberg A/S	11.5	-0.07	8	0.01	11	0.73	12	9.3	10
Anheuser Busch Inbev SA	39.8	-0.26	11	-0.03	14	0.44	6	9.3	10
ConAgra Foods, Inc.	13.4	-0.13	9	-0.09	19	0.31	3	9.3	10
General Mills, Inc.	16.7	0.26	4	0.00	12	0.88	15	9.3	10
Mead Johnson Nutrition CO	3.9	-1.40	19	0.03	8	0.44	7	10.2	14
The Coca-Cola Company	48.0	-0.78	17	0.03	7	0.78	13	11.1	15
Molson Coors Brewing Company	3.9	-0.54	14	0.02	10	0.88	16	12.0	16
Coca-Cola Enterprises Inc	8.1	0.24	5	-0.04	16	1.43	19	12.0	16
Danone S A	26.8	-0.39	12	-0.04	17	0.90	17	13.8	18
Hillshire Brands Co	4.0	-0.47	13	-0.16	20	3.35	20	15.9	19
Glanbia plc	2.8	-0.60	15	-0.07	18	3.91	21	16.2	20
Kellogg Company	14.2	-1.78	20	-0.17	21	0.78	14	16.5	21

Source: Supply Chain Insights LLC, Corporate Annual Reports 2009-2012

Consumer Packaged Goods

While consumer packaged goods manufacturers are often considered as peers to food & beverage manufacturers, we believe the industries are significant enough to analyze separately. Consumer packaged goods manufacturers have led the charge within the consumer value network on supply chain maturity. The industry is being attacked by retailers with house brands, and new start-ups in emerging economies. Growth is stalled. Marketing in new product launch is no longer as easy as putting a new product on a TV show and driving demand.

Because of this level of maturity and advanced processes, the industry as a whole ranked low in Tables 2 and 3. When supply chain excellence has been a focus for decades, there is less room for improvement than for companies and industries that have lagged in a focus on supply chain. Table 15 illustrates performance for the industry from 2006-2012.

Table 15. The Supply Chain Index: Consumer Packaged Goods (2006-2012)

Company	2012 Revenue (billions USD)	Balance	Balance Ranking	Strength	Strength Ranking	Resiliency	Resiliency Ranking	Index (0.3B + 0.3S + 0.3R)	Ranking
Estee Lauder Companies Inc	9.7	0.49	2	0.05	5	0.18	2	2.7	1
Church & Dwight Co., Inc.	2.9	0.04	3	0.09	3	0.71	12	5.4	2
Colgate-Palmolive Company	17.1	-0.08	9	0.05	6	0.19	3	5.4	2
Avon Rubber plc	0.2	7.44	1	0.33	2	2.29	16	5.7	4
L`oreal S.A	28.9	-0.04	7	0.01	13	0.18	1	6.3	5
Unilever N.V.	65.9	-0.03	5	0.06	4	0.89	13	6.6	6
Beiersdorf AG	7.8	-0.10	10	0.04	8	0.20	4	6.6	6
Reckitt Benckiser Group Plc	15.2	-0.13	12	0.04	7	0.54	9	8.4	8
British American Tobacco plc	24.1	-0.10	11	-0.01	15	0.26	5	9.3	9
Kao Corporation	12.7	-0.34	16	0.03	9	0.44	7	9.6	10
The Clorox Co	5.5	-0.03	6	-0.01	16	0.65	10	9.6	10
The Valspar Corporation	4.0	-0.07	8	0.03	10	1.00	14	9.6	10
Imperial Tobacco Group PLC	45.0	-0.82	17	0.34	1	1.19	15	9.9	13
Kimberly Clark Corp	21.1	-0.13	13	0.01	12	0.48	8	9.9	13
Scotts Miracle-Gro Co	2.8	-0.14	14	0.00	14	0.43	6	10.2	15
The Procter & Gamble Company	83.7	-0.17	15	0.01	11	0.65	11	11.1	16
Lorillard Inc.	6.6	-0.02	4	-0.04	17	2.32	17	11.4	17

Source: Supply Chain Insights LLC, Corporate Annual Reports 2006-2012

What is the story here? Overall, nontraditional consumer packaged goods companies have made the most progress. The beauty category continued to grow post-recession, while basic consumer goods are being pressed for more value-based pricing and struggling for growth. As a result, companies like **Estee Lauder Companies Inc**, **L'oreal S.A.** and **Beiersdorf** rank high on the Index for 2006-2012. Table 16 illustrates performance for the period of 2009-2012. In the shorter time period, **L'oreal S.A.** climbs to the top even with a negative balance performance of -0.21. In fact, all but three of the 17 companies lose ground from 2009 to 2012 on their balance performance (vector trajectory of growth and return on invested capital).

