S&P CAPITAL IQ

Solutions Exchange Product Spotlight

Trends In Supply Chain: Looking Through An Aerospace Lens

Thomas Yagel
Solutions Architect
(1) 212-438-4138
thomas_yagel@spcapitaliq.com

Evan Shenkin
Solutions Architect
(1) 212-438-5484
evan_shenkin@spcapitaliq.com

Solutions Exchange is developed by S&P Capital IQ's Solutions Architects, a separate and independent team at Standard & Poor's. The objective of this analysis is to gain greater insight into specific events and trends in the market using S&P Capital IQ data and analytics solutions.

Understanding supply-chain risks is critical because of the significant effects that supply-chain hiccups can have on production, corporate revenues, and even company reputations. In this supply-chain analysis, S&P Capital IQ's Solutions Architects have reviewed important supply-chain factors and highlighted Boeing Co.'s supply-chain management and methods. We decided to review the aerospace industry and Boeing Co. as an example because the industry relies heavily on a large global supply-chain network. Boeing has had supply-chain problems in the past because some parts that suppliers fabricated were not consistent with Boeing designs, resulting in assembly problems.

In this article, we analyzed Boeing's own perception of supply-chain risk and how the company's operational performance compares to its peers. We also developed a framework to analyze risks and identify operationally critical suppliers that could experience financial distress and therefore disrupt production. What did we find?

- The supply chain has high visibility and presents important risks.
- Some traditional supplier concepts such as just-in-time may be reversing.
- Assessing the financial risks of suppliers is critical.
- It is also important to consider supplier importance to the production line.

Supply-Chain Visibility

We reviewed the 2012 SEC 10K for Boeing and found 55 mentions of the term supplier, along with a handful of references to supply chain and other related concepts. We think it is very telling that out of the 21 items that Boeing illustrates in "Item 1A Risk Factors," four of them (about 19%) are directly related to supply chain risks. Even more of those risks may be related to the company's supply chain in some facet (see table 1).

Table 1

Boeing Company Risk Factors (summarized)
Exposure to business swings of commercial airlines
Aircraft development and planned production increases
Changing acquisition priorities of U.S. government
U.S. government contracts
Fixed-price contracts

May 8, 2012

Table 1

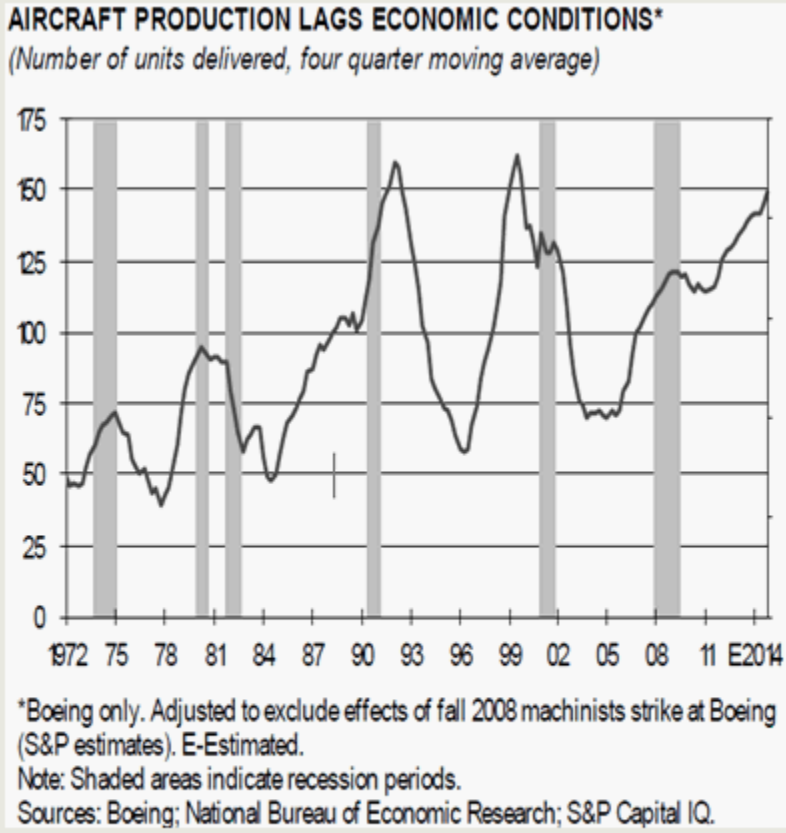
Boeing Company Risk Factors (summarized) (cont.)
Cost-type contracts
In-orbit incentive payments
Depend heavility on the performance of subcontractors and suppliers
Estimates in accounting for contracts
Competition within our markets may reduce our future contracts and sales
Signficant revenue subject to the risks of doing business in other countries
Litigation and of government inquiries could result in significant monetary payments
Customer financing portfolio concentration risks to certain U.S.-based customers and certain aircraft
Ability to raise debt at affordable terms
May not realize anticipated benefits of M&A , joint ventures/strategic alliances or divestitures
Our insurance coverage may be inadequate to cover all significant risk exposures.
Business disruptions could seriously affect sales, financial condition or increase costs/expenses
Supplier workforce labor unions may lead to work stoppages
Changes in discount rates
Risk of material environmental liabilities
Risk of unauthorized access to our or our customers' information/systems

