



# Supply Chain Metrics That Matter: Improving Supply Chain Resiliency

Insights on Reliability at the Intersection of  
Operating Margin and Inventory Turns

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# Contents

- Research ..... 2
- Disclosure ..... 2
- Research Methodology ..... 2
- Executive Overview ..... 3
- Medical Device Companies..... 6
- Consumer Packaged Goods ..... 7
- Food ..... 8
- Pharmaceuticals ..... 9
- Chemical.....10
- Consumer Electronics ..... 11
- Recommendations ..... 12
- Conclusion ..... 12
- Overview of Methodology..... 12
- Other Reports in the Metrics That Matter Series: ..... 14
- About Supply Chain Insights LLC.....15
- About Lora Cecere ..... 15

## Research

*Supply Chain Metrics That Matter* is a series of monthly reports published from August, 2012 through present time by Supply Chain Insights LLC. Each has been a deep focus on a specific industry.

In these reports, we analyzed how companies made trade-offs over the course of the last decade in balancing growth, profitability, cycles and complexity. In this report, we take a different approach. Here we take a closer look at industry performance at the intersection of operating margin and inventory turns. We have developed a methodology to determine corporate reliability at this critical intersection.

Within the world of Supply Chain Management (SCM), each industry is unique. We believe that it is dangerous to list all industries in a spreadsheet and declare a supply chain leader. Instead, we believe that we have to evaluate change over time by peer group. In this series of reports, we analyze the potential of each supply chain peer group, share insights from industry leaders from each industry, and give recommendations based on general market trends.

## 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](#).

These reports are intended for you to read, share and use to improve your supply chain decisions. Please share this data freely within your company and across your industry. 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

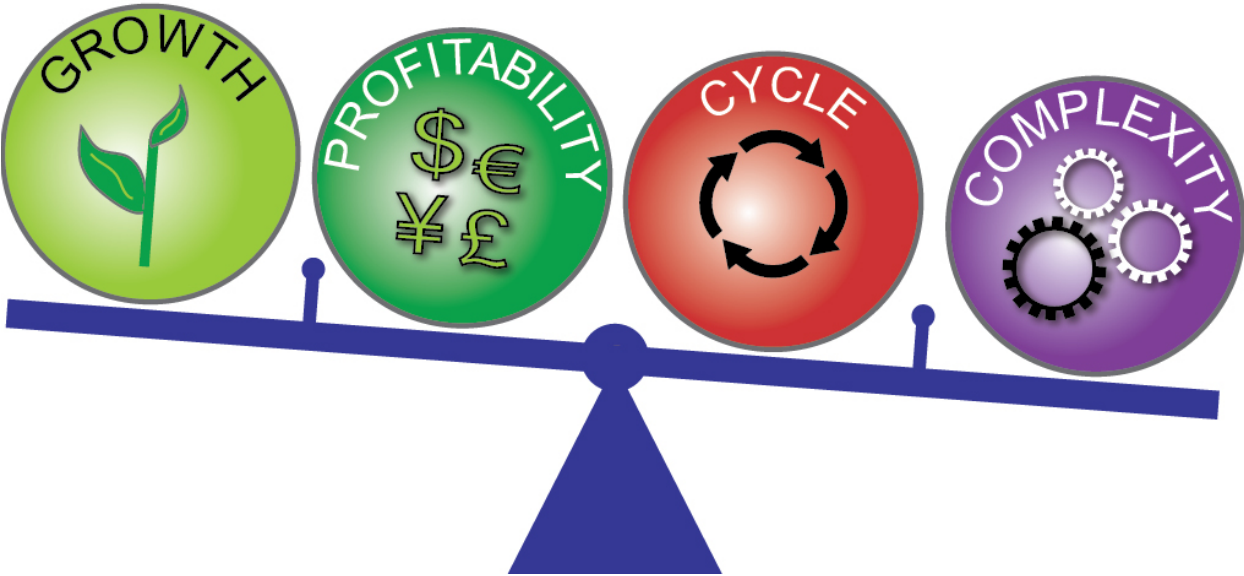
The basis of this report is publicly available information from corporate annual reports from the period of 2000-2013 as available. To complete this analysis, and understand the patterns, we partnered with the operations research team at Arizona State University in January 2014. Here we share the results.

# Executive Overview

Ask any supply chain leader which metrics are the most important to deliver, and the most common answers are operating margin, inventory turns, and revenue growth. In our plotting of industry results for the Supply Chain Metrics That Matter reports, we could see that certain industries had greater variation at the intersection of operating margin and inventory turns than others. We wanted to know why.

The supply chain is a complex system. It is growing even more so. Supply chain leaders are charged to deliver reliable results on The Effective Frontier for costs and inventory cycles. Failure to do so can result in termination. The Effective Frontier is depicted in Figure 1.