While **P&G** is believed to be the de facto supply chain leader, the company has lost significant ground on operating margin over the last six years, which hurts the company's rating on the Supply Chain Index. In contrast, while **Colgate** has driven 42 consecutive quarters of operating margin results, **P&G**'s investments in demand sensing and advanced planning, along with a focus on inventory, has improved the inventory levels by ten days when contrasted with **Colgate**'s. The rising star of the industry is **Unilever**.

Table 16. The Supply Chain Index: Consumer Packaged Goods (2009-2012)

Company	2012 Revenue (billions USD)	Balance	Balance Ranking	Strength	Strength Ranking	Resiliency	Resiliency Ranking	Index (0.3B + 0.3S + 0.3R)	Ranking
L`oreal S.A	28.9	-0.21	6	0.05	6	0.17	3	4.5	1
Beiersdorf AG	7.8	-0.13	4	0.01	10	0.17	2	4.8	2
Estee Lauder Companies Inc	9.7	-0.34	9	0.41	2	0.25	6	5.1	3
Avon Rubber plc	0.2	2.98	1	0.77	1	1.52	16	5.4	4
British American Tobacco plc	24.1	2.39	2	-0.03	13	0.19	4	5.7	5
Church & Dwight Co., Inc.	2.9	0.37	3	0.06	4	0.65	13	6.0	6
Unilever N.V.	65.9	-0.27	7	0.05	5	0.76	14	7.8	7
Kao Corporation	12.7	-18.22	16	0.17	3	0.41	8	8.1	8
The Valspar Corporation	4.0	-0.16	5	0.04	7	1.03	15	8.1	8
Colgate-Palmolive Company	17.1	-36.10	17	-0.01	11	0.09	1	8.7	10
Scotts Miracle-Gro Co	2.8	-0.44	10	0.02	8	0.63	12	9.0	11
Kimberly Clark Corp	21.1	-0.59	11	-0.06	16	0.35	7	10.2	12
Reckitt Benckiser Group Plc	15.2	-0.64	12	-0.03	12	0.54	10	10.2	12
The Clorox Co	5.5	-0.96	14	0.02	9	0.55	11	10.2	12
The Procter & Gamble Company	83.7	-0.71	13	-0.03	14	0.48	9	10.8	15
Imperial Tobacco Group PLC	45.0	-1.48	15	-0.16	17	0.23	5	11.1	16
Lorillard Inc.	6.6	-0.31	8	-0.05	15	2.59	17	12.0	17

Source: Supply Chain Insights LLC, Corporate Annual Reports 2009-2012

Consumer packaged goods companies have a long legacy of delivering supply chain excellence. Their performance was relatively stable through the Great Recession. This story of stability in operations and supply chain performance is very different from the one experienced by most chemical companies.

Chemical

Chemical companies operate in a downstream orientation of the supply chain and experience the worst of the bullwhip effect. The Great Recession hit hard and many companies struggled to persevere. During the worst of it, **Du Pont** took a significant portion of their footprint offline while **Dow** persevered through the Rohm and Haas acquisition and the K-Dow deal.

Over the period, the most resilient company (**Syngenta AG**) turned in a resiliency score of 0.14. Overall, the industry averaged 0.85. Compare these large resiliency scores with the 2009-2012 analysis.

Table 17. The Supply Chain Index: Chemical (2006-2012)

