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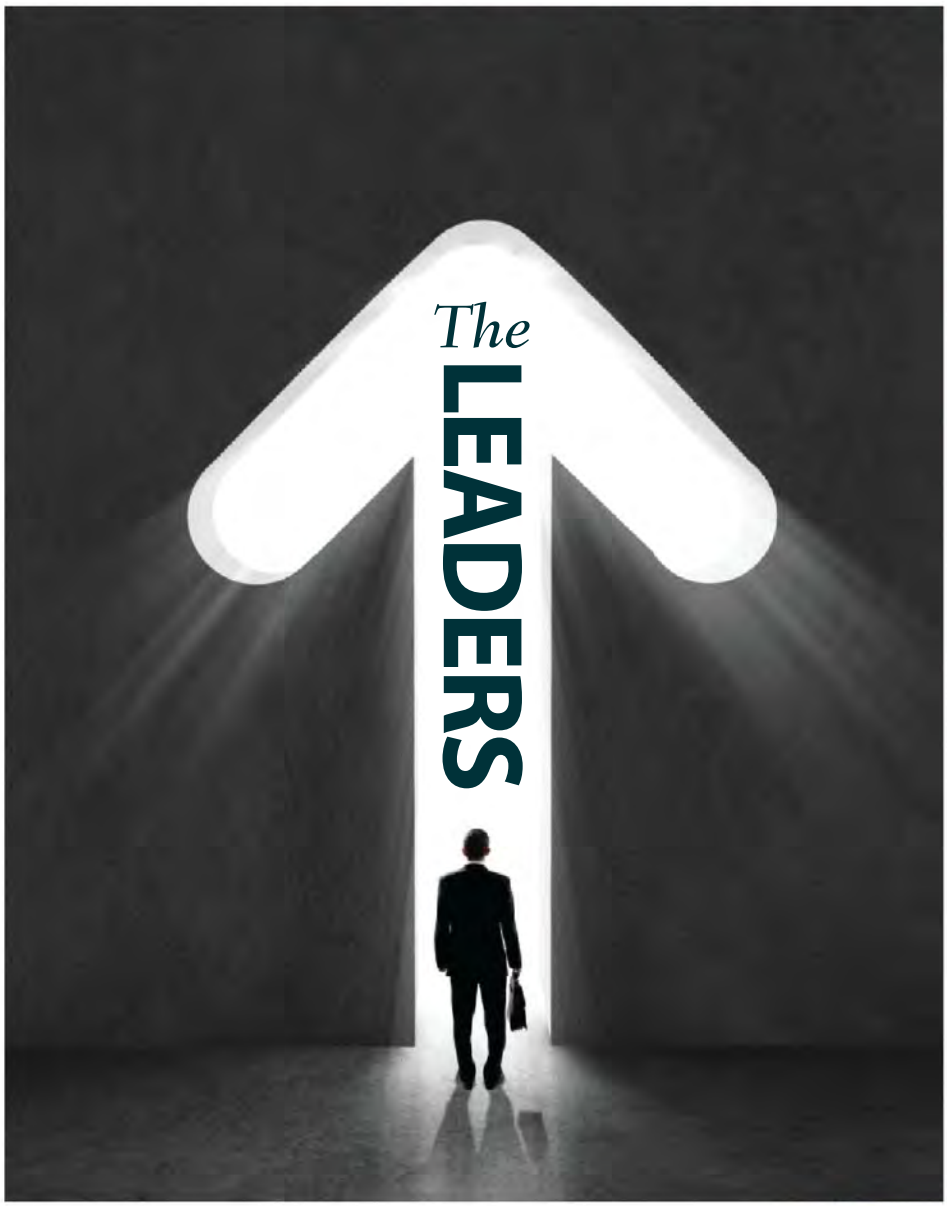

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Leading the Decade

Bob Trebilcock, Editorial Director
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Leading the decade was the theme of Gartner's annual supply chain conference at the end of May and is the title of this year's look at Gartner's list of the top 25 supply chains. The 2014 edition marks the 10-year anniversary of the Gartner Supply Chain Top 25 ranking.

What has changed in the last 10 years? That was a question posed by Gartner at the conference. Consider that 10 years ago, half of the companies surveyed by Gartner didn't have a supply chain program; the majority of those that did reported to manufacturing. Today, not only do most companies have a supply chain program, 71 percent of the Top 25 have a supply chain center of excellence and 40 percent of the chief supply chain officers report to the CEO. While supply chain management was rarely discussed on investor calls in 2004, it is now considered a critical enabler of the business. As Debra Hofman, Gartner's research vice president, put it: "Supply chain has a seat at the table."

Clearly, we've come a long way in the past decade, but there's still more to be done and new areas for improvement. As always, that's part of what we look at in *Supply Chain Management Review*. Consider Packaging: Think Inside and Outside the Box, a three-part article by Jack Ampuja, Marshall S. White, and V.G. Venkatesh and Rameshwar Dubey. The authors make the case for why supply chain organizations have ignored packaging as an opportunity to reduce costs and optimize processes across the global supply chain.

Meanwhile, in this month's How They Did it, John Dawson explains how Intel launched a collaboration program with its contract manufacturers that is delivering real-time visibility on a global level. The benefits, according to Dawson, include one version of the truth, B2B connectivity among multiple suppliers, exception management, "what if" analytics, and responsiveness to customers—what used to take days now takes hours.

Also, this month we're including a special excerpt from the new book by Andrew S. Winston, *The Big Pivot*. Winston is a noted expert on business sustainability and sits on sustainability advisory boards for Kimberly-Clark, Hewlett-Packard, and Unilever. In his new book, Winston offers "radically practical strategies for a hotter, scarcer, and more open world." In other words, the kinds of strategies that supply chain leaders will be adopting for the next decade.

Finally, if you're also one of our online subscribers, be sure to read the Operations Advantage column from A.T. Kearney when you're on our website. For this issue, we're positing it as a web exclusive.

Bob Trebilcock

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SUPPLY CHAIN MANAGEMENT REVIEW

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BY LARRY LAPIDE

Looking Over the Visible Planning Horizon

For successful S&OP, Telescoping Planning Horizons are best

Dr. Lapide has extensive experience in the industry as a practitioner, consultant, and software analyst. He is currently a lecturer at the University of Massachusetts' Boston Campus and is an MIT Research Affiliate. He received the inaugural *Lifetime Achievement in Business Forecasting & Planning Award* from the Institute of Business Forecasting & Planning. He welcomes comments on his columns at llapide@mit.edu.

I met a young woman at a semi-conductor manufacturer who wanted advice concerning Sales and Operations Planning (S&OP) processes. Her Chief Operating Officer (COO) had asked her to start a process among executives. Her main concern was that the COO wanted it to focus exclusively on the immediate fiscal quarter.

This planning horizon is too short for executives to have meaningful future impact. Sales and marketing activities can't be significantly changed, supply is relatively limited, and the S&OP meetings are too operationally-oriented. I advised that she should focus on getting a routine process started and eventually convince the COO to move the planning horizon out to at least six months, and possibly up to 18 months; consistent with typical S&OP processes.

Planning Horizons, Goals, and Objectives

My November 2011 Insights column, "S&OP: The Linchpin Planning Process," discussed three types of planning processes that companies conduct. The planning horizon for Strategic Planning is typically three or more years out and driven by a future vision of a company. Its develops strategic objectives and goals that should drive Tactical Planning processes, such as S&OP, that develop weekly and monthly demand-supply plans. S&OP would then provide the linkage from strategy to the third type of planning, Operational Planning, that typically has planning horizons looking out up to a few weeks on a day-to-day or week-to-week basis.

An S&OP process should have the major objective of helping companies achieve financial performance goals. As such, a cross-functional S&OP team of managers is responsible for routinely assessing whether a company is on a path toward achieving these, re-charting a path to get there, or changing to more realistic goals.

Length of the Planning Horizon

Using the analogy of a ship crossing an ocean, the captain and officers of the ship (i.e., the executives of a company) are supported by a navigation team (i.e., S&OP) that is constantly re-charting the path to reach the final destination (i.e., the financial goals). Much as the ship's navigators are responsible for using global positioning equipment and weather and tide forecasts to assess if a course correction is needed, an S&OP team needs to routinely update supply-demand plans based on where the company is going relative to goals and assessing whether extenuating factors prevent them from achieving them.

Thus, an S&OP process that only deals with a planning horizon significantly less than six months will not tap into S&OP's full potential. For example, using a planning horizon of one fiscal quarter is like navigating a ship by just looking ahead as far as the eye can see, without knowledge about what things are happening over the visible horizon. (Indeed, in ancient times sailors worried about falling off the edge of a "flat" Earth.)

When thinking about what should be the

length of planning horizons, most supply chain managers say that it should be as long as the longest lead-time production material or component. However, this approach is manufacturing-centric. An S&OP planning horizon needs to consider all supply-demand lead times, not just those of production-based items. On the supply side, for example, it must also consider resource lead times such as those of labor, indirect materials, and equipment, as well as supply chain processes. On the demand side it needs to consider lead times involved in sales and marketing activities, such as new product launch, promotional, pricing, and product placement processes.

An S&OP planning horizon needs to consider all supply-demand lead times, not just those of production-based items.

Telescoping Planning Horizons

A Stock Keeping Unit (SKU) for companies in the apparel and footwear industry is largely designated by an item's color, style, size, and width (for footwear). Yet these companies typically focus planning processes on the color and style of an item, possibly looking out up to 18 months. The planning horizon looks out that far because a company has to make decisions on the quantity of neutrally colored textiles to source in advance of production. Twelve months out, it needs to start making decisions on dying textiles. Closer in, such as six months out, it needs to decide on the quantities that will be sewn and stocked in terms of color, style, size, and width.

This industry follows a best practice that involves a Telescoping Planning Horizon, which is expanded up to 18 months and divided into three major segments. The period of time is extended this far out in order to support decisions that need to be made well in advance, while also recognizing that other decisions are made within shorter planning windows. Generally, the practice segments the planning horizon into two or more parts, and formally considers the decisions that need to be made within various segments of the planning horizon.

Some time ago, my Demand Management Research Group surveyed about 200 supply chain managers to get an understanding of the length of supply-demand planning horizons and the decision-making taking place within these horizons. (The survey solicited information for two segments of a Telescopic Planning Horizon: short term and long term).

Regarding the horizon, 68 percent of the respondents stated that their company plans supply-demand one or more years out, with only 16 percent using planning horizons less than six months. Eighty-six percent stated that during planning meetings, major decisions varied by the short term versus the long term, demonstrating telescoping approaches were prevalent. Lastly, the point at which respondents split the short term versus long term varied, with 33 percent stating that long term was after 12 months and 28 percent after six months.

Qualitative results on the focus of decision-making in the short versus the long term, as well as the aggregation of data used to support decisions within each segment, are summarized in Exhibit 1. The results support my advice to the young woman. An S&OP meeting focused exclusively on a planning horizon of only three months is too detailed and does not involve strategically impactful decision making. Executives need to attend meetings that deal with the long term as well as the short term.

I recommend using an SO&P process with a Telescoping Planning Horizon so that executive-level meetings are not entirely consumed by short-term decision making—often the purview of middle managers. It takes too much time away from an executive's focus on strategic issues. If executives are only looking three months out, much like ancient sailors, the failure to look beyond the visible horizon might result in a fall off the edge of the Earth.