Source: S&P Capital IQ, Boeing Co. 2011 10K.

Supply-Chain Trends

The S&P Capital IQ Equity Research team's Aerospace and Defense Industry Survey (published Feb. 9, 2012) highlights that aircraft production has declined with each recession prior to 2008. However, during the last recession, production for Boeing only experienced a slight period of softness, followed by continuing increases, despite significant economic contraction. The company cited the following factors that contributed to the strong current and future demand for aircraft:

- Demand from emerging markets, such as Asia, the Middle East, Eastern Europe, and Latin America; and
- A need for replacing aging fleets in the U.S. and Europe.



So what factors differentiate this cycle from the last one? S&P Capital IQ sees two primary dynamics driving demand for aircraft. The first is continued robust demand from emerging markets such as Asia, the Middle East, Eastern Europe, and Latin America. Many airlines in these regions have remained profitable, and fleet sizes must rise to accommodate increased demand for business and personal travel.

The second is the need among airlines to replace aging and less fuel-efficient planes to address rising fuel prices. Although the price of oil (and jet fuel) has fallen sharply from its mid-2008 peak, prices are again rising, and many believe the supply-demand balance for petroleum favors a return to higher oil prices in the future. The two regions with the oldest (as well as the largest) fleets are the U.S. and Western Europe. As a result, demand for aircraft from these regions, while not high, has begun to improve.

Source: Standard & Poor's Investment Advisory Services LLC, which is a part of S&P Capital IQ, Aerospace and Defense Industry Survey (published Feb. 9, 2012)

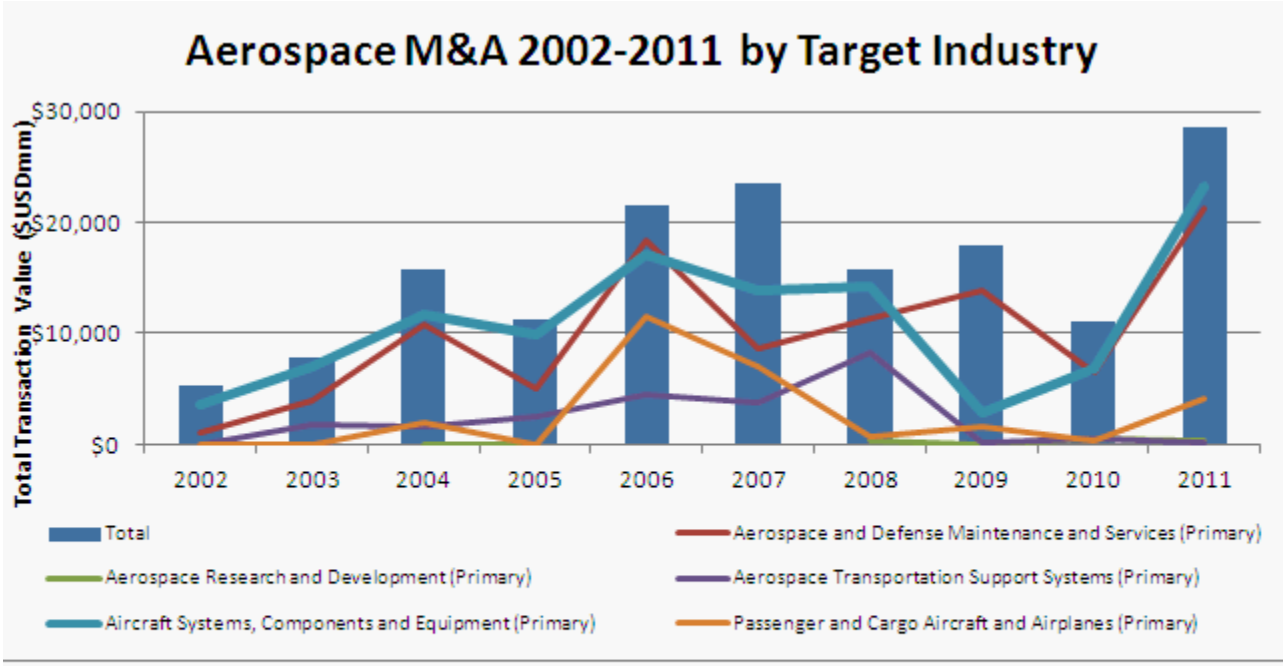
Given this, it should not be surprising that Boeing expects to significantly increase production across all their major airplane lines over the next several years.