**Figure 1. The Effective Frontier**



It is a juggling act. There are finite trade-offs and the metrics are interrelated. Each company is operating at a different potential. A new technology can elevate the frontier and improve the company's ability to operate at a higher level of performance. Often when companies attempt to drive down costs they will elevate inventory. When complexity increases, it can have an adverse effect on both operating margin and inventory turns. It is a continuous balancing act which has been made easier through the evolution of Advanced Planning Systems (APS).

Progress happens in small increments. It happens over the period of many years (three to five). We believe that reliability of results at the intersection of operating margin and inventory turns is a characteristic of supply chain excellence.

We are trying to understand who's done it best. It is for this reason that we have been studying these patterns for the last two years. What can we see? Over the last decade, industry progress

has been quite different. In Table 1, we list the performance of five industries (The industries are listed from the most to the least profitable as measured by operating margin). Companies have become more efficient, but not necessarily more effective. Note in this table that all manufacturing industries have significantly improved revenue per employee, but only one of the industries has improved both operating margins and inventory turns.

**Table 1. A Review of Industry Progress from 2000-2012**

Industry Snapshots (2000-2012)						
Industry		Operating Margin	Inventory Turns	Cash-to-Cash Cycle	Revenue per Employee (K\$)	SG&A Ratio
Pharmaceutical Industry	(n=24)	0.19 ↑12%	3 ↓8%	139 ↓1%	462 ↑98%*	27% ↑24%*
Medical Device Industry	(n=6)	0.16 ↓56%	3 ↑2%	141 ↓4%	270 ↑59%*	28% ↓3%^A
Consumer Packaged Goods	(n=14)	0.13 ↑17%	5 ↑4%	45 ↓45%	333 ↑82%*	34% ↓15%*
Combined Food & Beverage Industry	(n=32)	0.11 ↑11%	8 NC	41 ↓26%	455 ↑122%*	19% ↓30%*
Chemical Industry	(n=7)	0.10 ↓45%	5 ↑5%	89 ↓16%	458 ↑118%*	14% ↓32%^A

Source: Supply Chain Insights LLC, Corporate Annual Reports 2000-2012  
 Industry Average comprised of public companies (combined food & beverage industry: NAICS 3112% where % is any number from 0-9, 311320, 311520, 311821, 311941 & 312111), (chemical: NAICS 325188 & 325998), (consumer packaged goods: NAICS 3256% where % is any number from 0-9), (medical device industry: NAICS 339112), (pharmaceutical industry: NAICS 325412) reporting in One Source with 2012 annual sales greater than \$5 billion  
 \*Calculated from 2002-2012 due to data availability; ^Calculated from 2003-2012 due to data availability; NC=no change

It is the goal of most companies to improve operating margin, accelerate inventory turns, and reduce cash-to-cash cycles. The goal of most implementations of advanced planning systems was to do this together.

To understand reliability of supply chains at the intersection of operating margin and inventory turns, we plotted industry after industry. In the manual plotting of these results, we could see that some industries had a very tight pattern, but others did not. We partnered with the operating research team at Arizona State University to develop the best methodology to measure this variation. In Table 2, we share the results of this work.

Imagine a graph that represents the path a company takes in reporting operating margin and inventory turns over a period of several years. The resiliency rating that we developed in concert with Arizona State University measures the mean distance between the points. The smaller the number, the more reliable the supply chain is in delivering consistent results at this intersection. In Table 2, we share the median, mean, maximum, minimum and standard deviation of these industry trends. Note that while medical device, consumer packaged goods, and food industries have little variation, industries like pharmaceutical, chemical, consumer electronics and contract manufacturing have wider variation. What drives the difference? It varies by industry. For pharmaceutical companies, consumer electronics and communications equipment companies, it

revolves around successful R&D pipelines. For the chemical and contract manufacturing companies it is based on contracts and cost of materials.

**Table 2. Summary of Supply Chain Resilience Rankings By Industry**

Mean Distance Analysis of Orbit Chart Performance (Inventory Turns & Operating Margin)					
Industry	Median	Mean	Maximum	Minimum	Standard Deviation
Medical Device Manufacturing (n=108)	0.7	1.9	51.9	0.2	5.5
Consumer Packaged Goods (n=133)	0.8	2.8	118.6	0.2	11.9
Cereal Food (n=209)	2.1	5.3	141.1	0.1	13.2
Pharmaceutical (n=489)	1.0	9.7	1556.1	0.2	75.9
Chemical (n=181)	1.2	9.8	644.2	0.2	59.3
Consumer Electronics (n=120)	1.6	11.8	697.8	0.1	68.8

Source: Supply Chain Insights LLC, Corporate Annual Reports 2000-2013 as available  
 Based on cooperative work between Arizona State University & Supply Chain Insights LLC  
 Industry Average comprised of ALL public companies (cereal food: NAICS 3112% where any % is any number from 0-9), (chemical: NAICS 325188 & 325998), (consumer electronics: NAICS 33431% where % is any number from 0-9), (consumer packaged goods: NAICS 3256% where % is any number from 0-9), (medical device manufacturing: NAICS 339112), (pharmaceutical: NAICS 325412) reporting in One Source

The smaller the mean value, the more reliable the results are within an industry. We find it interesting that the wider the deviation within an industry, the greater the differences between individual company performance within that industry. In the next section, to help readers understand the methodology, we share orbit charts and results on resiliency by industry.