Company	2012 Revenue (billions USD)	Balance	Balance Ranking	Strength	Strength Ranking	Resiliency	Resiliency Ranking	Index (0.3B + 0.3S + 0.3R)	Ranking
Lanxess AG	11.7	0.29	3	0.09	2	0.43	6	3.3	1
Monsanto Company	13.5	0.13	5	0.09	4	0.27	2	3.3	1
Givaudan S.A.	4.5	-0.04	8	0.01	9	0.32	3	6	3
Henkel AG & Co KGaA	21.2	-0.15	11	0.09	3	0.46	7	6.3	4
Asian Paints Ltd	2.0	0.09	6	0.06	8	0.52	8	6.6	5
Syngenta AG	14.2	-1.67	18	0.08	5	0.14	1	7.2	6
FMC Corp	3.7	0.34	2	0.07	6	1.47	16	7.2	6
E I Du Pont De Nemours And Co	35.3	0.02	7	-0.07	16	0.41	5	8.4	8
Ecolab Inc.	11.8	1.31	1	-0.04	13	1.21	15	8.7	9
BASF SE	101.2	-0.05	9	-0.01	11	0.77	10	9	10
Huntsman Corporation	11.2	-0.21	13	0.00	10	0.53	9	9.6	11
Air Liquide	19.7	-0.16	12	0.07	7	1.15	14	9.9	12
Westlake Chemical Corporation	3.6	-0.25	15	0.17	1	2.19	18	10.2	13
Sasol Limited	21.8	-0.06	10	-0.06	14	1.06	12	10.8	14
Eastman Chemical Company	8.1	0.21	4	-0.06	15	1.92	17	10.8	14
Celanese Corporation	6.4	-0.24	14	-0.03	12	0.93	11	11.1	16
Chemtura Corp	2.6	-1.05	17	-0.84	18	0.35	4	11.7	17
The Dow Chemical Company	56.8	-0.43	16	-0.13	17	1.09	13	13.8	18

Source: Supply Chain Insights LLC, Corporate Annual Reports 2006-2012

In the more recent time period, the most resilient company was still **Syngenta AG** with a score of 0.10 amid an industry average of 0.77. In addition, the giants of the industry like **Dow Chemical Company**, **BASF SE** and **E. I. du Pont de Nemours and Company** made significant progress. These large companies were hit hard in the Great Recession and have made progress since 2009.

It is hard to turn a big ship. At over $101 billion in annual revenue, **BASF**'s improved performance across the board on the Index is impressive. The company's focus on supply chain excellence and the use of new forms of analytics played a major role.

Table 18. The Supply Chain Index: Chemical (2009-2012)

Company	2012 Revenue (billions USD)	Balance	Balance Ranking	Strength	Strength Ranking	Resiliency	Resiliency Ranking	Index (0.3B + 0.3S + 0.3R)	Ranking
Lanxess AG	11.7	0.56	2	0.67	3	0.45	8	3.9	1
Monsanto Company	13.5	1.31	1	0.07	10	0.32	4	4.5	2
BASF SE	101.2	0.41	6	0.22	5	0.37	6	5.1	3
The Dow Chemical Company	56.8	0.42	5	0.99	1	0.67	11	5.1	3
Westlake Chemical Corporation	3.6	0.54	3	0.97	2	0.71	12	5.1	3
Celanese Corporation	6.4	-0.30	11	0.11	6	0.28	3	6	6
E I Du Pont De Nemours And Co	35.3	-0.28	10	0.02	14	0.12	2	7.8	7
Givaudan S.A.	4.5	-0.35	13	0.08	9	0.34	5	8.1	8
Asian Paints Ltd	2.0	0.49	4	0.05	11	0.79	13	8.4	9
Henkel AG & Co KGaA	21.2	0.21	7	0.22	4	2.97	18	8.7	10
Syngenta AG	14.2	-0.73	16	0.02	13	0.10	1	9	11
Air Liquide	19.7	-0.16	9	0.08	8	0.93	14	9.3	12
Huntsman Corporation	11.2	-0.16	8	-0.15	17	0.55	10	10.5	13
Sasol Limited	21.8	-0.30	12	0.01	15	0.51	9	10.8	14
FMC Corp	3.7	-0.45	15	0.09	7	1.24	16	11.4	15
Eastman Chemical Company	8.1	-0.45	14	0.02	12	1.23	15	12.3	16
Chemtura Corp	2.6	-1.11	17	-0.74	18	0.42	7	12.6	17
Ecolab Inc.	11.8	-6.89	18	-0.02	16	1.76	17	15.3	18

Source: Supply Chain Insights LLC, Corporate Annual Reports 2009-2012

Paper

Similar to the chemical industry, the paper industry is located downstream and far removed from the ultimate end-consumer. It is an asset-intensive industry that is closely coupled to the demand of downstream partners. These companies are not known as supply chain leaders. Instead, their focus has been on manufacturing excellence and transportation efficiency.

As can be seen in the charts on the Index performance for the last seven years, there is significant room for supply chain improvement within the industry. Performance for 2006-2012 is shown in Table 19.