EXHIBIT 1

Ranked Qualitative Results from S&OP Planning Horizon Survey

	Segment Within the Planning Horizon	
	Short-Term	Long-Term
Decision-Making Focus (ranked)	1. Inventory Replenishment 2. Production and Operations Scheduling 3. Buying or Procurement 4. Plant Capacity Planning	1. Outsourcing 2. New Product Launches 3. Plant Capacity Planning
Decision-Supporting Data Aggregations (ranked)	1. Detailed Item & SKU Level 2. Regional (Geographic) Demand 3. Customer Segments	1. Product Family 2. Brand 3. Customer Segments

Source: Demand Management Solutions Group Supply Chain Manager Survey (Fall 2007; 199 respondents)

Closing the Loop on a Circular Supply Chain

By Edgar Blanco and Ken Cottrill

Edgar Blanco, Ph.D., is research director of the MIT Center for Transportation & Logistics (MIT CTL). He can be reached at eblanco@mit.edu. Ken Cottrill is global communications consultant of the MIT CTL. He can be reached at kencott@mit.edu.

While conventional supply chains seek to efficiently move products in a linear fashion from raw materials to end consumers, a "circular" or "closed-loop" supply chain is one that is also dependent on feeding used products back as raw materials. The resulting circular supply chain poses unique challenges and opportunities for supply chain professionals.

Successfully building and managing such a system requires new and unconventional thinking. That's what the Milwaukee, Wisc.-based global manufacturer Johnson Controls has done to incorporate automotive battery recycling into its business.

Distinguishing Features

There are plenty of economic incentives for rethinking the auto battery supply chain. As much as 80 percent of the materials used to make auto batteries can be derived from recycled batteries. The metals, plastics, and acid used to make conventional auto batteries can all be recycled. This creates a significant business benefit by minimizing the impact of price volatility of these commodities and providing raw materials at a more competitive cost. Moreover, automotive batteries contain hazardous materials. The best and most responsible form of minimizing the health and environmental risks is to recycle them.

Managing the reverse flows of a circular supply chain differs from managing a linear one on a number of fronts, from engaging customers to rethinking the distribution processes. In the specific case of Johnson Controls, it has to manage three linked supply chain processes simultaneously.

Consumer provided raw materials. The Johnson Controls supply chain starts with consumers, when their existing batteries have reached their end-of-life. Rather than calling this a "reverse flow," Johnson Controls considers the supply of used batteries the beginning of its raw materials supply given the large amount of recycled content that comprises its products.

Consumers often go to auto repair shops or specialized retailers to replace a non-functional battery. Johnson Controls has partnered with these outlets to provide an easy to follow process to collect, sort, and send the units to recycling centers. Currently over 97 percent of automotive batteries are responsibly recycled. Johnson Controls is actively working to achieve 100 percent recycling rates for automotive batteries in the United States.

A unique challenge of collecting raw materials from consumers is the variability of supply. The rate at which consumers replace batteries is highly cyclical and typically peaks twice per year. Batteries fail over time mainly due to extreme temperatures. As temperatures rise in the summer, older batteries will begin to expire at increasing rates. However some batteries that are nearing their end of life will survive the summer but will not have enough energy storage capacity to start the car when the first cold snap occurs the next winter. As a result, the demand for replacement batteries—and in turn, the collection of used batteries—typically rises in summer and spikes again in the winter months. However, this is all dependent on the temperature the battery has experienced. Mild summers and winters will extend battery life. Predicting this demand seasonality is not simple and leads to significant short-term variability. Supply chain professionals work with cross-functional business teams, including marketing and manufacturing, to plan for and mitigate this variation.

Recycling center operations. A network of Johnson Controls recycling centers throughout North America uses furnaces to recover the metals from the batteries. Once a furnace is activated, it is more cost effective to keep the furnace hot as long as possible. As a result, the company needs to recycle batteries at a constant rate.

Because the used batteries don't come in at a steady rate, there is a need to either stockpile used

batteries or vary the number of furnaces used throughout the year and then stockpile the recycled materials. Deciding how many used batteries to process is a fairly complex optimization. The cost of capital equipment, current raw material market pricing, inventory carrying costs, labor planning, and distribution lead times and costs all need to be considered.

Battery manufacture and distribution. Once the recycling center processes the batteries, the resulting materials are sent to manufacturing plants to make new batteries. The finished product is delivered through a distribution network with multiple channels. Like any other seasonal consumer good, these distribution channels have to build inventory to prepare for the eventual demand spikes. As a result, peak demand for recycled materials required to manufacture batteries occurs a few months ahead of peak consumer demand, typically in the early summer and late fall. Johnson Controls is continuously re-evaluating its models, assumptions, forecasts, and plans to manage this mismatch.

Circular Challenge

Because these three linked supply chains run at three different seasonal schedules, the timing of the demand for new batteries and supply of used batteries is never 100 percent in sync. It is important for supply chain professionals to optimally plan and manage all three simultaneously. In a linear supply chain, managers start by looking downstream and then plan for upstream impacts (inventory pooling, demand shaping, network optimization). In a circular supply chain, finished good consumer behavior dictates raw material supply and both processes need to be planned simultaneously.

The Network Challenge

Keeping the many components of this circular supply chain in balance is a major task.

One example of the sophistication required is the use of a set of network optimization models on a daily, monthly, and annual basis. The models help Johnson Controls determine where to process recycled materials, which plants should make new batteries, and how to distribute the units down to the individual customer level. They take into account several factors: The costs and capacity of recycling centers; which batteries are produced in which plants; and the locations and capabilities of distribution networks for shipping new and collecting used batteries. Vehicle load factors on each route are also built into the model, although it is important to understand that this is a network—not a route—optimization model. It's a very detailed one too. Batteries are heavy and therefore transportation is expensive. Specific location data is an input; the geographic area is too broad if less granular location data is used.

A linear model must have a beginning and an end—circular equations are not as clear-cut. Used batteries come from separate supply sources mirrored to represent the same locations as final product customers. As a result, these models tend to be rather large, as they need to manage significantly more variables and constraints than a typical supply chain. In addition, care must be taken to aggregate products and customers while balancing the need for geographic granularity.

The Transportation Challenge

Another unique challenge is ensuring that the batteries are transported safely and efficiently. That requires special training for drivers and a program to help customers make sure that the units are packed correctly for transportation.

Drivers are trained to handle hazmat materials. They are also aware that used batteries carry a residual charge and represent an electrical hazard. Certain logistical skills are also required. Because trucks deliver new and collect old batteries, drivers must manage load balancing and repositioning during the delivery route while meeting the required safety and transportation standards.

In a circular supply chain, finished good consumer behavior dictates raw material supply and both processes need to be planned simultaneously.

Johnson Controls has concluded that the economic and environmental efficiency of the closed-loop system is optimized by a one-to-one exchange of batteries between retailers and delivery trucks. Under this scenario, a new battery that comes off a truck at a retail point-of-sale is replaced with a used battery, from the retailer, that is placed on the truck. This leverages the full truck capacity on each run, turning each truck into a two-way warehouse on wheels. This cuts costs and emissions and maximizes efficiency .

Lessons Learned

The biggest lesson learned by Johnson Controls is that in a highly integrated, circular supply chain like this one, every element is connected; when one fails, the entire system is affected. Channels and customers also need to have the right incentives to participate in the closed loop.

If Johnson Controls loses sight of the entire loop when planning each component of the supply chain, the system's efficiency breaks down. Supply chain interaction with marketing and manufacturing takes a new dimension, as they all affect the flows of products toward customers and of raw materials.

The authors thank Johnson Controls for its help in compiling this article.

The 2014 Supply Chain Top 25: Leading the Decade

By Stan Aronow, Debra Hofman, Mike Burkett, Jim Romano, and Kimberly Nilles

Gartner recently published its 10th annual Supply Chain Top 25, a ranking of the world's leading supply chains. From the beginning, a primary objective of the Top 25 has been to foster the celebration and sharing of best practices and to raise the bar of performance for the broader supply chain community. We also seek to shine a light on the importance of supply chain for corporate executives and the investment community at large.

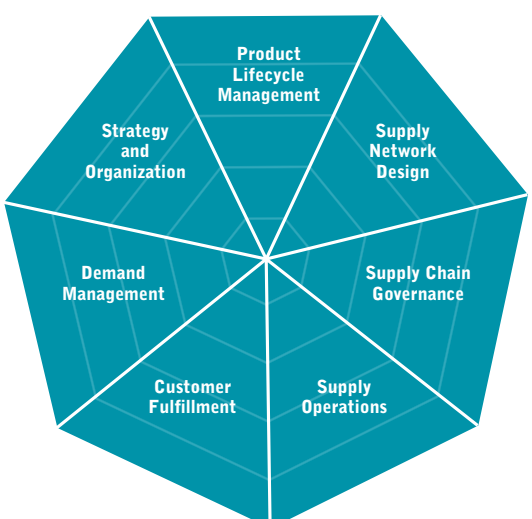
The ranking is focused on identifying supply chain leadership, which includes operational and innovation excellence, but also other behaviors such as corporate social responsibility and a desire to improve the broader practice of supply chain management. While the list always changes from year to year, there are some common characteristics that separate the best from the rest. This article discusses the insights and trends we've seen this year from the leaders.

What is the Definition of Excellence?

Gartner defines excellence as demonstrating leadership toward a demand-driven ideal. Our Demand Driven Value Network (DDVN) model (Exhibit 1) has seven dimensions with interrelated areas of capability and five stages of progressive maturity along each dimension.

EXHIBIT 1

The Seven Dimensions of DDVN Excellence



Source: Gartner

Leading companies have achieved a much higher degree of visibility, coordination, and reliable processes both within and across the Plan, Source, Make, Deliver, and Return functions, but also in partnership with sales and marketing and product management organizations in lines of business. Their supply chains are designed starting with what brings value to customers and then back through the supply network. The ability to sense, translate, and shape demand—and pair up appropriate

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2014 marks the 10 year anniversary of the Gartner Supply Chain Top 25 ranking. This year we have a diverse set of large, global companies with mature, demand-driven supply chains. There are lessons to be learned from these supply chain leaders, many of whom have led their industries over the past decade.

supply is also improved and both demand and supply are determined in close collaboration with customers and upstream suppliers.

Our methodology is detailed below, but at a summary level it operates as such. Each year, approximately 300 companies are chosen to be ranked. Companies do not apply to be included; rather, we select the companies from publicly available lists using a defined set of criteria, including size and industry sector. Each company gets a composite score, and these scores are force-ranked to come up with the final list. The composite score is made up of a combination of publicly available financials, as well as an opinion component, providing a balance between objective and subjective perspectives. In completing their ballots, voters are asked to identify those companies they believe are furthest along the journey toward the demand-driven ideal, as defined in Gartner research and on the voting website.