"Boeing employees are carrying out a historic increase in the production rates of all five major commercial airplanes programs: the 737, 747-8, 767, 777, and 787," Boeing said on their website in October 2011. "An overall 40-percent production increase, to be phased in over three years, aims to meet airlines' growing demand for more fuel-efficient and environmentally-progressive airplanes."

While Boeing and other aerospace companies have learned many lessons in recent years, significant production increases put added pressure on supply chains. Global outsourcing of suppliers and inventory practices such as "just-in-time" have expanded the complexity of assessing and managing the risks of suppliers and other counterparties. Decentralization, complex supply-chain structures, and an increasing number of potential suppliers have made it harder than ever to stay on top of supply chains.

We reviewed recent trends in the aerospace industry that might explain how practices are adapting to accommodate these complexities. First, increased M&A in the aerospace industry seems to indicate a potential consolidation of suppliers, potentially indicating a reversal of supply decentralization. Second, we observed a key supply-chain metric--inventory days--for Boeing Co. and found a steady increase in the amount of time inventory is held--a potential signal that just-in-time is less of a focus than in the past.

Dollar volume from M&A transactions in the aerospace industry (defense excluded) reached its highest total since a record 2006 year, according to S&P Capital IQ data (see chart 1). Interestingly, we see that most of that consolidation occurred in the sub-industry--aircraft systems, components, and equipment. Not surprisingly, companies in this sub-industry are the aircraft suppliers. Not only was this sub-industry responsible for the largest deal volume, it also grew significantly--by 240%--from 2010 to 2011.