The decline in growth for CPG and food & beverage manufacturers had an impact. As a result, the paper industry struggled with balance in both time periods, i.e. 2006-2012 and 2009-2012. The struggle for balance was worse for the second period. The vast majority of companies in this peer group for the time frames lost ground on both growth and return on invested capital. With low or negative growth, everything becomes significantly more challenging. In this tough environment, a conservative company like **Crown Holdings** demonstrates the greatest improvement.

Table 19. The Supply Chain Index: Paper (2006-2012)

Company	2012 Revenue (billions USD)	Balance	Balance Ranking	Strength	Strength Ranking	Resiliency	Resiliency Ranking	Index (0.3B + 0.3S + 0.3R)	Ranking
Packaging Corp of America	2.8	0.01	5	0.07	5	0.55	4	4.2	1
Crown Holdings, Inc.	8.5	-0.22	10	0.09	4	0.46	1	4.5	2
AptarGroup, Inc.	2.3	-0.08	6	0.02	8	0.47	2	4.8	3
Graphic Packaging Holding Company	4.3	0.43	2	0.13	3	0.86	11	4.8	3
Ball Corporation	8.7	-0.14	7	0.03	7	0.49	3	5.1	5
Rock-Tenn Company	9.2	0.29	3	0.05	6	1.28	12	6.3	6
Boise Inc.	2.6	-0.98	13	0.58	2	0.65	6	6.3	6
Sonoco Products Company	4.8	0.08	4	-0.02	10	0.71	7	6.3	6
Sealed Air Corp	7.6	0.45	1	-0.41	13	0.73	8	6.6	9
MeadWestvaco Corp.	5.5	-0.31	12	0.87	1	0.80	10	6.9	10
Silgan Holdings Inc.	3.6	-0.17	8	0.02	9	0.76	9	7.8	11
Bemis Company, Inc.	5.1	-0.29	11	-0.02	11	0.59	5	8.1	12
Greif, Inc.	4.3	-0.21	9	-0.07	12	1.76	13	10.2	13

Source: Supply Chain Insights LLC, Corporate Annual Reports 2006-2012

Table 20. The Supply Chain Index: Paper (2009-2012)

Company	2012 Revenue (billions USD)	Balance	Balance Ranking	Strength	Strength Ranking	Resiliency	Resiliency Ranking	Index (0.3B + 0.3S + 0.3R)	Ranking
Crown Holdings, Inc.	8.5	-0.15	4	0.06	1	0.44	4	2.7	1
AptarGroup, Inc.	2.3	-0.14	3	-0.01	5	0.32	2	3.0	2
Packaging Corp of America	2.8	-0.76	9	-0.01	4	0.18	1	4.2	3
Ball Corporation	8.7	-0.54	8	0.01	3	0.61	5	4.8	4
Sonoco Products Company	4.8	-0.51	7	0.01	2	0.72	8	5.1	5
Graphic Packaging Holding Company	4.3	2.22	1	-0.03	8	0.92	9	5.4	6
Bemis Company, Inc.	5.1	-0.11	2	-0.09	9	0.68	7	5.4	6
MeadWestvaco Corp.	5.5	-0.50	6	-0.03	6	1.26	11	6.9	8
Greif, Inc.	4.3	-0.36	5	-0.03	7	1.53	12	7.2	9
Boise Inc.	2.6	-0.98	11	-0.17	12	0.37	3	7.8	10
Silgan Holdings Inc.	3.6	-0.87	10	-0.10	10	0.67	6	7.8	10
Sealed Air Corp	7.6	-2.27	12	-0.87	13	0.97	10	10.5	12
Rock-Tenn Company	9.2	-25.65	13	-0.14	11	2.03	13	11.1	13

Source: Supply Chain Insights LLC, Corporate Annual Reports 2009-2012

Through great work in Sales and Operations Planning, **Sonoco Products**, a major provider to **P&G** moves up the stack of relative peer ratings while a supply chain laggard, **Rock-Tenn Company**, falls to the bottom of the list.

Who We Admire

In doing this work, companies will ask us, "Who do you admire? Where can we learn the most about the definition of supply chain excellence?" Our answer may surprise you. Here we give our response by category:

- Retail: The work by **CVS Caremark Corporation**, **Walgreen Company** and **Wal-Mart Stores** remains impressive. **Target**'s turnaround is also noteworthy.