Inside the Numbers

The Top 5

Apple's (No. 1) supply chain strategy has always centered on orchestrating the delivery of winning customer solutions. Historically, this was through complete ownership of the design and control, but mixed ownership of the physical supply chain. Of late, it is investing billions of dollars in manufacturing tooling and equipment to ramp and automate production of its latest gear. Within

The Gartner Supply Chain Top 25 for 2014

Rank	Company	Peer Opinion[1] (188 voters, 25%)	Gartner Opinion[1] (32 voters, 25%)	3-yr. Weighted ROA[2] (25%)	Inventory Turns[3] (15%)	3-yr. Weighted Revenue Growth[4] (10%)	Composite Score[5]
1	Apple	3187	371	20.5%	69.2	31.2%	8.85
2	McDonald's	1612	369	15.6%	153.0	4.0%	6.25
3	Amazon	3171	510	0.8%	8.9	27.2%	6.08
4	Unilever	2031	517	9.9%	6.9	2.6%	5.32
5	Procter & Gamble	2166	513	8.2%	5.9	2.2%	5.20
6	Samsung Electronics	1871	351	11.4%	18.1	12.7%	5.13
7	Cisco Systems	1092	480	9.1%	12.3	6.3%	4.57
8	Intel	908	475	12.8%	4.8	3.8%	4.51
9	Colgate-Palmolive	891	322	17.4%	5.1	3.1%	4.22
10	The Coca-Cola Co.	1820	265	10.1%	5.3	6.2%	4.03
11	Inditex	751	259	17.7%	3.9	9.1%	3.99
12	Nike	1192	225	14.2%	4.2	11.0%	3.89
13	H&M	690	108	26.7%	3.6	6.4%	3.83
14	Wal-Mart	1764	215	8.0%	7.9	3.5%	3.52
15	PepsiCo	1000	298	8.6%	8.2	3.2%	3.37
16	Lenovo	808	210	3.3%	17.5	24.4%	3.14
17	Starbucks	1044	185	8.5%	5.7	11.9%	3.06
18	3M	975	146	13.6%	4.1	4.1%	3.05
19	Qualcomm	193	56	14.1%	6.8	30.6%	2.95
20	Seagate Technology	67	39	19.5%	12.5	8.1%	2.75
21	Kimberly-Clark	605	206	9.9%	6.1	1.6%	2.65
22	Johnson & Johnson	957	149	9.6%	2.8	5.2%	2.65
23	Caterpillar	696	245	5.4%	3.0	3.3%	2.43
24	Cummins	153	144	12.1%	5.3	6.0%	2.34
25	Nestlé	1060	99	8.3%	5.4	1.5%	2.30

Notes:
1 Gartner Opinion and Peer Opinion based on each panel's forced-rank ordering against the definition of "DDVN Orchestrator"
2 ROA: ((2013 net income / 2013 total assets)*50%) + ((2012 net income / 2012 total assets)*30%) + ((2011 net income / 2011 total assets)*20%)
3 Inventory Turns: 2013 cost of goods sold / 2013 quarterly average inventory
4 Revenue Growth: ((change in revenue 2013-2012) *50%) + ((change in revenue 2012-2011) *30%) + ((change in revenue 2011-2010) *20%)
5 Composite Score: (Peer Opinion*25%) + (Gartner Research Opinion*25%) + (ROA*25%) + (Inventory Turns*15%) + (Revenue Growth*10%)
2013 data used where available. Where unavailable, latest available full-year data used.
All raw data normalized to a 10-point scale prior to composite calculation.
Ranks for tied composite scores are determined using next decimal point comparison.

the past year, Apple has become more vertically integrated through strategic acquisitions for key component technologies. Its supply chain also brought its iPad and iPhone component sourcing back in-house. Apple has consistently delivered the operational performance and votes to keep it at the top of our list.

McDonald's (No. 2) is focused on talent management, new product expertise, coordination across the supply chain, and high speed to market. It's "McDonald's System" has well-articulated operating principles for owner-operators, suppliers, and McDonald's corporate. This is supported by a culture that emphasizes long-term strategic collaboration with suppliers. In the product domain, one of the more impressive aspects of McDonald's supply chain is how it manages consistency across its large global network.

Amazon (No. 3) continues to innovate in both products and services. In a high-tech version of a razor handle and blade model, Amazon manages its physical supply chain with precision and efficiency, enabling broad adoption of its competitively priced hardware, which acts as a platform for software and media content sold either discretely or through its Prime subscription service. Amazon is exploring taking over management of the last mile of delivery to customers in some markets. One of its more provocative proposals in this area is the use of unmanned aerial drones to deliver shoebox-size packages from Amazon's fulfillment centers to customers' homes within 30 minutes.

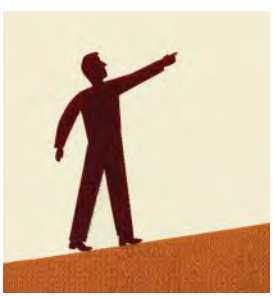
Unilever (No. 4) has pursued an ambitious vision for sustainable growth for the past few years that targets doubling its revenue at half the environmental footprint by 2020. Its channel-ready supply chain program determines the appropriate level of supply chain services and marketing support each channel and customer requires to enable growth, in a profitable way. A complementary cost-to-serve program is helping drive improvements in its distribution network and trade marketing budgets.

P&G (No. 5) is a pioneer in demand management excellence incorporating a range of inputs, including consumer social data. P&G also scores well with retailers for collaboration. Understanding the importance of emerging markets, a few years ago, P&G moved its personal care and cosmetics HQ to Singapore. Now it has an advanced Innovation Center there enabling prototype manufacturing for rapid, small-scale consumer testing and innovations in packaging. Recently P&G made an announcement that it would be cutting nearly half of its brands to drive growth through its higher velocity products.

Movers and Shakers: Number 6 through Number 15

Three leading high tech companies sit atop this group: Samsung, Cisco, and Intel. Samsung (No. 6) runs a highly coordinated, vertically integrated supply chain that includes critical display, touch, camera, and microprocessor component technologies. Having built solid Collaborative Planning Forecasting and Replenishment (CPFR) capabilities with larger, more mature customers, its supply chain has expanded its effectiveness by including detailed sell-through and activation visibility in many of its other channels.

Amazon is exploring taking over management of the last mile of delivery to customers in some markets. One of its more provocative proposals in this area is the use of unmanned aerial drones.



Cisco's (No. 7) supply chain is viewed as a growth enabler for existing and new businesses in cloud infrastructure and the "Internet of Everything." This includes the 160-plus acquisitions the company has completed over past two decades. Cisco is well known for maturity in collaborative planning and risk management with customers and suppliers, and also has a major focus on supply chain talent.

Intel (No. 8) is an ingredient company that cracked the code on being customer-centric several years ago. Partnering with customers to quickly ramp inventory hubs and collaborate on products and operational efficiency capabilities has led to world-class customer satisfaction levels. Intel has also been a vocal advocate for social responsibility in areas such as conflict minerals.

There are also several leading consumer product and retail companies in this second group:

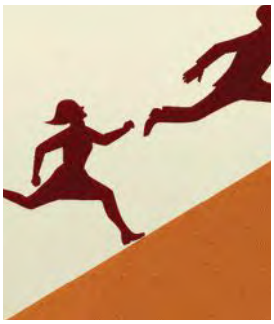
Colgate-Palmolive (No. 9) has a long heritage of people management at a global level. Colgate once again leads the CP industry in return on assets (ROA) at 17.4 percent. It has one of the best item management programs in consumer products, focused on product productivity, and continues to reinvest the savings back into its business operations. In general, there is strong alignment from the CEO down through to operational execution, driving margin expansion and improved cash flow.

Coca-Cola (No. 10) has a global goal of becoming water neutral by 2020 and replenishing 100 percent of the water it uses in making its products. We recognize Coke's ability to grow by shifting its portfolio from carbonated to non-carbonated beverages with support from supply chain initiatives like demand analytics and segmentation; capabilities that help Coca-Cola profitably serve 22 million channel customers.

Nike (No. 12) has improved its sensing and shaping of demand in volatile markets. Its COE is leveraging advanced analytics for supply network design. This fashion and apparel leader also has mature practices in sustainable design and speed to market.

Swedish retail giant, H&M (No. 13) is also very good at PLM coordination across its 160 in-house designers and 900 independent suppliers. It is strong at demand sensing (i.e., fashion trend sensing) and the supply chain supports brand messaging on fashion, quality, and price. H&M runs a leading sustainability program and launched its first closed loop products with about 20 percent of materials sourced from 3,000 tons of unwanted garments.

Wal-Mart (No. 14) is accelerating its focus on multi-channel. For the first time in a decade, its online sales growth is greater than Amazon's (up 30 percent).



Inditex (No. 11), owner of the Zara brand, is another large European retailer on the list. It has continued to post strong financial performance and has leveraged its excellent demand sensing and shaping into supply chain capabilities like supply chain segmentation. Inditex is also partnering with H&M on several corporate social responsibility initiatives.

Wal-Mart (No. 14) is accelerating its focus on multi-channel. For the first time in a decade, its online sales growth is greater than Amazon's (up 30 percent). In support of this capability, the retail giant has acquired 12 e-commerce software companies in the last three years.

To complement these online capabilities, Wal-Mart has added a stand alone pick-up center where shoppers drive up and receive orders.

PepsiCo (No. 15) is a leader in inventory turns again this year in the consumer segment. The PepsiCo supply chain is using consumption data to plan transportation and truck routing for Direct Store Deliveries. PepsiCo also leverages consumer insights for store level execution. One product group, in particular, is able to manage event-based promotions to specific location, SKU, and hourly timing combinations.

Rounding Out the List: Number 16 through Number 25

We typically see companies enter the list in the group between No. 16 and No. 25, and 2014 is no exception. We're excited to welcome Seagate to the list for the first time and Kimberly-Clark for its second appearance in three years.

Seagate (No. 20) is consistently turning in strong financial performance. Its supply chain is running multiple transformation programs out of a Supply Chain Center of Excellence (COE). Two notable examples are focused on supply visibility/resiliency and talent management. After the Thailand floods of 2011, Seagate developed advanced analytics to "heat map" supply risks. In the area of talent management, it is attracting high potential individuals from outside the company and offering an advanced development program for top existing performers.

Kimberly Clark (No. 21) is another supply chain with a well-developed COE team. It has a strong focus on demand sensing through structured analysis of point of sale data and are implementing both a customer segmentation program and supply chain cost-to-serve capabilities to the joint benefit of Kimberly Clark and its customers.

Several industrials are also in this group, including: 3M (No. 18), Caterpillar (No. 23), and Cummins (No. 24). Each has its own supply chain COE and all three are delivering differentiated solutions to customers linked to either geography-specific requirements or a consciously-designed set of tradeoffs between product complexity, order fulfillment lead time, and cost.

3M has a vision to move the extended value streams supporting customers from "good to great" performance

What differentiates the leaders is that they have moved beyond the discussion phase to make the hard changes that are required throughout the organization.

as a key differentiator to support growth. The company has brought in new senior leaders to drive this vision and is building capabilities such as the adoption of Lean concepts across the extended supply chain.

CAT, facing a secular downturn in the mining industry last year, leveraged its skills in network optimization to continue servicing dealers without a large build-up of inventory. The industrial leader has also created a new "order-to-delivery" organization to improve its supply responsiveness to demand.

Cummins is focused on strengthening its supply chain orchestration capabilities. The company is running a synchronized business planning (SBP) initiative designed to provide a real-time, enterprise-wide alignment of demand, supply, and product. Its supply chain strategy team is also focused on spreading the adoption of differentiated business models across its vertically integrated network.

Two high-tech companies, Lenovo (No. 16) and Qualcomm (No. 19), are also returning to this group for a second year in a row.