# Medical Device Companies

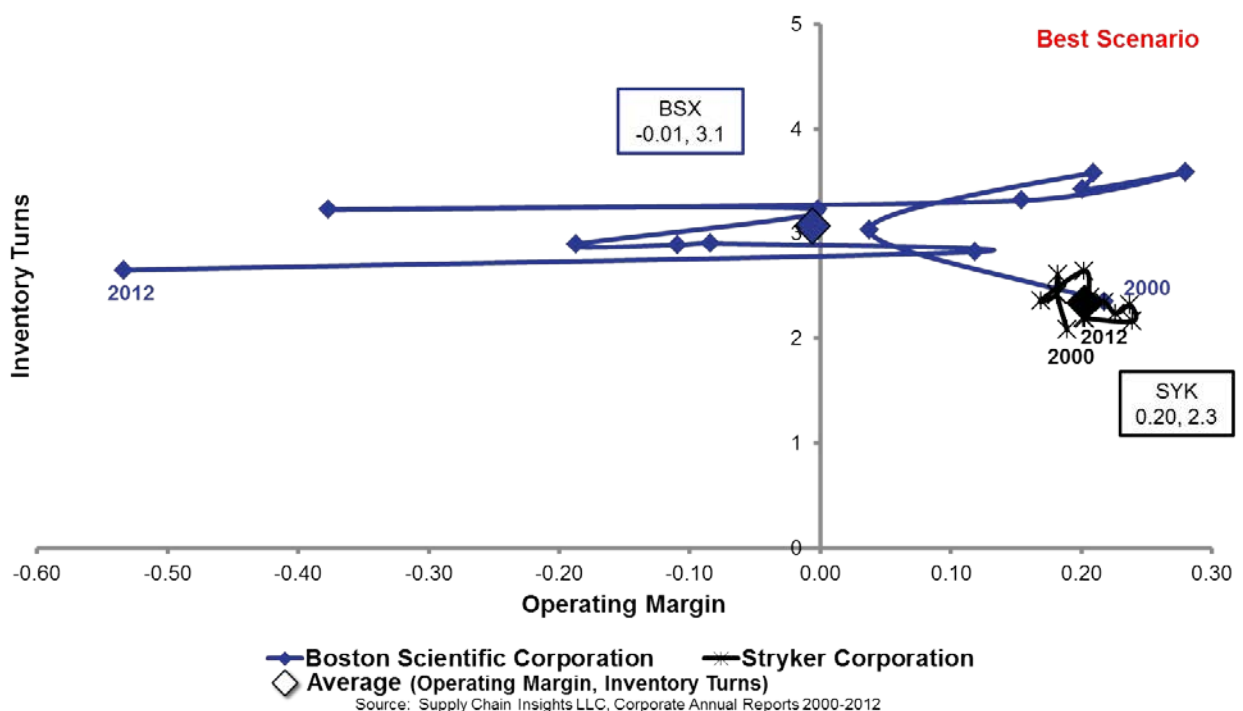
The most resilient industry is the medical device industry. This industry operates with both high margins and high levels of resiliency. With a decline in operating margin of 56% over the last decade, and rising inventories, a 2% increase of inventory was seen in an industry that turns inventory three times a year.

This industry is struggling with increasing government compliance and the pace of innovation of implantable devices. As hospitals have pushed back to reduce costs in the operating theatre, the industry has increased Sales, General & Administrative Expense (SG&A) by training the sales team on procedures and augmenting the hospital staff resources on procedures.

The medical device industry is not known for supply chain excellence. It lacks the sophisticated inventory systems of other industries. Many devices are termed “trunk stock” and travel to the hospital on the day of the procedure in the trunk of a sales person’s car. Instead, we believe that these results are better defined by the industry dynamics. The product line has been less volatile than big pharmaceutical and the make-to-order and configure-to-order processes are quite effective on this lower-volume, highly-configured supply chain.

A leader in this group is Stryker, and a laggard is Boston Scientific. Their results are plotted in Figure 2. Stryker’s pattern of performance is significantly tighter than Boston Scientific in the graphical format. This is also visible in the resiliency rankings in table 3.

**Figure 2. Boston Scientific Corporation and Stryker Corporation (2000-2012)**



As shown in Table 3, the deviation between industry players is relatively small.