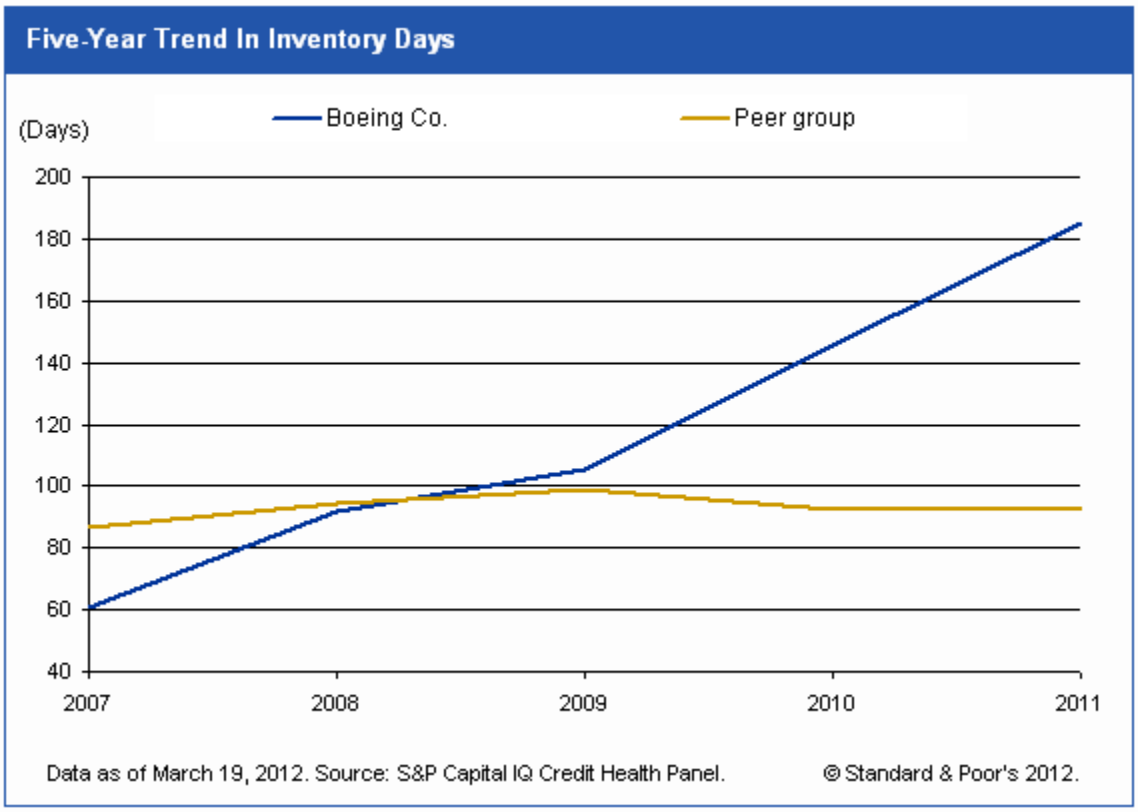


*Note: Criteria were: Announced and not cancelled M&A transaction from 1/1/2002 to 12/31/2011 where the target company primary industry was an Aerospace sub-industry. Transactions may be represented in multiple sub-industries, but are not only counted once in the total. For this reason, the total columns will not be a sum of the sub-industry values.
Data as of Mar. 19, 2012. Source: S&P Capital IQ Transaction Screener

Although volume alone cannot tell us what motivated these transactions, consolidation of suppliers is one effective approach to better control supply and quality of critical components. In July 2010, CEO of Aerospace Structures at Senior PLC, Jerry Goodwin said, "Boeing, Airbus and the other airframers are looking to consolidate their supply chain, and we're getting back into acquisition mode now, doing some research."

Beyond M&A, we also see some potential trends in inventory management. Traditionally, we have come to associate a lower inventory-days number as a good measure of how well a company is managing its supply chain. However, Boeing's inventory days has increased year over year for the past five years, exceeding the peer average in December 2009 (see chart 2). By increasing inventory on hand, Boeing is likely making a tradeoff between optimal high inventory turnover and carrying an excess of inventory to buffer against changes in production velocity. In this case, given the risks of production stoppages, Boeing's method of holding inventory longer than its peers may be a good risk-management strategy.

Chart 2



Assessing Supplier Financial Risk

One of the most critical aspects of supply-chain risk management is gauging the financial risk of a company's suppliers. Even if a company in trouble does not default, credit concerns can cause delays and quality issues that all supply-chain managers should be on the lookout for as early as possible. Given the right tools and data, financial risk is also one of the easiest risk factors for a supply-chain manager to follow.

Beginning in September 2007, Boeing Co. announced the first of a series of delays in the production of the newly designed 787 Dreamliner. In January 2008, president and CEO of Boeing Commercial Airplanes Scott Carson said, "The fundamental design and technologies of the 787 remain sound. However, we continue to be challenged by start-up issues in our factory and in our extended global supply-chain." This statement addresses an extremely complicated and global supply chain and the importance of being able to identify suppliers who might cause disruptions. Although many disruptions are unforeseen, especially when caused by natural disasters, the ability for a supplier to maintain production is paramount for a supply-chain manager.

Table 2 displays the 31 key suppliers of the 787 as reported by Boeing Co. The scoring is taken from S&P Credit Health Panel, which ranks a group of peers based on 22 different financial metrics related to credit health. These metrics are grouped into operational, solvency, and liquidity categories, and then combined to form an overall relative credit health score. The scores for each of the individual panels and the overall score are divided into quartiles from bottom (4) to below average (3) to above average (2) to top (1). Scoring the 787 suppliers on a relative basis against each other, CTT Systems AB, Esterline Technologies Corp., Finmeccanica SpA, JAMCO Corp., Korean Air Lines Co. Ltd., Panasonic Corp., Spirit AeroSystems Holdings, and Thales S.A. have the weakest relative credit health of the 787 suppliers.