Lenovo has aggressively pursued growth, both organically in PCs, servers, and mobile devices and through acquisitions. Its supply chain analytics COE is leveraging a more data-driven approach to global supply network design, including sourcing and manufacturing decisions. The team is also focused on improving supply chain visibility over a standard cross-enterprise platform for improved productivity, control, and inventory management.

Qualcomm is the dominant chip player for mobile devices, particularly smart phones. Its supply chain is focused on improving new product time to market and governance of their active product portfolio. On the supply side, Qualcomm is investing in analytics to improve both planning cycle time and manufacturing costs.

Rounding out the last group are Starbucks (No. 17), J&J (No. 22), and Nestle (No. 25). All of these supply chains are focused on sustainable growth and improving living conditions in emerging markets.

Starbucks runs a broad spanning supply chain that includes new product development, customer service, and strategy. A proactive talent strategy is also one of Starbucks' strengths. This includes a career development rotational program where participants gain experiences in leadership competencies, supply chain education, and Starbucks culture. This year, it has launched an innovative new partnership with a U.S.-based university to subsidize college expenses for qualifying associates.

J&J has a visionary supply chain organization focused on supporting the next billion healthcare consumers. Operationally, this means driving economies of scale across its diverse businesses and differentiating where it is value add for its customers. Its Janssen pharmaceutical group has implemented a handful of distinct supply chain models, leading to improved service and inventory management.

Nestle, the largest food manufacturer in the world, is driving complexity reduction and item productivity improvements from its Nestlé's Continuous Excellence (NCE) and lean value stream implementations. It has also developed advanced and well-integrated raw materials sourcing strategies.

Characteristics of Leaders

As demonstrated above, each company develops supply chain strategies and priorities tailored to its corporate and market context. While these are useful for others to learn from, in our research we also look for shared characteristics. For many companies, these characteristics are easier to talk about than to actually implement. What differentiates the leaders is that they have moved beyond the discussion phase to make the hard changes that are required throughout the organization.

We've talked about many of these in past articles, and they remain relevant.

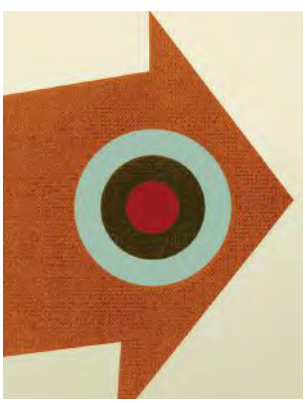
- Outside in focus: Most companies think that they are demand driven and focused on the customer, but the two concepts are not identical. You can be focused on the customer from either an outside-in or inside-out mentality. Leaders start with the customer experience of their supply chain and work their way back through their supply chain designs for an appropriate, profitable response.
- Embedded innovation: Indicates a supply chain's close integration into product lifecycle management both internally and with up and downstream partners. There is also the ability to innovate supply chain practices. This means not only adopting and adapting others best practices, but also breaking the rules, defying conventional wisdom and writing new rules for the supply chain community, as a whole. These companies are not afraid to experiment, fast fail in some areas and drive

competitive advantage in others.

• Extended supply chains: More mature companies are managing multi-tier networks with strong visibility and agility to support rapid changes in demand or disruptions in supply.

• Excellence addicts: These companies are never satisfied, even if their performance in an area would be considered world class by objective standards. Most often there is an underlying culture driving this behavior and strong governance mechanisms managed through centers of excellence.

Several of the leading CP companies on this year's list are offering e-commerce subscriptions for their products, in partnership with retailers, to create a seamless multichannel experience.



Trends

Each year, our analysts talk to and research the supply chains of hundreds of companies. Through these discussions, we note certain patterns in the trends on which the leaders are focusing their time and efforts. Here are the notable trends this year:

Understanding and Supporting the Fully Contextualized Customer. Listening to supply chain leaders over the past year, we heard them expand the demand-driven concept in terms of how they relate to their customers. It is now about understanding customers in a deeper way and blending seamlessly into their daily routines. Big Data analytics has become a buzz phrase, whether sourced from point of sale (POS) transactions, online searches, ordering activities, or assets-in-service. We see leading companies going beyond just advanced analysis from a distance, however. They study the environments this activity occurs in to parse out the contextual reasons behind local behaviors.

Some examples of this include:

• A consumer products company runs a simulated retail environment where it tracks the eye movements of paid volunteers to determine the optimal placement of product along aisles and on shelves. The company also runs similar eye movement tests for various packaging types to see which ones attract the most attention on a crowded shelf.

• A U.S. mall operator has set up a communications infrastructure that enables individual retailers to recognize when past customers, who have agreed to be tracked, enter the premises. Some of the retailers have set up event management rules that will automatically send out "come back, we miss you!" promotional texts and e-mails to these shoppers, if they have come to the mall a couple times in the recent past, but have not bought anything in their stores. Machine learning routines are also being used to target what approaches work best with shoppers.

A Convergence of Digital and Physical Supply Chains Delivering Total Customer Solutions. Leading companies have moved past only selling discrete products or services to their customers and are now focused on delivering solutions. In high tech, this might mean selling a coordinated collection of hardware, software, and services to stand up a data center for a business customer. In consumer markets, this same company might sell a hardware device for near break-even, recognizing that the profit of the solution will come later through the metered delivery of software applications and content.

Regardless of industry, these companies want their customers to be loyal subscribers to their solutions. Several of the leading CP companies on this year's list are offering e-commerce subscriptions for their products, in partnership with retailers, to create a seamless multichannel experience. This approach offers convenience and privacy to end customers that would normally buy these products in a physical store and might switch to another consumer brand during any given store shopping visit.

Some other examples of this trend include:

• A heavy industrial company sells equipment through its dealer network, but also monitors equipment in service at end users. More specifically, this company is looking for equipment usage patterns that may lead to the need for more or less maintenance. Historically, the assumption was that spare parts demand (i.e., equipment failure) was most closely correlated with time in service, but a more detailed analysis showed that failure rates spiked when the equipment was loaded above a specific threshold over its rated capacity.

• P&G sells a lot of Oral B toothbrushes and Crest toothpaste, but for these products, their connection to the consumer typically ends at the check-out line. A few months ago, Oral B introduced a Bluetooth connected toothbrush with cloud-based software that monitors oral care routines and health as part of a broader solution.

Supply Chain as Trusted and Integrated Partner. Our annual CEO survey this year showed that the C-suite is now laser-focused on growth. A full 63 percent of senior executives picked growth as a top imperative, as compared to the next most popular area, cost management, at 25 percent. Leading supply chains are enabling this growth, both organically and through successful M&A integration. At the same time, we're seeing true supply chain leaders emerge as trusted and integrated partners to business groups. Their focus on profitable growth often leads to smarter, more conscious decision making, saving business groups from spiraling out of control in the drive to maximize revenue.

This means strong governance and analytics around the cost to serve customers and the profit contribution of products. It is also about Corporate Social Responsibility (CSR). Sometimes doing the right thing for the environment also yields cost savings through the elimination of waste. By contrast, pursuing a higher standard for human rights at suppliers in less-stringent geographies costs more, but is the right thing to do. In organizations where the head of supply chain speaks passionately and often on this topic, social responsibility has become a mantra for the entire organization.

Supply Chain Top 25 Methodology

The way we determine the ranking is something we have been transparent with since the beginning. We have also sought to keep it both consistent as well as responsive year after year, taking direct feedback from the supply chain community of professionals and incorporating suggested changes into the methodology where possible. As a result, the list reflects not only what Gartner analysts think about supply chain leadership, but what the community as a whole respects.

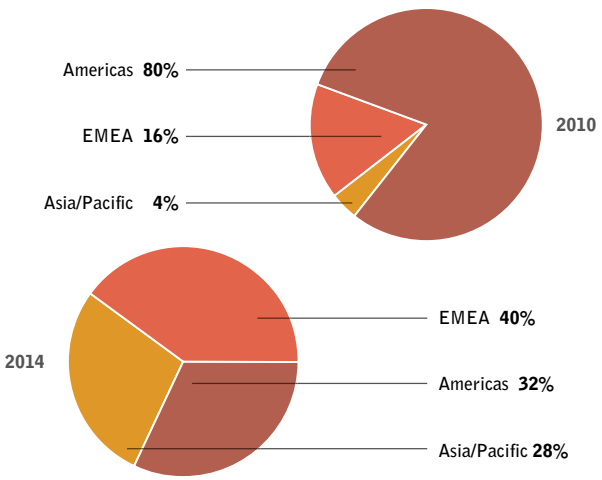
The Supply Chain Top 25 ranking comprises two main components: financial and opinion. Public financial data provides a view into how companies have performed in the past, while the opinion component offers an eye to future potential and reflects future expected leadership, which is a crucial characteristic. These two components are combined into a total composite score.

We derive a master list of companies from a combination of the Fortune Global 500 and the Forbes Global 2000, with a revenue cutoff of $10 billion. We then pare the combined list down to the manufacturing, retail, and distribution sectors, thus eliminating certain industries, such as financial services and insurance, which do not have physical supply chains.

Financial component. ROA is weighted at 25 percent; inventory turns at 15 percent; and growth at 10 percent. Inventory offers an indication of cost management, and ROA provides a general proxy for overall operational efficiency and productivity. Revenue growth, while clearly reflecting myriad market and organizational factors, offers some clues to innovation. Financial data is taken from each company's publicly available financial statements.

EXHIBIT 2

Supply Chain Top 25: Comparison of Peer Panel Regional Composition, 2014 vs. 2010



Source: Gartner

The weighting within the financials has remained consistent since 2010. Prior to 2010, inventory was weighted higher than it is today, at 25 percent. We had considered dropping it all together. As much as inventory is a time-honored supply chain metric—one of the few "real" supply chain metrics on a company's balance sheet—there have always been issues, not the least of which is that higher turns don't always point to the better supply chain. At the same time, it's a metric that is widely known and understood, both inside and outside the supply chain community. Despite the issues, it's not entirely invalid as an indicator, particularly if combined with other metrics. Therefore, we left it in, but reduced its weighting.

Since 2009, we've used a three-year weighted average for the ROA and revenue growth metrics (rather than the one-year numbers we had previously used), and a one-year quarterly average for inventory (rather than the end-of-year number we had previously used). The yearly weights are as follows: 50 percent for 2013, 30 percent for 2012, and 20 percent for 2011.

The shift to three-year averages was put in place to accomplish two goals. The first was to smooth the spikes and valleys in annual metrics, which often aren't truly reflective of supply chain health, that result from events

such as acquisitions or divestitures. It also accomplishes a second, equally important goal: to better capture the lag between when a supply chain initiative is put in place (a network redesign or a new demand planning and forecasting system, for example) and when the impact can be expected to show up in financial statement metrics, such as ROA and growth.

Inventory, on the other hand, is a metric that is much closer to supply chain activity; we expect it to reflect initiatives within the same year. The reason we moved to a quarterly average was to gain a better picture of actual inventory holdings throughout the year, rather than the snapshot, end-of-year view provided on the balance sheet in a company's annual report.

Looking forward, we are evaluating changes to the way the financial components will be calculated in future Supply Chain Top 25 cycles.

Opinion component. The opinion component of the ranking is designed to provide a forward-looking view that reflects the progress companies are making as they move toward the idealized demand-driven blueprint. It's made up of two components, each of which is equally weighted: a Gartner analyst expert panel and a peer panel.