**Table 3. Resiliency Rankings in the Medical Device Industry**

Company	Stryker Corporation	Becton, Dickinson and Company	Covidien Ltd.	Haemonetics Corporation	Boston Scientific Corporation
Resilience Rating	0.22	0.23	0.42	0.58	0.68

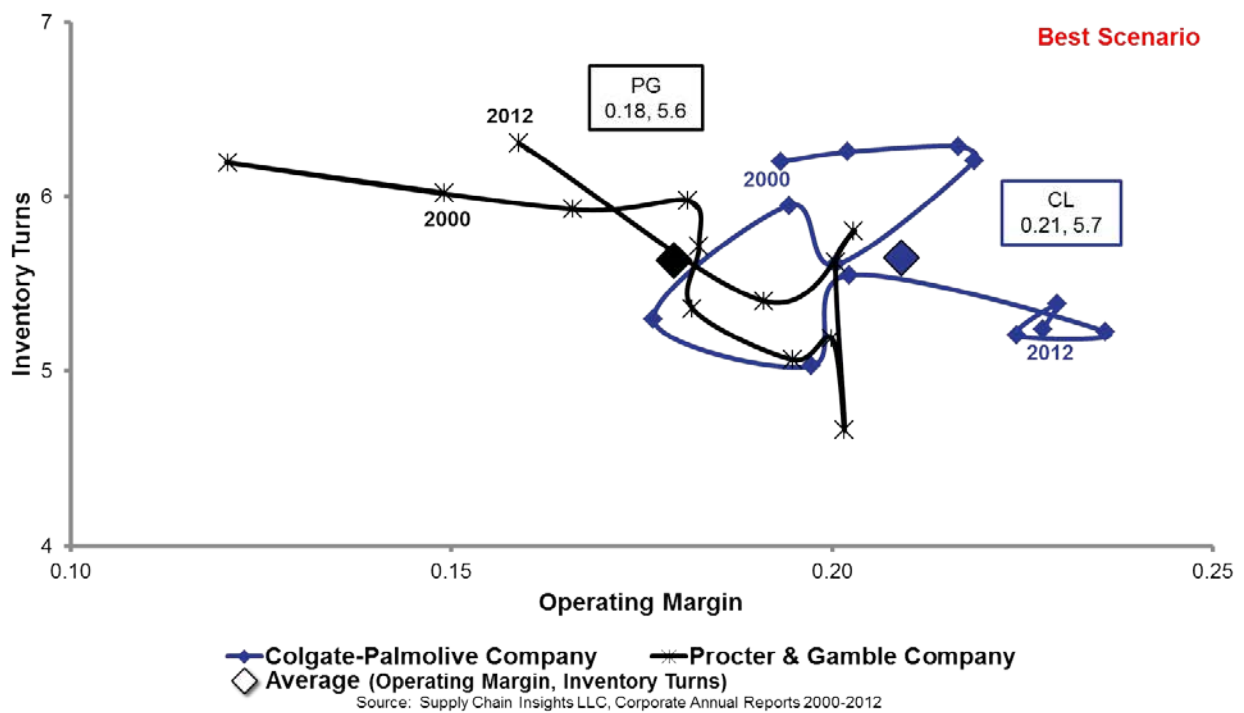
Source: Supply Chain Insights LLC, Corporate Annual Reports 2000-2013 as available  
Based on cooperative work between Arizona State University & Supply Chain Insights LLC

## Consumer Packaged Goods

As an industry, Consumer Packaged Goods (CPG) companies have improved both operating margin and inventory turns since 2000. They have also delivered high reliability of corporate results at the intersection of operating margin and inventory turns. Colgate has outperformed Procter & Gamble (P&G) Company in the reliability of these results. P&G's loss of operating margin in the past four years reduced their resiliency ranking.

This industry has built global supply chains and successfully executed a myriad of Mergers and Acquisitions (M&A) since 2000. The entire industry shows good results and higher levels of resiliency (lower values).

**Figure 3. Colgate-Palmolive Company and Procter & Gamble Company (2000-2012)**





**Table 4. Resiliency Rankings in the Consumer Packaged Goods Industry**

Company	Colgate-Palmolive Company	Beiersdorf AG	Henkel AG & Company KGaA	Kao Corporation	Procter & Gamble Company
Resilience Rating	0.23	0.24	0.42	0.43	0.52