- Apparel: **Under Armour Inc** is a fabulous story of supply chain excellence. And, while **VF Corp** falls down the chart, we feel that it is due to the uneven progress on supply chain excellence in their coalitions. The progress of **Hanesbrands** and **Columbia Sportswear Company** are also notable.

- Food & Beverage: We love the story of **The Hershey Company** turnaround. While **Campbell's** work is significant, it did not happen at the same pace of **Hershey**. The improvements by **The J. M. Smucker Company** and **Nestle SA** are also impressive.

- Consumer Packaged Goods: The work by **Beiersdorf AG** is a classic supply chain turnaround story driven by hard work and focus. While **Colgate** and **P&G**'s progress is stalled, the question is, "Can the **Unilever** work be sustained?"

- Chemical: Our pick in chemical is **BASF SE**. The improvement in **BASF**, a very large company, in a turbulent time is also a great case study of supply chain excellence.

- Paper: While **Crown Holdings, Inc.** is a classic case study of a focus on maximizing profitability, we are impressed by the results of **Sonoco Products Company**. They made progress despite the major downturn in growth of their customers and the aggressive shift in days of payables by their upstream customers.

Conclusion

The goal of the Supply Chain Index is to provide a tool for the measurement of supply chain improvement over time. It is a measurement of improvement. It should never be used to determine who does supply chain best. Supply chain excellence is less about the destination than it is about the journey.

In this value network, progress in supply chain excellence has slowed. Companies are in a transition. While the last decade was about global expansion, this decade is about defining excellence in global

operations. To accomplish this goal, many companies will need to adopt new technologies and practices to redefine processes outside-in, from the customer back. Investment in horizontal processes like S&OP, new forms of analytics for market sensing and orchestration, and the evolution of B2B networks offers promise. However, one thing is clear: the evolution of collaborative processes by the parties in this value network may have improved individual buy/sell relationships, but it did not improve the basics of the metrics that underlie the consumer value network.

Overall, the industries have pushed cost and waste backwards in the value chain without redefining for value. Let's take an example. While the cost of capital is much better for **P&G** than **Rock-Tenn**, the elongation of payables without the improvement in a demand signal is pushing these costs backwards into the supply chain versus a redefinition for value. As a result, it is difficult for all to make progress on the Effective Frontier.

Appendix

The specific methodology and development of the three metrics is diagrammed below with the assistance of Dr. George Runger and Bahareh Azarnoush of Arizona State University.

Balance

The definition of balance is based on the analysis of a scatter plot, or orbit chart over time, of revenue growth and return on invested capital for a specific company. The balance measure (B) is defined similar to the strength measure but now at the intersection of revenue growth and return on invested capital. Let REV_i denote the revenue growth of the ith time period, $ROIC_i$ denote the return on invested capital of the ith time period and n denote the total number of periods under consideration. Thus balance is defined as

$$B = \frac{1}{n-1}\left(\frac{REV_n - REV_1}{REV_1} + \frac{ROIC_n - ROIC_1}{ROIC_1}\right).$$

Strength

The definition of strength is based on the analysis of a scatter plot, or orbit chart over time, of operating margin and inventory turns for a specific company. Consider a scatter plot of operating margin and inventory turns for a specific company. Let OM_i denote the operating margin of the ith time period (e.g. i^{th} year), IT_i denote the inventory turns of the ith time period and n denote the total number of periods under consideration. The strength measure (S) is defined as

$$S = \frac{1}{n-1}\left(\frac{OM_n - OM_1}{OM_1} + \frac{IT_n - IT_1}{IT_1}\right)$$

The denominator reflects that there are *n-1* differences between *n* time periods. Figure A depicts the intersection of operating margin and inventory turns for an example company. The difference in operating margin and inventory turns between the first and last time period is depicted.