The goal of the peer panel is to draw on the extensive knowledge of the professionals that, as customers and/or suppliers, interact and have direct experience with the companies being ranked. Any supply chain professional working for a manufacturer or retailer is eligible to be on the panel, and only one panelist per company is accepted. Excluded from the panel are consultants, technology vendors, and people who don't work in supply chain roles (such as public relations, marketing, or finance).

We accepted 219 applicants for the peer panel this year, with 188 completing the voting process. Participants came from the most senior levels of the supply chain organization across a broad range of industries. There were 32 Gartner panelists across industry and functional specialties, each of whom drew on his or her primary field research and continuous work with companies.

Organizations must surpass a base threshold of votes from both panels to be included in the ranking. Therefore, a company that had a composite score fall within the Supply Chain Top 25 solely based on the financial metrics would not be included in the ranking.

The regional breakdown of voters continued to be a particular emphasis for us, and we made significant progress this year. In the past, North American voters made up 80 percent of the total, despite many efforts to get a more even regional distribution. We've been making steady and constant improvements since then to increase the percentage of voters from Europe and Asia/Pacific. This year, we had 40 percent representation from Europe, 32 percent from North America and 28 percent from Asia Pacific. We expect the trend to continue towards fully balanced regional representation (see Exhibit 2).

Polling procedure. Peer panel polling was conducted in April 2014 via a Web-based, structured voting process identical to previous years. Panelists are taken through a four-page system to get to their final selection of leaders that come closest to the demand-driven ideal, which is provided in the instructions on the voting website for the convenience of the voters.

Here's a breakdown of the voting system:

- The first page provides instructions and a description of the demand-driven ideal.
- The second page asks for demographic information.
- The third page provides panelists with a complete list of the companies to be considered. We ask them to choose 30 to 50 that, in their opinion, most closely fit the demand-driven ideal.
- After the subset of leaders is chosen, the form refreshes, bringing just the chosen companies to a list. Panelists are then asked to force-rank the companies from No. 1 to No. 25, with No. 1 being the company most closely fitting the ideal.

Individual votes are tallied across the entire panel, with 25 points earned for a No. 1 ranking, 24 points for a No. 2 ranking and so on. The Gartner analyst panel and the peer panel use the exact same polling procedure.

By definition, each person's expertise is deep in some areas and limited in others. Despite that, panelists aren't expected to conduct external research to place their votes. The polling system is designed to accommodate differences in knowledge, relying on what author James Surowiecki calls the "wisdom of crowds" to provide the mechanism that taps into each person's core kernel of knowledge and aggregates it into a larger whole.

Composite score. All of this information—the three financials and two opinion votes—is normalized onto a 10-point scale and then aggregated, using the aforementioned weights, into a total composite score. The composite scores are then sorted in descending order to arrive at the final Supply Chain Top 25 ranking.

Conclusion

We are proud to share this 10-year celebration of supply chain leadership with the supply chain community and look forward to continuing to highlight the lessons learned, providing a platform for informed and provocative debate, and helping supply chains provide vital contributions to the global economy.

How They Did it: Multi-Enterprise Collaboration at Intel

By John Dawson

When it came, the sign that something was wrong with one of Intel's supply chains was not hard to miss. A key subcontractor for a particular Intel business unit was awash in excess inventory for turnkey and consigned parts. The cause? Someone had wrongly entered the required order quantity, and the subcontractor had acted on that information.

But that was simply the manifestation of the problem. The real problem was that nobody caught the problem until it was much too late—until this particular business unit (BU) owned the parts its subcontractor had unwittingly ordered. Nobody caught it because nobody knew about it: The BU had no proactive way of identifying, let alone cross-checking, appropriate purchases against actual demand. It did not have visibility.

What went wrong? That is a question those of us with supply chain responsibilities have examined at Intel reaching back at least to 2009, when my team identified a collaboration supply chain software program to address our outsourcing challenges. While putting this solution in place had to wait until a corporate-wide software initiative was well underway, rolling it out ultimately involved a broad training and certification program for supply chain

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Intel has always had superlative internal supply chain processes within its vertically integrated operations. But until recently, the same could not be said of one of its business units that outsourced to subcontractors around the world. In fact, the ad hoc nature of that unit's supply chain interactions posed a threat to its competitiveness. Here's how a determined team championed a powerful supply chain collaboration model that is getting real results—and that is now being rolled out across the company.

planners, buyers, and managers. Along with raising the skill level and supply chain knowledge of our team, it set the stage for the collaborative pilot program that is currently in place with our partners. What follows are the steps of how we did it at Intel.

Setting the Stage

First, it's important to give some background on Intel Corp. The company is a Silicon Valley legend—a world-class developer and manufacturer of integrated circuits, notably its microprocessors and memory chips. Now almost 45 years old, Intel had revenues of close to $53 billion in 2013, with more than 107,000 employees. Intel has had a transformative impact on the world around us, making possible the first personal computers and much of the computing infrastructure that drives the Internet, as well furthering fields of significant scientific endeavor.

Working with suppliers as far away as China, and with many of its buyers and planners in Malaysia, the Boards/Systems BU had struggled to balance customer responsiveness against asset utilization, and to juggle both of those with inventory management.

Throughout, the company has performed strongly, growing steadily and very profitably. It recently hit an all-time high for quarterly microprocessor unit shipments—just one hint that it has an exceptionally effective supply chain. However, that is largely an internal supply chain: Much of what the company produces is within vertically integrated operating models. There, its steadily improved business processes are supported by customized production management software to ensure extremely consistent, cost-efficient outputs. Intel's prowess in this respect has not gone unnoticed: For 2014, the chipmaker ranked eighth in Gartner's Supply Chain Top 25 listings (page 8).

So it's natural to ask how any Intel BU fell afoul of the over-ordering snafu mentioned earlier. The short answer: The problem affected the supply chain of one BU that is heavily reliant on outsourcing. This particular BU makes boards and systems that support several Intel product lines. In addition, some of the new market segments that Intel is pursuing are supplied largely by trusted outsourcing partners, and with those external arrangements come significant supply chain challenges.

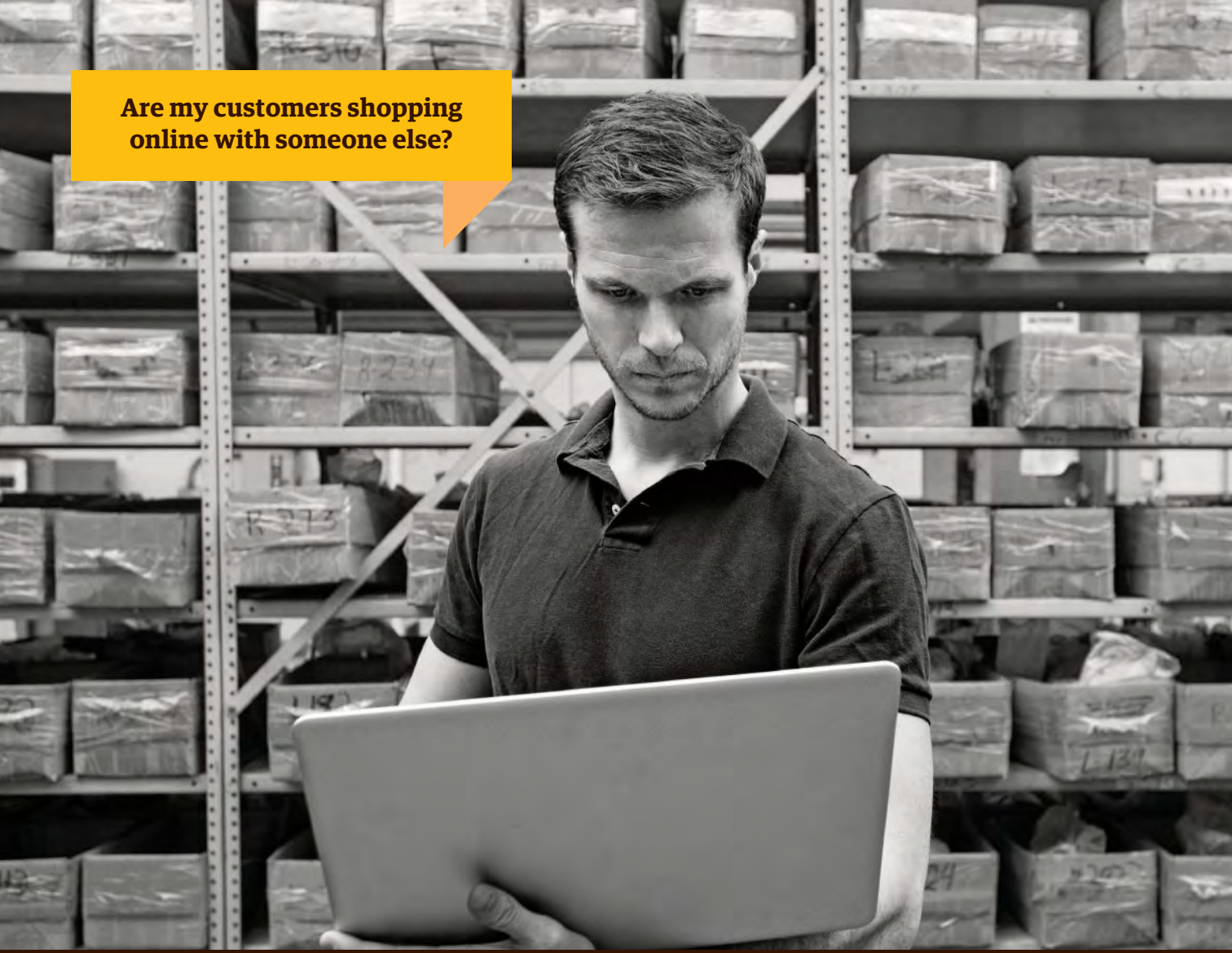
It's important to state that the problem was not about outsourcing per se: Intel had been outsourcing successfully for many years. But at that time—when the chronic over-ordering incident happened—outsourcing was still a small part of the company's overall business and had not received the focus on the levels of efficiency that had long been Intel's internal hallmark on the silicon side of the supply chain.

Working with suppliers as far away as China, and with many of its buyers and planners in Malaysia, the Boards/Systems BU had struggled to balance customer responsiveness against asset utilization, and to juggle both of those with inventory management. Collaboration was problematic: Often, the BU's leaders had very limited visibility of the inventory that Intel was responsible for. They depended on weekly or bi-weekly manual reports from subcontractors, and it was not always clear whether there was enough or too much inventory, so they were exposed to the worst of the bullwhip effect. Many of the BU's supply chain processes were outdated: dependent on manual methods to update and share Excel spreadsheets, for instance. "Ad hoc" would be a kind way to describe the way in which its information supply chain ran.

The Push for Real Collaboration Begins

Of course, collaborative inter-company methods were not novel: Groups such as the Voluntary Interindustry Commerce Solutions (VICS, merged into the GS1 US industry group in 2012) had long ago laid down powerful practices in collaborative planning, forecasting, and replenishment. Their methods and teachings had established best practices for everything from collaboration for distribution center replenishment to collaborative assortment planning. The ideas were well-known to experienced supply chain practitioners throughout Intel.