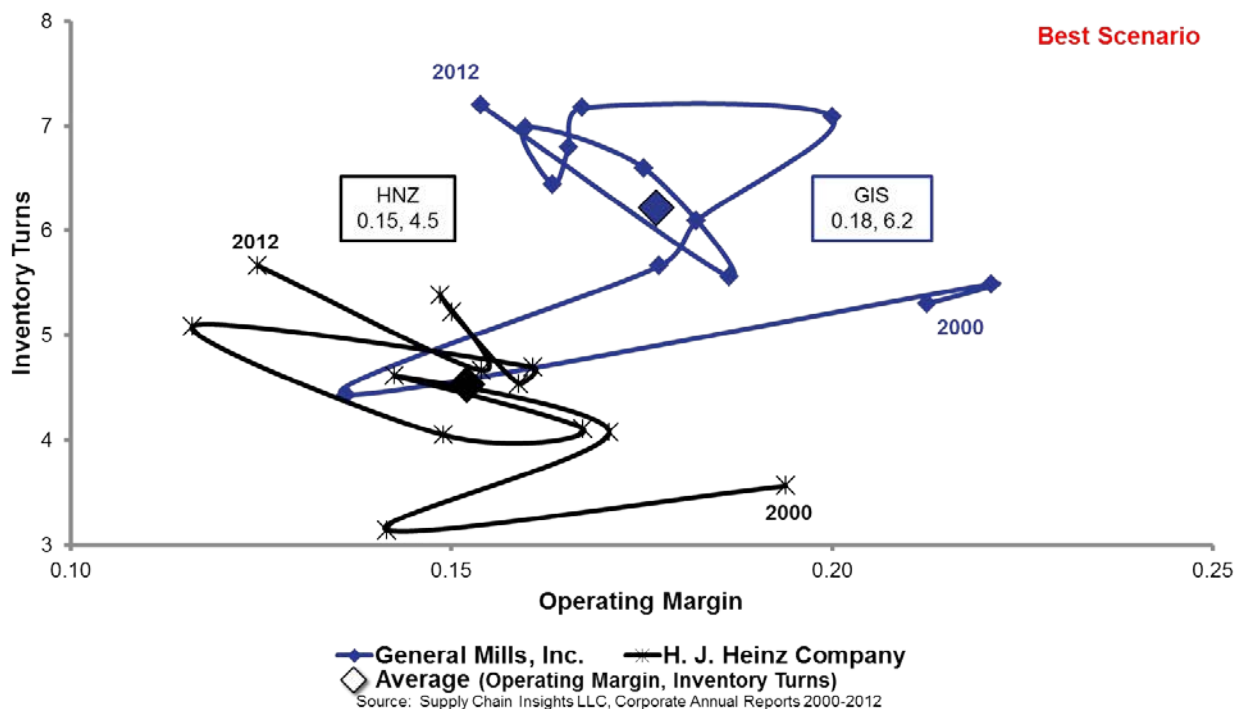
Source: Supply Chain Insights LLC, Corporate Annual Reports 2000-2013 as available  
Based on cooperative work between Arizona State University & Supply Chain Insights LLC

## Food

Commodity volatility has never been higher. The cost of new product launch is four times the cost of five years ago. Growth has slowed. Food manufacturing companies are still regional, lacking the economy of scale of global CPG operations. They also are facing increasing competition.

Note in Figure 4, the wilder swings of the food players than the consumer packaged goods manufacturers in Figure 3. Also note the extreme loss of margin of these two major food manufacturers. The resiliency rating values are higher as a result of the erratic patterns.

**Figure 4. General Mills, Inc. and H. J. Heinz Company (2000-2012)**



**Table 5. Resiliency Rankings in the Food Industry**

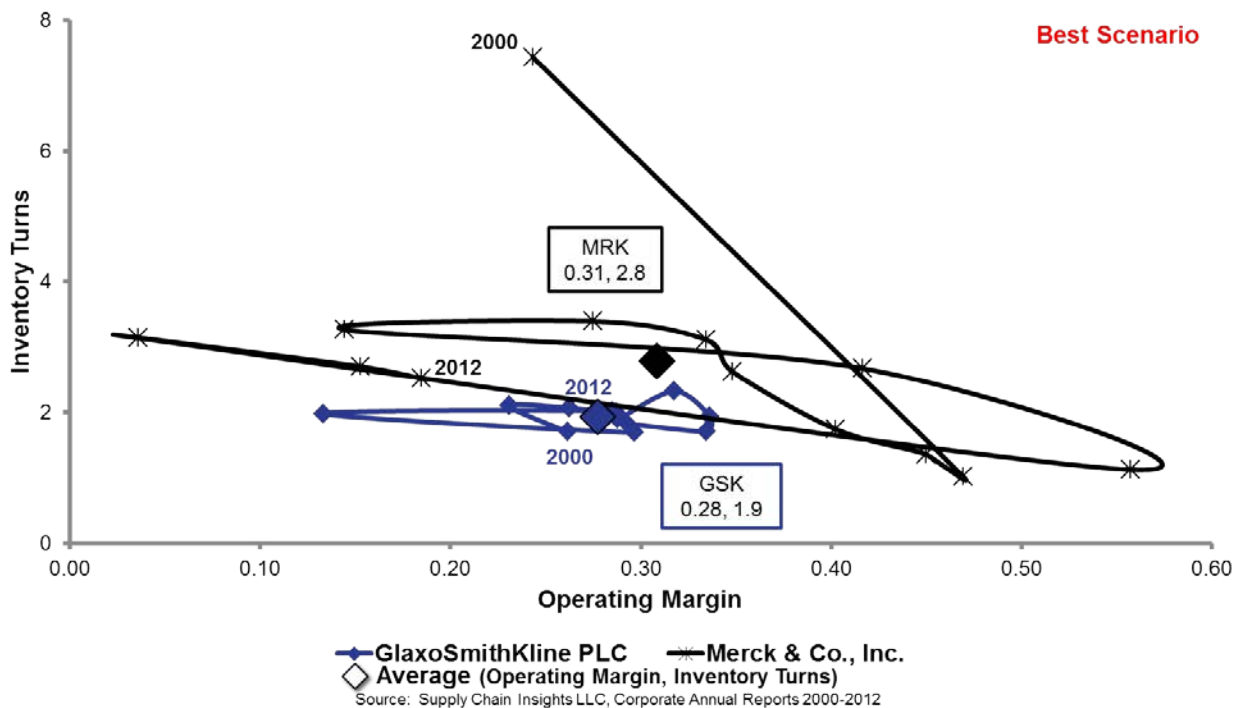
Company	H. J. Heinz Company	ConAgra Foods, Inc.	Kellogg Company	Pinnacle Foods Group LLC	General Mills, Inc.
Resilience Rating	0.50	0.83	0.89	0.97	0.98