Table 2

Relative Credit Health Analysis

	--Credit Health Panel company scores--						
Company	**Overall**	**Operational**	**Solvency**	**Liquidity**	**LTM period ending**	**Foreign long-term rating**	**Probability of default (1) (%)**
CTT Systems AB	4	4	3	4	9/30/2011		0.1449
Esterline Technologies Corp.	4	4	4	3	1/31/2012	BB+	0.0105
Finmeccanica SpA	4	4	4	3	9/30/2011	BBB-	0.4168
JAMCO Corporation	4	4	3	2	12/31/2011		0.0572
Korean Air Lines Co. Ltd.	4	4	4	2	12/31/2011		
Panasonic Corp.	4	2	4	4	12/31/2011	A-	0.0553
Spirit AeroSystems Holdings Inc.	4	3	3	4	12/31/2011		0.0183
Thales S.A.	4	4	4	3	6/30/2011	BBB+	1.3242
Eaton Corp.	3	2	3	3	12/31/2011	A-	0.0056
Fuji Heavy Industries Ltd.	3	3	2	4	12/31/2011	NR	0.1037
Honeywell Industries Ltd.	3	2	3	3	12/31/2011	A-	0.0029
Kawasaki Heavy Industries Ltd.	3	3	3	2	12/31/2011	NR	0.1089
Meggitt PLC	3	3	4	1	6/30/2011		0.3742
Mitsubishi Heavy Industries Ltd.	3	4	4	2	12/31/2011	BBB+	0.0370
Moog Inc.	3	4	2	2	12/31/2011	BB	0.0087
PPG Industries Inc.	3	1	4	4	12/31/2011	BBB+	0.0028
Bridgestone Corp.	2	1	2	4	9/30/2011	BBB+	0.0120
GKN PLC	2	1	2	4	6/30/2011		0.0423
Goodrich Corp.	2	2	3	1	12/31/2011	BBB+	0.0026
Rockwell Collins Inc.	2	2	1	3	12/31/2011	A-	0.0075
SAFRAN	2	3	2	3	12/31/2011		0.0348
Toray Industries Inc.	2	3	1	2	12/31/2011	NR	0.0162
United Technologies Corp.	2	1	2	3	12/31/2011	A	0.0039
Zodiac Aerospace	2	2	2	2	8/31/2011		0.0096
Dassault Systems	1	2	1	1	6/30/2011		0.0066
Donaldson Co. Inc.	1	1	1	4	1/31/2012		0.0035
General Electric Co.	1	3	3	1	12/31/2011	AA+	0.0069
Parker-Hannifin Corp.	1	1	2	2	12/31/2011	A	0.0062
Rolls-Royce PLC	1	3	1	1	12/31/2011	A-	0.0327
SAAB AB	1	2	1	1	12/31/2011		0.2232
Ultra Electronics Holdings PLC	1	1	1	1	12/31/2011		0.1187

Data as of March 19, 2012. Source: S&P Capital IQ, Credit Health Panel.

Table 2 also displays both Standard & Poor's Ratings Services' foreign long-term credit ratings and the S&P Capital IQ probability of default (PD) score for the list of suppliers. While credit ratings can be an important part of the analysis of financial health for these companies, ratings do not cover all of the suppliers. The PD is a separate quantitative estimate of the one-year forward-looking default probability and is especially useful when broader coverage of a list of companies is necessary to make across-the-board comparisons. As the PD is updated daily, it is not completely consistent with the

ratings or the overall credit health comparison, which are more stable measures. However, the average PD for categories 1 and 2 above (0.04%) is significantly lower than for categories 3 and 4 (0.18%), as would be expected. One exception is SAAB AB, which scores in the top quartile on a relative basis but has a PD higher than that of many companies in the bottom quartile (0.2232%). This might signify recent credit concerns for the company that deserve further research.

Risk Frontier

While it's necessary to analyze the credit health of the suppliers, it's also crucial to understand the importance of the suppliers to the company being analyzed. In the past, the importance of a supplier to a company's supply chain was based on total spend. However, we have identified a more useful means to assess a supplier's importance. Components that are supplied by one firm or a critical component that cannot be replaced easily have been identified as being of high importance. In this article, we would like to propose one potential framework--risk frontier--for combining the financial risk of suppliers with the operational importance of the supplier. In this framework, we plotted supplier financial risk versus operational importance. This allowed us to visualize the intersection of these two factors causing the suppliers of most concern to stand out in the north east quadrant (see quadrant 4 in chart 3). Since only the individual supply-chain managers can actually measure the importance or scarcity of a given component, we used a rough measure of industry competitiveness as a proxy. We assumed that individual supply-chain managers or company analysts will likely exchange or augment our measure for their own assessments.