About four years ago, my team and I had succeeded in convincing our BU's top managers of the need to remedy our outsourcing supply chain challenges. We had identified a collaboration software system that would be ideal. But the gears did not begin to move because Intel—long a user of enterprise ERP systems—imposed a company-wide moratorium on new software implementations, until the whole company had been re-platformed onto a more flexible and interoperable foundation of ERP enterprise



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Time passed: For a $50 billion-a-year organization, a re-platforming imitative is anything but a weekend fix. Many of us—myself included—moved onto other roles. But my team never lost sight of the need to push for our collaboration ideal.

Our chance came in 2009. The IT organization was leading the ERP re-platforming, which incorporated industry standard ERP concepts. As part of that effort, they implemented APICS Certified Supply Chain Professional (CSCP) training for applicable IT staff members. As a long-time APICS member (I'd held many chapter board positions over the years), I knew about this program; I knew it could it would work well for our business users who had long been used to Intel's heavily customized ERP systems (see Exhibit 1).

EXHIBIT 1

It All Started with APICS CSCP

Source: Intel

With the IT's group's move as a catalyst, my team and I convinced our BU's management team that we needed to run a similar training program for our planners, buyers, and managers. The beauty of the CSCP program was that it would get our people from zero knowledge to substantial understanding in a 17-week program taught by internal instructors. We certainly understood the value of the full APICS Certified in Production and Inventory Management (CPIM) program—training in production and inventory activities within a company's global operations that takes more than a year and comes with multiple exams—but we knew we didn't have time to embark on that level of customized training.

Firm Foundations for a Collaborative Outsourcing Strategy

In 2010, a broad-based APICS CSCP program began. We conducted internal classes across several Intel sites worldwide; in just one year, more than 100 employees had become qualified CSCP professionals. As the program gained traction, we formed an APICS core team, responsible for administering APICS education and certification programs across the company. Momentum was growing rapidly, and as we expanded classes, the knowledge derived from CSCP was becoming a game-changer, especially for the outsourcing supply chain. The program continues today, with more than 250 Intel employees now APICS CSCP-certified.

Over the next couple of years, my team and I had long and involved conversations about collaboration and supply chain visibility with the new management team at our business unit. Our vision was broader still: We saw opportunities to bring new levels of supply chain performance to outsourcing activities all across Intel. But we had to start somewhere, and we knew very well that we had to design and run rigorous pilot projects to prove out the concepts, determine returns on investment, figure out vendor selection, and so on.

The Boards/Systems BU was a great place to start. We knew there was an appetite for real solutions; with competition heating up and the BU's supply chains spread worldwide, the management team was keen to have this kind of collaborative capability. They did not need much convincing about the vulnerabilities of the "as is" state: They knew the lack of supply chain visibility and limited use of analytics were acute problems where outsourcing was concerned. They saw that the collaborative capabilities needed to support outsourcing and internal manufacturing were fragmented and could not scale enough to ensure future business growth and complexity.

The BU's operations team had also seen the effects of multiple and siloed reporting interfaces, systems, tools, and databases. They were familiar with the problems caused by the lack of data integration. With data distributed in many forms across several dozen users—much of it on Excel on individuals' desktops—sharing of data was very difficult, and effective analysis and reporting were, well, not effective. Band-Aid offline processes were the order of the day. The management team knew they could not continue this way.

Late in 2012, we had management's commitment—and funding—for a Collaboration, Visibility and Business Information (CVBI) program to properly pilot and test our collaborative supply chain tools and processes. We put together a use case definition and—picking up on evaluation work we had done years earlier—we quite quickly selected a vendor of collaborative software-as-a-service (SaaS). This was a significant departure: essentially running many of our critical processes in the cloud,

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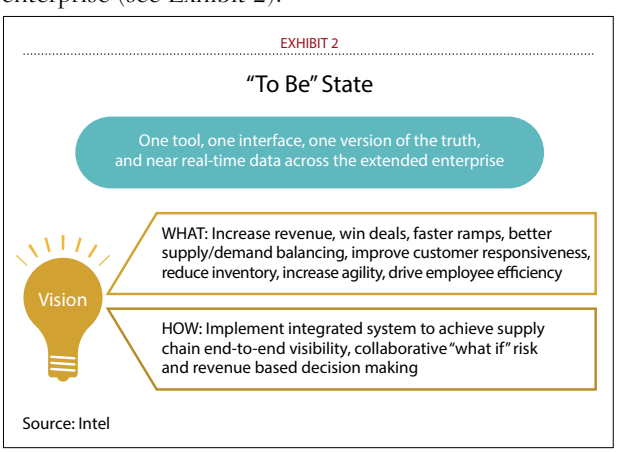
with the potential risks that data outside Intel's firewall might imply. But the SaaS tool came with plenty of benefits: These included "one version of the truth;" real-time, any-to-any connectivity and visibility for all participants; the opportunity for participants to self-service online; and with real ability to scale up.

By the first quarter of 2013, CVBI was off and rolling, starting with assessment and design of the pilot and on-boarding of selected subcontractors. We would pilot the program in three of the business unit's half-dozen manufacturing sites. Our CVBI teams were coached in the "to be" state: one tool, one interface, one version of the truth, and near real-time data across the extended enterprise (see Exhibit 2).



They understood the "what:" the business objectives of increasing revenue, winning deals, ramping up faster, achieving better supply/demand balance, improving customer responsiveness, reducing inventory, increasing agility, boosting employee efficiency, and more. And they grasped the "how:" implementation of an integrated system that would become the platform for multi-enterprise collaboration execution among Intel and its subcontractors, with streamlined information flow, integrated and automated data, highlighted business exceptions, and rapid resolution processes.

We kept the teams small—roughly a dozen people representing a cross-section of the business, including planners and buyers who were our "super users." I led the core CVBI team together with a representative manager from IT and one from the business side; we also had an executive sponsor from each side, and another from the procurement group. We would meet roughly twice a week.

By the second quarter, we began integrating those subcontractors' supply chain data systems with our own, using the new software; configuration and testing got going in earnest too. By the fall of last year, user training was well under way, and we were getting ready to go live with the software.

Results Achieved to Date

Our CVBI pilot in the Boards/Systems BU has already proved itself. We're closing up the visibility black hole. There is indeed one tool and one version of the truth out there in the cloud. We are still in the early days—the pilot is only now wrapping up—but we can already point to real business-to-business connectivity to and among multiple suppliers. We now have multi-level inventory visibility across the supply network. We can do exception management, drilling down into the details. And we have "what if" analytics with which to make faster decisions. We can now get back to customers with timely answers: In some cases, we can respond inside an hour whereas this time last year, the quickest we could have done that would have been a week—a level of response that did not endear us to customers (see Exhibit 3).

None of what we've achieved so far has been plain sailing. Data quality has been a challenge: It has been really tough to get subcontractors in sync on this point. Some have good systems and good tools; others don't. Many question why we need this data; they need to be persuaded that their data will be safe in the cloud. Others are concerned that we're micromanaging them; we have to enlist Intel's supplier relationship management experts to help those contractors understand the benefits to them of identifying supply-demand imbalances more quickly.

With many others, they are not clear what types of data we need, and in what formats; many are used to simple spreadsheets. There's also the question of timing of the data. We have to be able to "choreograph" the data coming from multiple sources—from subcontractors, from the warehouses and DCs, from elsewhere within Intel—so our buyers and planners can make "apples to apples" comparisons. Then there are the language barriers. And, some of the subcontractors in China are so huge that we have to deal with entirely different groups, with each one like dealing with a different company. Time zones are the least of our challenges.

There have been plenty of internal challenges at Intel too. The biggest has been that CVBI is very new, and it takes time for busy people to understand what it can do. So educating the user community—buyers,planners, and others—is a big part of what we've been doing, and will continue to do. When we present CVBI in terms of "a day in the life of a planner," it helps them see how they can

EXHIBIT 3

Business Value

Quicker Ramps	• Solution is BU/product agnostic • Scalable to support quick ramp
Better Revenue Vs. Risk Decisions	• Scenario assessment/"what if" modeling to make fast and accurate data-based decisions
Inventory and Scrap Cost Reduction	• Lower engineering change impact on inventory • Financial liability analysis to lower inventory exposure • Scrap root cause visibility
Customer Satisfaction	• Respond to customer request in hours; not days/weeks
Employee Productivity	• Workflow management for internal collaboration • Event management with drill down for quick root cause and corrective action
Better OHS Scores	• Less stress on employees = better organization health scores

Source: Intel

be more efficient and do their jobs better. We do similar outreach for senior managers, pitching the CVBI initiative in terms of what it's going to do for entire business unit.

We've run dozens of training sessions, using methods that range from conference calls and face-to-face meetings with small groups to hands-on demos of the SaaS tools. We've had the super users on our CVBI teams lead training—and set up and supervise "train the trainer" sessions.

One other big hurdle: getting the new SaaS vendor to understand our business requirements. That has proved to be heavy lifting. We've had what we call "map days" where we sit down with the vendor and take them through the detail of how we plan, how we buy, how we work with our subcontractors, and so on. That education process alone took the better part of six weeks.

Expanding the Initiative

Of course, our results to date represent only one of Intel's many business units. And this is very much a work in progress. We still get Excel spreadsheets from subcontractors, so we still need to have people poring through those spreadsheets looking for the right inventory data. We're moving toward the ideal of the "integrated enterprise" but we're a ways off yet.

But what is so encouraging is that we now have a broad-based user community that is very excited about CVBI and the SaaS tool behind it. In fact, we now have more demand from more places across Intel than we have resources to handle it. There hasn't been one big "a-ha" moment: As users start seeing valuable data coming out of the CVBI system—data and insights they hadn't been able to get before, and in near real-time—they want more. There's definitely a "wildfire" effect: We have a heavy concentration of our buyers and planners in Malaysia, and those in office space next to the staff who already have access to CVBI are very interested and eager.

Similar effects are happening at management levels within Intel. The general manager and the director of operations at the Boards/Systems BU are very enthusiastic about the new collaborative processes; the ops director regularly jumps on the tool himself. He sees it as a must-have: a good thing too, because he has to justify the funding for it. So the word is traveling to the heads of other business units throughout Intel.

We're now a year into the program, but we're looking at this being at least a three-year program. We are now beginning the process of planning a broader roll-out, using Intel's formal transition change management processes to determine what actions we have to take, when to take them, and who will be responsible for them. Crucially, we want to template these changes: The last thing we want to do is customize the CVBI process for every business unit in Intel. Ideally, as we continue to proliferate it, CVBI becomes a standard process, much like Intel's famed "copy exactly" manufacturing method.

Moving Forward

Intel now has the tools and methods to be able to run its external supply chain activities with efficiencies and visibility approaching those of its superlative internal supply chains. It can now blunt the risks of increasing supply chain complexity, the steep growth in the number of SKUs, and the rising tide of competition.

The CVBI system is agnostic with regard to business unit or product; it can be scaled easily to support the quick ramp-ups that are increasingly typical of consumer-driven demand today. It helps Intel's managers lower their exposure to inventory overages, gives them the wherewithal to run "what if" models to make faster and more accurate fact-based decisions, and makes them much more responsive to customer queries.

We've seen what it has done for one business unit, and look forward to seeing what it can do for Intel as a whole. Given the enthusiasm for CVBI that we're now sensing across the company, we don't think we will have to wait long.