Source: Supply Chain Insights LLC, Corporate Annual Reports 2000-2013 as available  
Based on cooperative work between Arizona State University & Supply Chain Insights LLC

## Pharmaceuticals

With the largest operating margin and the highest inventory levels, pharmaceutical companies struggle with reliability at the intersection of operating margin and inventory reliability. Note the increasing swings of the major pharmaceutical companies as depicted in Figure 5. Merck & Co, Inc. is an extreme example with large oscillations in performance.

**Figure 5. GlaxoSmithKline Comparison to Merck (2000-2012)**



**Table 6. Industry Ranking of Resiliency in the Pharmaceutical Industry**

Company	GlaxoSmithKline PLC	Shire PLC	Abbott Laboratories	Bristol-Myers Squibb	Merck & Co., Inc.
Resilience Rating	0.25	0.56	0.77	0.80	0.88

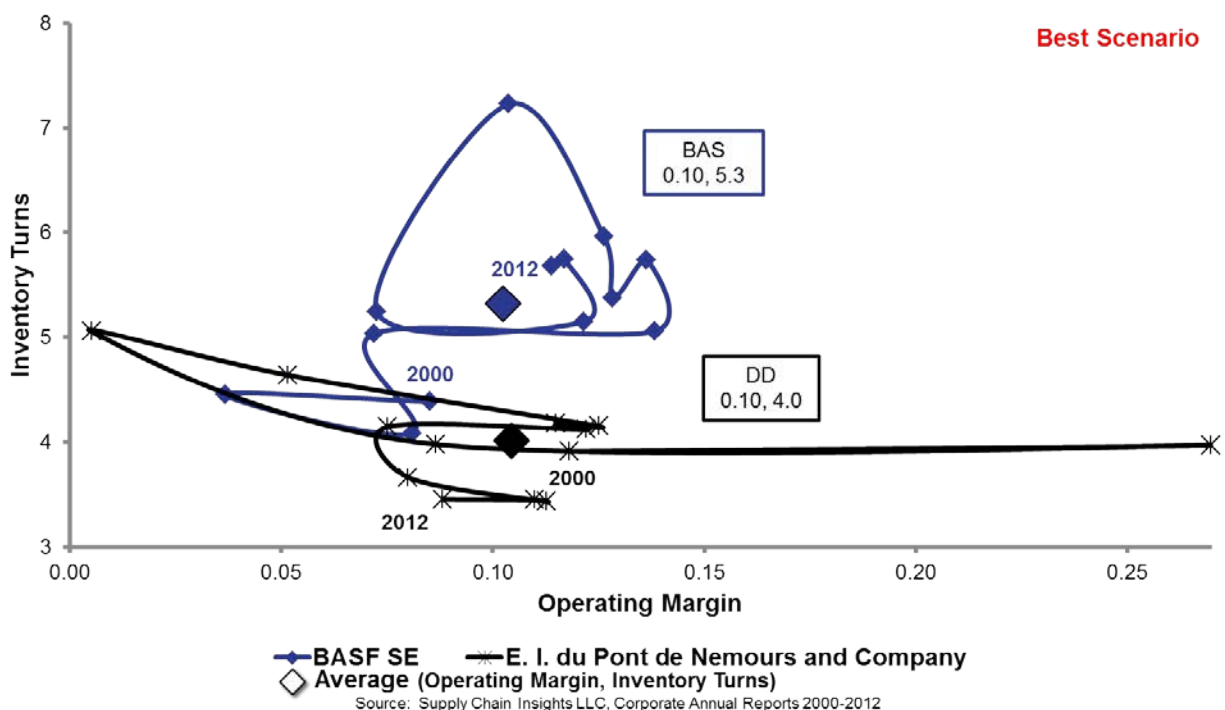
Source: Supply Chain Insights LLC, Corporate Annual Reports 2000-2013 as available  
Based on cooperative work between Arizona State University & Supply Chain Insights LLC

While the prior industries profiled had a tight deviation of companies within the industry, within pharmaceutical companies there is a wider range. We believe that this is based both on the wide range of supply chain competency and the changes in product pipelines. While many people group pharmaceutical and medical device companies together, we find it quite interesting to see the stark difference in resiliency between these two industries.