Figure A. Inventory Turns and Operating Margin Intersection for an Example Company
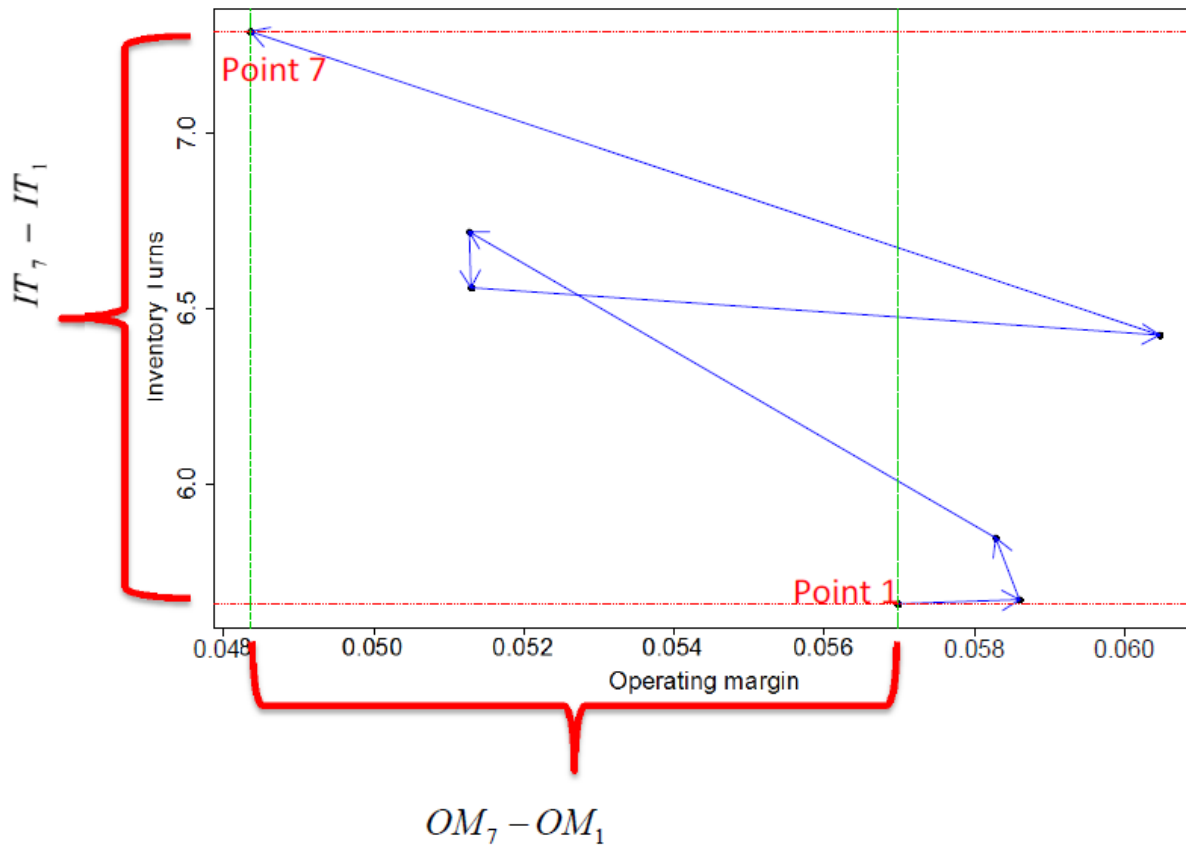
Resiliency

Consider a scatter plot of operating margin and inventory turns for a specific company. Let d_{ij} denote the Euclidean distance between a pair of points i and j and let m denote the total number of pairs. The resiliency measure (R) is defined as the mean distance of all possible pairs of points at the intesection. That is,

$$R = \frac{1}{m}\sum_{i}\sum_{j>i}d_{ij}$$

Figure B shows an example of the operating margin and inventory turns intersection for an example company. Table A shows the distances between every possible pair of points at the intersection. The resiliency is calculated from the mean of the distance values and is equal to 0.7335.