Warehouse Control *in the Age of the* Internet of Things

By Steve Banker

Steve Banker is the service director for supply chain management at ARC Advisory Group. He can be reached at sbanker@arcweb.com. For more information, visit www.arcweb.com.

If warehouses are to utilize new sensors and intelligence to optimize performance and connect to the enterprise, warehouse management systems and warehouse control systems architectures need to be re-conceptualized.

In the age of the Internet of Things, an increasing number of materials handling systems (MHS), and even components of the larger systems, are gaining both sensors and intelligence. However, existing warehouse control systems (WCS) have not been engineered for this new age. Going forward, we believe that warehouse management (WMS) and warehouse control systems architectures need to be re-conceptualized to enable optimum warehouse performance.

Materials Handling Systems and the Internet of Things

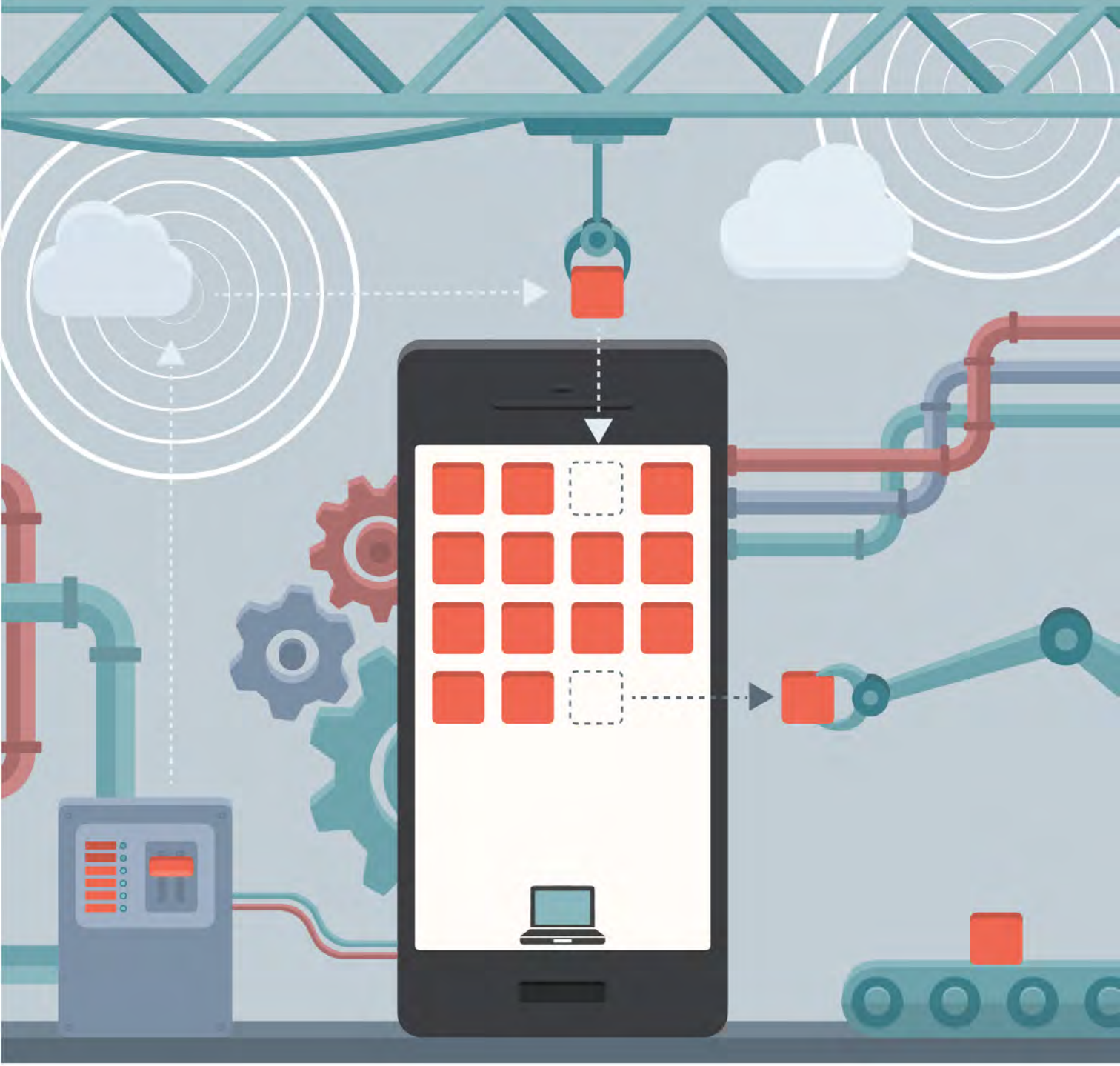
In one definition of the term "Internet of Things," almost all objects have sensors, connectivity to a broader environment, and intelligence. Sometimes the object has just a sliver of intelligence; but it can be much more substantial. Objects can be products, equipment, containers, or other things as well. For our purposes, the objects we are focused on are forms of materials handling equipment.

Traditionally, we said that warehouses were operated in either a manual, semi-automated, or highly automated fashion. In a manual warehouse, pickers used carts, forklifts, and other "dumb" forms of carriage to go to picking locations, gather the inventory, and deliver those goods to the shipping dock. However, forklifts are becoming intelligent. With the right kind of control system, a warehouse using forklifts becomes semi-automated.

The Intelligent Forklift

Traditionally, the forklift was the backbone for manual material movement in a factory or distribution center, a "dumb" piece of machinery that was entirely dependent upon the operator. In contrast, modern forklifts epitomize the evolution to intelligent, sensor-enabled equipment. Today's "smart" forklift includes diagnostics that allow the equipment to signal when it needs to be serviced, speed controls, anti-slip technology that monitors wheel spin and improve traction on slick floors, collision detection, fork speed optimization, and more.

Intelligent forklifts promote new process flows in the warehouse.



When integrated to a WMS, the forklift's fork can be raised or lowered much quicker. The WMS directs a forklift to a pick location. Once at the location, the forklift knows whether the pallet to be picked is being stored at a height of three feet, six feet, etc. The operator pushes a button on the console and the forks move at the maximum safe speed, a speed considerably faster than the operator would be apt to move them.

Speed controls can be used to help ensure safety. For example, RFID tags placed in the floor can signal the forklift that this is a busy section of a warehouse traversed by humans. The forklift automatically knows it cannot exceed a set speed, for example two mph, and the governor automatically limits the top speed to two mph in those sections of the warehouse.

In mixed case picking, intelligent forklifts can integrate with pickers wearing voice systems, follow them up an aisle, lift the pallet to the correct ergonomic height for picking based upon the location of the inventory in the warehouse racking, and then, when ordered to do so, autonomously (without a human driver) make the trip to a shipping dock for unloading.

The most intelligent forklifts today are built with real-time location systems that allow drivers to proceed to a specified location and pick up (or put down) a load without the need for drivers to scan the location to prove

that they have picked up (or delivered) the right load. This solution is designed for full pallet moves in either a warehouse with racks or a bulk warehouse in which pallets are stacked on top of each other.

The Intelligent Material Handling Component

Intelligence is also becoming more componentized and distributed in conveyor and sortation systems. Modern conveyors resemble modular Lego blocks. Distinct segments of the conveyor can have their own sensors and intelligence. This makes this form of materials handling more flexible and the investment in these technologies less risky.

For example, imagine a warehouse in which daily throughput volumes have increased over time. One can now pop in a new five-yard segment containing the conveyor, a divert sensor, the sortation device, and a motor. If the WCS signals a divert, the distributed control at the component level can kick the inventory off the conveyor, and the engine on that segment of the conveyor revs up to close the gap with other items on the conveyor.

The Traditional View of WMS and WCS

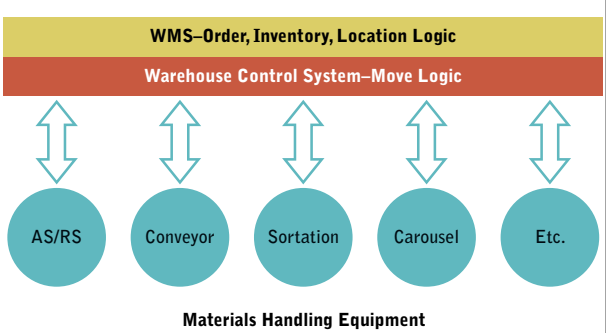
The following diagram shows how WMS and WCS have traditionally been visualized (see Exhibit 1). In this example, the WMS contains the order, inventory, and location logic. The WCS has the move logic. The WMS knows that this many units of this SKU need to be picked and where that inventory is located. When inventory is inducted into the automated materials handling system, it is the job of the WCS to move those items. The WCS does not need to know what inventory is being moved, or how that inventory fulfills customer orders.

Actually, it's much more complicated than that. If we are talking about moving goods by conveyors, the traditional view is apt. But if we are talking about automated storage and retrieval systems (AS/RS), the WCS also needs to have the location logic for the goods stored in the AS/RS. And the providers of highly automated materials handling solutions will tell you that in particular situations for some process flows, the WCS also needs to contain a subset of inventory data.

Still, at its heart, a traditional WCS is all about moving goods via intelligent materials handling systems. Because traditional forklifts are not intelligent, the idea of using WCS to integrate with forklifts in this example would have been unthinkable just a few years ago.

EXHIBIT 1

The Traditional View of WMS and WCS



Source: ARC Advisory Group

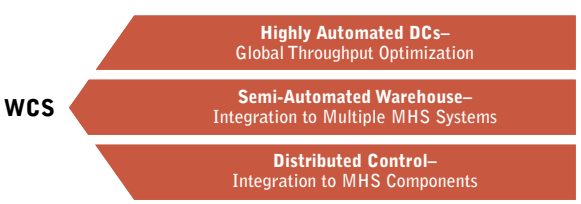
A New Conceptualization of the WMS/WCS Stack

Warehouse control in the age of the Internet of Things, requires a new conceptualization of WCS. The new view segments warehouse control into three segments (see Exhibit 2).

In highly automated warehouses, a warehouse is designed from the ground up around end-to-end flows based upon "advanced" materials handling systems. Because different materials handlings systems operate at different speeds and have different carrying capacities, a key job for the WCS is to achieve global throughput optimization by properly buffering and throttling the various subsystems.

EXHIBIT 2

A New Conceptualization of the WMS/WCS Stack



Source: ARC Advisory Group

In a semi-automated warehouse, one key aspect of the WCS is to solve the "islands of automation" problem. In many warehouses, over time new materials handling systems have been added. For example, a short conveyor section in the shipping department one year, a carousel a couple of years later, conveyors in the receiving department after that, and so forth.

Each of these distinct materials handling systems has its own control system that needs to be integrated with the WMS. This ad hoc process of integrating to the WMS drives up costs and makes WMS upgrades all but impossible. Thus, a key job of a WCS in a semi-automated warehouse is to be the central integration point between the WMS and the various material handling systems that have been added over time (see Exhibit 3).

A forklift that integrates through a control layer to some of the logic in a WMS to move its forks faster and more efficiently is now engaged in a move activity. That means intelligent forklifts need to be part of a larger warehouse control solution in this new WMS/WCS stack.