## Chemical

With an average decline in operating margins of 45%, and a rise of inventories in the industry, the chemical industry is struggling to raise the potential of the Effective Frontier. While DuPont has increased Days of Payables to improve working capital, BASF has not only one of the best resiliency ratings but has also decreased payables and improved inventory. BASF has consistently implemented technologies better than DuPont and has been more aggressive on the automation of B2B connectivity.

**Figure 6. DuPont vs. BASF (2000-2012)**



**Table 7. Resiliency Rankings in the Chemical Industry**

Company	Chemtura Corporation	BASF SE	Nalco Holding Company	E. I. du Pont de Nemours and Co.	W. R. Grace and Company
Resilience Rating	0.54	0.55	0.64	0.67	0.69

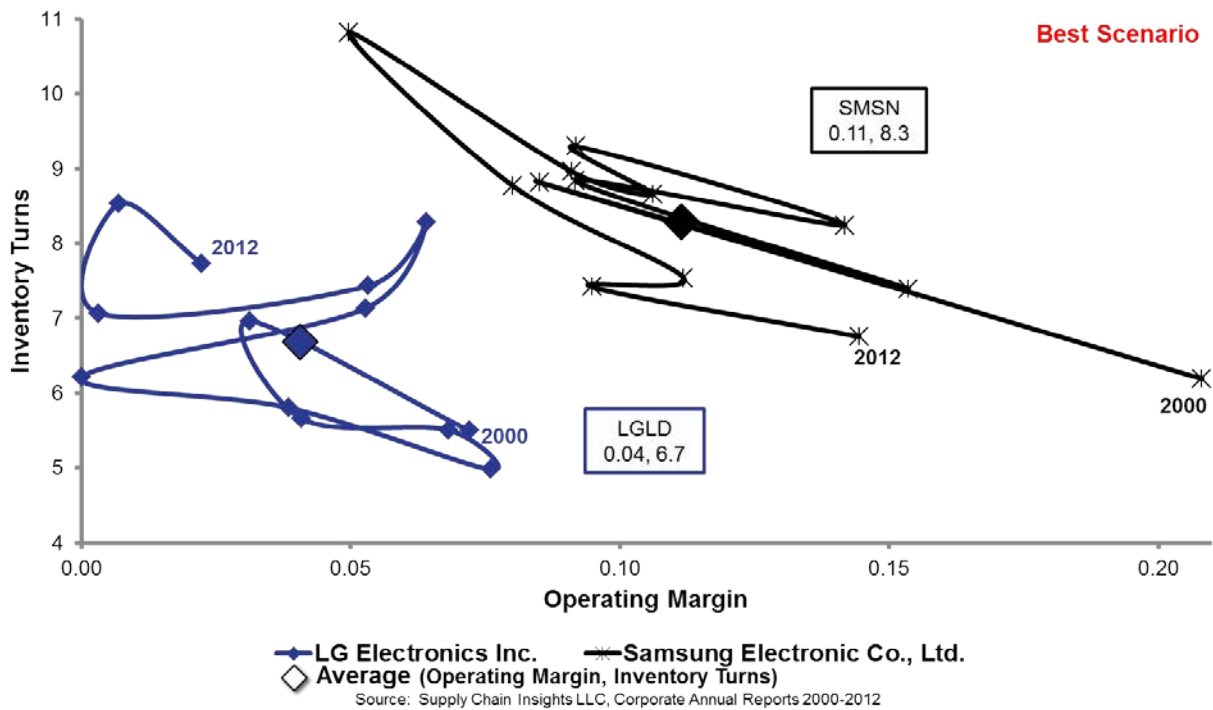
Source: Supply Chain Insights LLC, Corporate Annual Reports 2000-2013 as available  
Based on cooperative work between Arizona State University & Supply Chain Insights LLC

# Consumer Electronics

Consumer electronics weathers both demand and supply volatility. There is probably no industry that has had faced greater challenges. The industry has some of the most mature planning practices and maturity in sourcing practices.

Inventory, in the consumer electronics industry, declines quickly in price with age. It is a lot like the value of an aging banana. As a result, the leaders in the industry, like Samsung, have developed very mature inventory practices.

**Figure 6. LG Electronics Inc. & Samsung (2000-2012)**



As shown below, not only did Samsung operate with a better margin and inventory turn level, the pattern is also tighter and their resiliency value is lower than LG's.

**Table 8. Resiliency Rankings in the Consumer Electronics Industry**

Company	Panasonic Corporation	Samsung Electronics Co., Ltd.	Bang & Olufsen A/S	Sanyo Electric Co., Ltd.	LG Electronics Inc.
Resilience Rating	0.51	0.59	0.63	0.68	1.13

Source: Supply Chain Insights LLC, Corporate Annual Reports 2000-2013 as available  
Based on cooperative work between Arizona State University & Supply Chain Insights LLC

## Recommendations

**1) Industries with High Variability Pose Risk in the Extended Supply Chain.** If you are dependent on companies with a large resiliency rating, they pose risk in the ability to post reliable, consistent results. For example, the variability and the lack of resiliency of contract manufacturers should be of concern for the brand owners of consumer electronics. In our interviews, few seem aware of this issue.