There are several measures that we could use to measure financial risk, but we used the PD measure for the risk frontier analysis. Although the PD measure is an estimate of the percentage chance that a given company will default in the next 12 months, we converted it into a scale that maps to the 20 different credit ratings categories but uses lower case letter symbols to signify that it is a different measure, from d (0) to aaa (20). Categories cc and c are not represented in this scale. This is accomplished by measuring the observed default rates for different rating categories to obtain an observed PD range for each rating category.

For our measure of operational risk, we created a Competitiveness Index similar to that of the Herfindahl–Hirschman Index (HHI). We calculated the index by determining the percentage of total industry revenue that each company in an industry contributes. We then summed these values for each company in the industry and multiplied by 10,000. Finally, we took the log of the result to create a scale from 0 to 4. Values close to zero indicate extremely competitive industries, and those close to four indicate extremely noncompetitive industries. For our purposes, competitive industries are less operationally risky than noncompetitive industries (where there may be scarcity of replacements). For example, in an industry with two companies--one with $100 in revenue and a second with $900 in revenue--the first company's percentage of revenue (10%) would be squared (0.01) and added to the second company's (90% ^ 2 = 0.81) to yield 0.82. Multiplying by 10,000 and taking the log results in a value of 3.9.

Chart 3 shows the risk frontier for Boeing 787 Dreamliner suppliers. Suppliers in quadrant 2 have low financial and operational risk, and those in quadrant 4 have high financial risk as well as high operational risk. CTT Systems AB, Saab AB, Finmeccanica SpA, Ultra Electronics Holdings PLC, Korean Air Lines Co Ltd., and Fuji Heavy Industries Ltd. appear in quadrant 4. (See table 3 for the list of all suppliers on the risk frontier.)