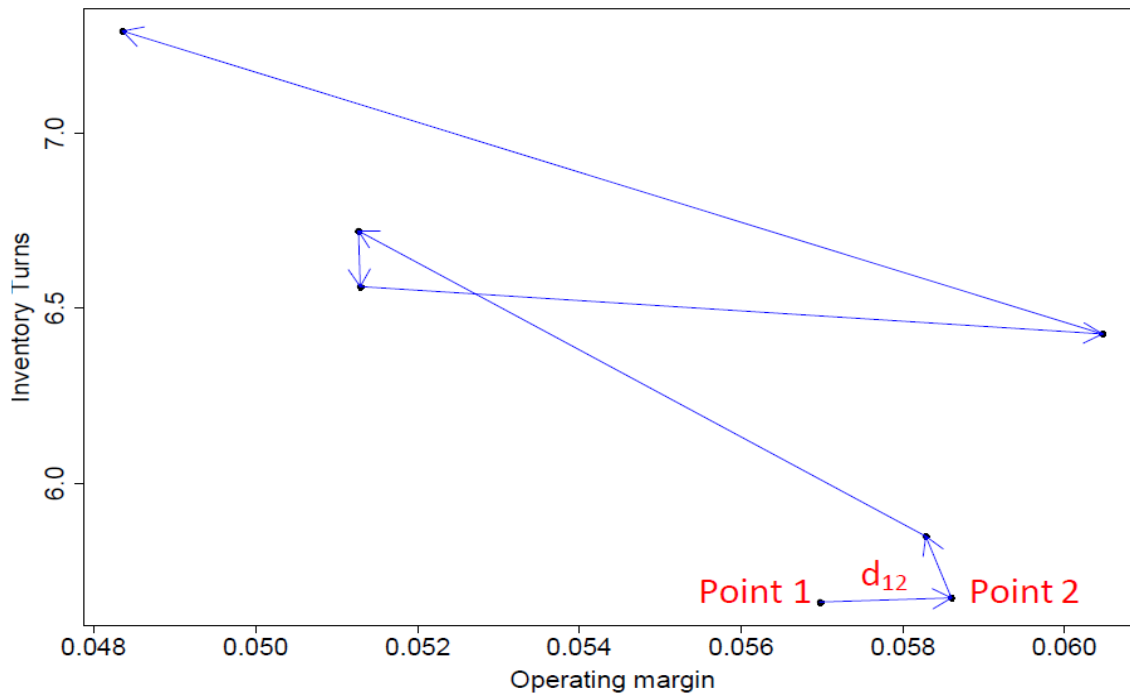**Figure B. Inventory Turns and Operating Margin Intersection for an Example Company**

Table A. Euclidean Distances for an Example Company.

0.013255					
0.18865	0.17549				
1.061544	1.0484	0.872912			
0.901407	0.888264	0.712778	0.16014		
0.766595	0.753434	0.577946	0.295086	0.135114	
1.630622	1.617476	1.441988	0.569077	0.729216	0.864097

Alternative Measures Considered

Principal components analysis (PCA) is a traditional method to summarize multi-dimensional data. We considered measures commonly applied with PCA based on eigenvalues and eigenvectors. (e.g., the condition index, percentage of variance explained by the first principal component). Although these measures were reasonable they did not distinguish between orbit plots that were visually different as well as simpler approaches. We also considered other measures based on the distances (e.g., sum, maximum, minimum and the coefficient of variation of the distances). The mean distance

was finally selected to measure the compactness of a set of points. In fact, a similar measure called cohesion is frequently used in cluster analysis to measure the compactness of a set of points. Rather than taking the sum of distances (as in cohesion), we consider the mean to account for the potentially different number of points for each company.

Other Reports About The Index

Supply Chain Metrics That Matter: Improving Supply Chain Resiliency

Published by Supply Chain Insights in March 2014

Supply Chain Index: Improving Strength, Balance and Resiliency

Published by Supply Chain Insights in April 2014

Endnote:

1 While we would love to profile case fill rate performance, we struggle to find an industry-to-industry benchmark that can be reliably used for comparison. As a result, we focus in the report on only corporate balance sheet data.

About Supply Chain Insights, LLC

Founded in February, 2012 by Lora Cecere, Supply Chain Insights LLC is focused on delivering **independent, actionable, and objective advice for supply chain leaders**. If you need to know which practices and technologies make the biggest difference to corporate performance, turn to us. We are a company dedicated to this research. We help you understand supply chain trends, evolving technologies and which metrics matter.

About Lora Cecere

Lora Cecere (twitter ID @lcecere) is the Founder of Supply Chain Insights LLC and the author of popular enterprise software blog Supply Chain Shaman currently read by 5,000 supply chain professionals. She also writes as a Linkedin Influencer and is a a contributor for Forbes. Her book, *Bricks Matter*, (co-authored with Charlie Chase) published on December 26th, 2012. She is currently working on a second book, *Metrics That Matter*, to publish in 2014.

With over ten years as a research analyst with **AMR Research, Altimeter Group, and Gartner Group** and now as a Founder of Supply Chain Insights, Lora understands supply chain. She has worked with over 600 companies on their supply chain strategy and speaks at over 50 conferences a year on the evolution of supply chain processes and technologies. Her research is designed for the early adopter seeking first mover advantage.

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. Her supply chain interests include connecting financial performance and supply chain excellence, as well as talent management issues and emerging markets. Abby has a B.A. in International Politics and Economics from Middlebury College and a M.S. in International Supply Chain Management from Plymouth University in the United Kingdom. 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?!?!