**2) Benchmark your Results and Look for Opportunities to Improve Reliability and Resiliency at the Intersection of Operating Margin and Inventory Turns.** While still under study, and not conclusive, we do see that companies with stronger Sales and Operations Planning processes (S&OP) score better on resiliency within their industry. They also have strong and parallel supply chain financial organizations and a run a more data-driven focused process.

**3) Measure Progress in Centimeters not Kilometers.** Supply chain excellence happens slowly over many years. Focus on building capabilities to power and raise the potential of the organization on their Effective Frontier. Move in a deliberate manner to keep the organizations balanced.

## Conclusion

This report is designed to give the supply chain leader an objective measurement to compare progress across industries in a meaningful way. Use the data to mitigate risk benchmark your progress and align your organization on a goal.

## Overview of Methodology

The plan was simple. Our goal was to connect corporate performance with supply chain performance using financial ratios from corporate balance sheets. The execution has been more difficult than we could have imagined. It sounds simple. However, it is not. We are two years into the research and still working to deliver on our mission.

Our work began in February 2012 when Abby Mayer, Research Associate, mined online annual reports industry-by-industry to construct spreadsheets of common financial metrics. We experimented with a multitude of ways to turn a spreadsheet into a story. We finally discovered orbit charts which you see scattered throughout this report. It allowed us to see the pattern at the intersection of The Effective Frontier.

In August of 2012, we began work on the first of many Supply Chain Metrics That Matter reports. These reports tell the story of an industry. They usually focus on a single industry ranging from automotive to consumer packaged goods and everything in between. This gave us a chance to better understand the differences between the industries and cemented our belief that they have to be evaluated separately. The supply chain of a hard disk drive manufacturer is inherently different from a supply chain focused on food products. It made us believers that a methodology that compares companies within the same framework, like the Gartner Top 25, is an apples-to-oranges comparison that benefits no one.

In January of 2014, we partnered with Arizona State University’s School of Computing, Informatics and Decision Systems Engineering to use more advanced math techniques to understand the patterns that define supply chain excellence. To understand the variation of this pattern at the intersection of operating margin and inventory turns—which we now call resiliency—we considered a variety of measures and ultimately settled upon mean distance. The full gamut of techniques considered is shown in Table A.

**Table A. Techniques Considered for Resiliency Ranking**

<b>Metrics Considered</b>	
<b>Cohesion</b>	<b>Maximum Distance</b>
<b>Coef Var Dist</b>	<b>Mean Distance</b>
<b>Condition Index</b>	<b>Minimum Distance</b>
<b>Eigen 1</b>	<b>Minimum Distance * (100/Maximum Distance)</b>
<b>Eigen 2</b>	<b>Perc Var Eigen 1</b>

Source: Supply Chain Insights LLC,  
Based on cooperative work between Arizona State University & Supply Chain Insights LLC

Connecting supply chain performance with financial performance has been much harder than any of us could have imagined. This report reflects our learnings over the past 2 years, but we are not done yet. You can read more about this work in our upcoming book, *Metrics That Matter*, to be published in September 2014.

## Other Reports in the Metrics That Matter 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.

[Supply Chain Metrics That Matter: A Focus on the Chemical Industry](#)

Published by Supply Chain Insights in November 2012.

[Supply Chain Metrics That Matter: The Cash-to-Cash Cycle](#)

Published by Supply Chain Insights in November 2012.

[Supply Chain Metrics That Matter: A Focus on the Pharmaceutical Industry](#)

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[Supply Chain Metrics That Matter: Driving Reliability in Margins](#)

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[Supply Chain Metrics That Matter: A Focus on Hospitals](#)

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[Supply Chain Metrics That Matter: A Focus on Brick & Mortar Retail](#)

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[Supply Chain Metrics That Matter: A Closer Look at the Cash-To-Cash Cycle \(2000-2012\)](#)

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[Supply Chain Metrics That Matter: Third Party Logistics Providers](#)

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[Supply Chain Metrics That Matter: A Critical Look at Operating Margin](#)

Published by Supply Chain Insights in December 2013

[Supply Chain Metrics That Matter: Semiconductors & Hard Disk Drives](#)

Published by Supply Chain Insights in February 2014

[Supply Chain Metrics That Matter: A Focus on Aerospace & Defense](#)

Published by Supply Chain Insights in March 2014

## 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 10,000 supply chain professionals each month. She also writes as a LinkedIn Influencer and is a contributor for Forbes. Her book, ***Bricks Matter***, (co-authored with Charlie Chase) was published on December 26<sup>th</sup>, 2012. She is currently working on a second book, *Metrics That Matter*, to publish in 2014.

With over nine 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.