Chart 3

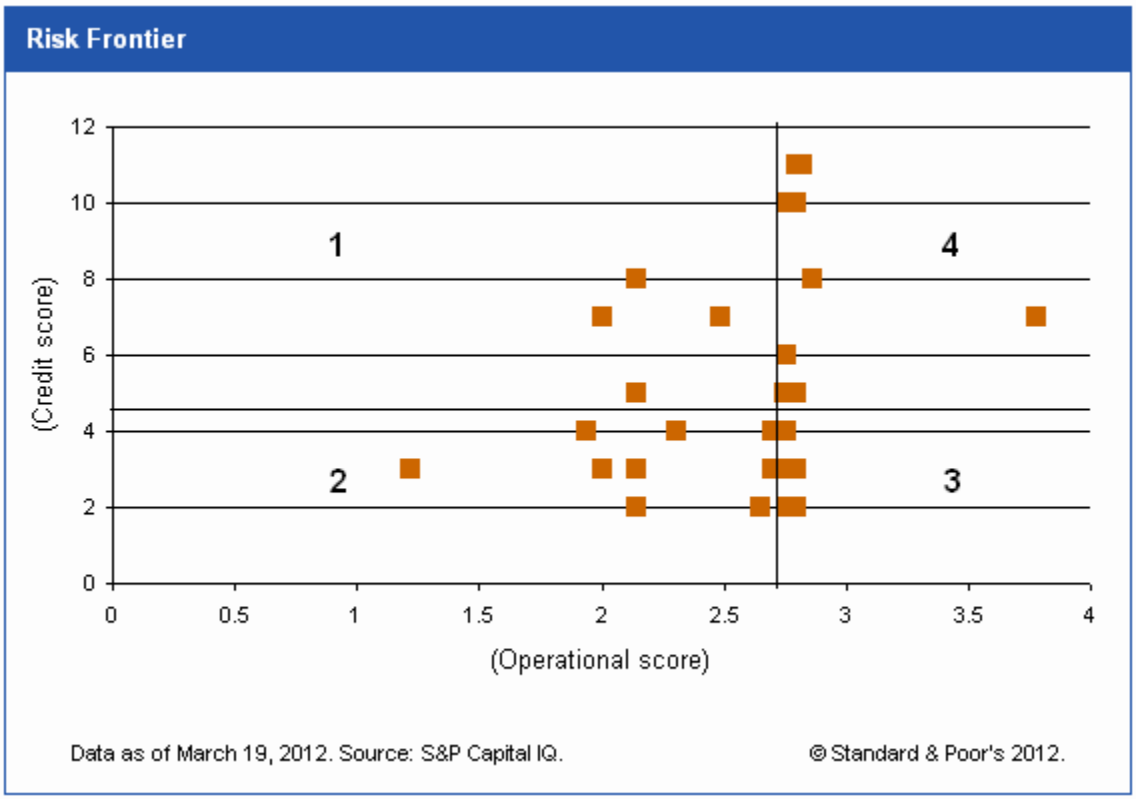


Table 3

Exposures Of The Risk Frontier

Company	Industry (GICS)	Operational score	Credit score
CTT Systems AB	Aerospace and defense	2.76	11
Saab AB	Aerospace and defense	2.76	11
Finmeccanica SpA	Aerospace and defense	2.76	10
Ultra Electronics Holdings plc	Aerospace and defense	2.76	10
Fuji Heavy Industries Ltd.	Automobile manufacturers	3.78	7
Korean Air Lines Co. Ltd.	Airlines	2.86	8
GKN plc	Auto parts and equipment	2.49	7
Kawasaki Heavy Industries Ltd.	Industrial machinery	2.14	8
Jamco Corp.	Aerospace and defense	2.76	6
Panasonic Corporation	Consumer electronics	2	7
Thales SA	Aerospace and defense	2.76	5
Safran SA	Aerospace and defense	2.76	5
Rolls Royce Holdings plc	Aerospace and defense	2.76	5
Zodiac Aerospace SA	Aerospace and defense	2.76	4
Meggitt plc	Aerospace and defense	2.76	4
Spirit AeroSystems Holdings Inc	Aerospace and defense	2.76	4
Mitsubishi Heavy Industries Ltd.	Industrial machinery	2.14	5
Toray Industries Inc.	Commodity chemicals	2.31	4
United Technologies Corp.	Aerospace and defense	2.76	3

Table 3

Exposures Of The Risk Frontier (cont.)			
Rockwell Collins Inc.	Aerospace and defense	2.76	3
Esterline Technologies Corp.	Aerospace and defense	2.76	3
Moog Inc.	Aerospace and defense	2.76	3
United Technologies Corp.	Aerospace and defense	2.76	3
Bridgestone Corp.	Tires and rubber	1.94	4
Eaton Corporation	Industrial machinery	2.14	3
Parker Hannifin Corporation	Industrial machinery	2.14	3
General Electric Company	Industrial conglomerate	2	3
Goodrich Corp.	Aerospace and defense	2.76	2
Honeywell International Inc.	Aerospace and defense	2.76	2
PPG Industries Inc.	Diversified chemicals	2.65	2
Donaldson Company, Inc.	Industrial machinery	2.14	2
Dassault Systemes SA	Application Software	1.22	3

Data as of March 19, 2012. Source: S&P Capital IQ.

Conclusion

- The supply chain has high visibility and presents important risks.
- Some traditional supplier concepts such as just-in-time may be reversing.
- Assessing the financial risks of suppliers is critical.
- It is also important to consider supplier importance to the production line.

Boeing Co. has had its fair share of supply-chain issues in its goal to launch the 787 Dreamliner. By exploring Boeing Co., the S&P Capital IQ Solutions Architect team outlined potential trends in the industry and the importance of identifying and monitoring a company's supply chain.

Risk to a company's integrated and possibly global supply chain is difficult to identify and even more difficult to monitor. Deficiencies in a supply chain usually arise in the most inopportune moment, such as after a natural disaster like the ones that hit Japan and Taiwan in 2011. The risk frontier framework, when used with additional monitoring capabilities such as up-to-date news and alerts to key developments and daily movements in S&P Capital IQ proprietary metrics can allow a supply-chain manager (or company analyst monitoring supply chain) to shed more light on potential risks.

This report was prepared by the S&P Capital IQ Global Markets Intelligence group, formerly known as the Global Markets Intelligence research group. This group is analytically and editorially independent from any other analytical group at S&P.