A small section of a conveyor, with its own logic and sensors to allow it to move items within its small domain more efficiently, is also engaged in a move activity. Wii technology provides a useful analogy of what is likely to come to the warehouse in the future. The Wii is an electronic game that senses the motions of players; it is inevitable that this form of technology will come to the warehouse. For example, it is possible to imagine a worker loading a truck supported by an extendable conveyor. One can imagine that worker making hand gestures to speed up or slow down the conveyor speed and other motions that signal the conveyor to extend further into the trailer or begin to pull back into the warehouse. Thus, we clearly need to visualize a WCS as integrating with new forms of sensor intelligence.

There's never been a neat line separating the types of logic contained in a WMS and a WCS, and this isn't going to change. Semi-automated warehouses also need to attempt to attain global throughput optimization. However, the logic to do this is frequently found in a WMS, sometimes in the WCS, but more often will require cooperation between the two. For example, if a manual pack station is the warehouse bottleneck, a conveyor feeding those stations needs to be able to throttle up and down to provide a buffer to avoid overwhelming those stations. Acting as a control tower, a WMS can utilize visualization to allow a warehouse manager to see whether work is proceeding on schedule or slowing down at those stations. If the pack stations are falling behind, the manager can reposition labor from other sections of the warehouse to ramp up warehouse throughput.

In highly automated warehouses, the WCS technology is critical. In these warehouses, local zone needs must be balanced to speed up or slow down, with global optimization of all move activities occurring in the warehouse. While this will create new hurdles, it is likely that agent-based software development will be needed to solve this requirement.

Meeting These New Challenges

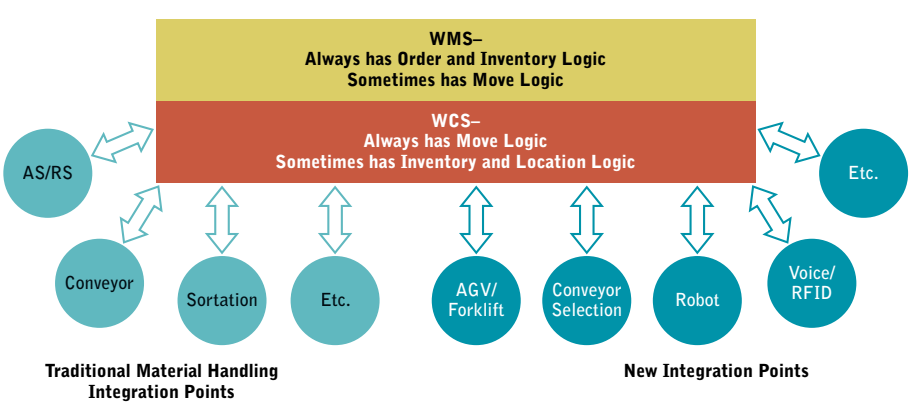
Clearly, our key recommendation for materials handling and WMS suppliers is to reexamine their WMS/WCS architectures and ask themselves whether these can support far more types of materials handling systems and subcomponents of those systems that have sensors, connectivity to a broader environment, and intelligence.

In an era of distributed intelligence, a robotic revolution, and an environment in which new forms of "goods-to-person" automation are arising, it is inevitable that we will see value migrate from certain types of solution providers to others. Value will migrate away from solution providers focused on highly automated warehouses based on fixed (bolted down) material handling systems. That is because highly automated warehouses don't flex well as order volumes and profiles change, and thus can carry a high-risk profile even though they can provide un-patrolled throughput. Value is beginning to migrate toward more mobile (non-bolted down) forms of materials handling used in goods-to-person processes.

WMS and materials handling suppliers that can provide WCS solutions that can treat a forklift as an advanced form of automation, allow companies to add new forms of automation while protecting the WMS upgrade path, and provide logic that helps optimize throughput (even in warehouses where bottlenecks may shift over time between manual and materials handling system choke points), will be the winners in this brave new world.

EXHIBIT 3

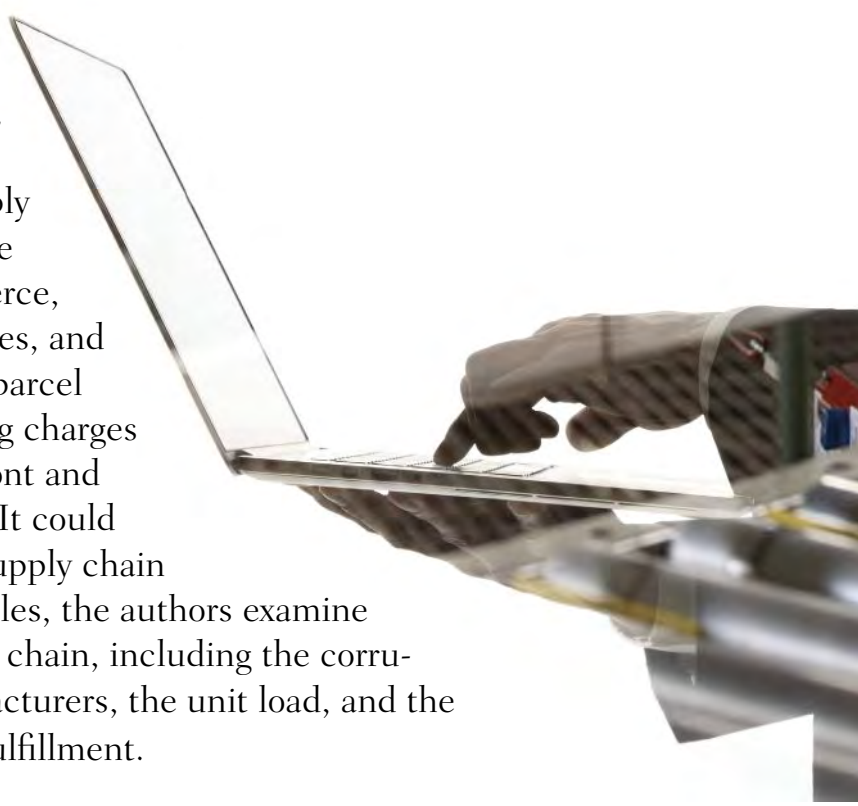
The New WMS/WCS Stack



Source: ARC Advisory Group

Packaging: Think Inside and Outside the Box

By Jack Ampuja, Marshall S. White, and V.G. Venkatesh and Rameshwar Dubey



Packaging has traditionally operated in its own silo, disconnected from the rest of the supply chain. However, the growth of e-commerce, smaller and more frequent deliveries, and proposed changes in the way that parcel and LTL carriers calculate shipping charges are combining to put packaging front and center for supply chain managers. It could be the next—or last—frontier in supply chain optimization. In the following articles, the authors examine the role of packaging in the supply chain, including the corrugated box used by contract manufacturers, the unit load, and the emergence of e-commerce order fulfillment.

The Box: Is Packaging Optimization the Last Frontier for Supply Chain Efficiency?

Far too many companies focus on the cost of the corrugated box when their real attention should be on the impact of the box on the cost of warehousing and transportation.

By Jack Ampuja

Jack Ampuja is president of Supply Chain Optimizers, a consulting firm that specializes in packaging optimization. Ampuja also serves as executive-in-residence at Niagara University. He can be reached at jtampuja@supplychainoptimizers.com.

"Packaging remains a major area of supply chain optimization opportunity for most companies."
—Bob Delaney in 1999 State of Logistics

So here we are 15 years after Bob Delaney's seminal observation, and after a career as a supply chain executive for several major corporations and working on packaging optimization as a consultant for more than a decade, I would say the total results are underwhelming.

As Delaney long ago realized, the lowly corrugated box has a huge efficiency impact within the supply chain. Typically the shipping container makes up less than 10 cents of each supply chain dollar; the other 90 cents is composed of handling, storage, and transportation costs. Yet, far too many companies still focus on reducing the cost of the corrugated box—the 10 cents—when their real attention should be on reducing the impact of the box on the 90 cents spent on warehousing and transportation.

One place to start analyzing the impact of packaging optimization is on the product entering the United States via import from around the world. I was recently asked for an analysis by the Group Vice President of Packaging and Sustainability of a major retailer. Looking at his operations, my response was that his firm, a big importer of clothing, was relying on suppliers in India, Pakistan, Bangladesh, China, and Vietnam to figure out the optimal packaging for his product, even though

this is not an operational strength in Asia. And because his company shared the supply chain with the suppliers, they all shared in the inefficiencies caused by suboptimal packaging. Consider these facts:

• Industrial Asia does not have major softwood forests, as we do in North America and Northern Europe, where pulp and paper have been major well-developed industries for over 100 years. Instead, Asia relies on recycled paper as its major source of raw material for corrugated packaging. In fact, the largest export material by volume from the U.S. to China is wastepaper that is then recycled into corrugated containers.

"The world hates change, yet it is the only thing that has brought progress."

—Charles Kettering, American inventor

• That may be "green." However, each time paper is ground up for recycling, cellulose fibers become shorter, making the paper softer and less strong. For some uses, such as facial tissue, increased softness is a positive attribute. For packaging that requires protective strength, softness is a negative. North American paper mills prefer to use no more than 35 percent recycled content in order to balance their desire for green with their need for packaging performance.

• Contrast that with industrial Asia where many paper mills use 100 percent recycled content in their corrugated packaging. The inherent lack of strength in 100 percent recycled corrugate has led to the well recognized use of double- and triple-wall boxes even for shipments of textiles, which normally would not require that level of protection; this is merely the Asian standard for corrugated shipping containers.

• While some Asian paperboard is manufactured from virgin material, this product also falls well short of Western world standards. That is because the mechanical pulping process most commonly practiced in Asia leaves as much as 30 percent more paper lignin in the final product than in North America or Europe. Unfortunately, lignin also makes the resulting paper weaker and subject to discoloration over time. These attributes have led many in North America to describe the Asian corrugate as rice board or rice paper.

• In North America and Europe there have been university courses in the sciences of packaging, papermaking, and forestry for decades. These sciences are only now gaining traction in Asia.

Beyond the production of packaging, Asia also lags the Western world in the arena of logistics. This is clearly evident in domestic logistics costs, where North America comes in at well under 10 percent of GDP while China reports a number of 20 percent of GDP; many experts believe the real number is closer to 25 percent. I suspect that India, Pakistan, and Bangladesh are even less efficient in logistics than China.

The basic question to consider is why would a company that can manage logistics at 10 percent of sales ever turn over its packaging and logistics processes to another firm that routinely spends 20 percent of sales managing its logistics?

I believe Wal-Mart reached this conclusion years ago when it began working with suppliers to lower their logistics costs. As far back as 1996, then Chairman Lee Scott announced a target for all suppliers to reduce packaging by 5 percent. This minimal improvement was projected to reduce total costs by $10 billion per year, with two-thirds of the savings going to suppliers. At the time, a reporter asked me if this was really possible. I replied that because most companies can reduce packaging-related costs by 10 percent, I felt that Scott was very comfortable projecting $10 billion in savings, knowing that Wal-Mart could really achieve $20 billion through packaging optimization.

So how does this process work? Here are four real world examples from our project files. In each case, we worked with a client to rethink the size of the shipping container handling its products without changing the unit size or the shelf packaging of the products. The resulting savings came from increased shipping density—getting more product in the same footprint in a trailer; reduced labor, handling, and storage costs; in how shipments were rated by carriers; or a combination of the three. Most important, the savings weren't driven by the cost of the corrugate—the 10 cents—but on the reduction of overall supply chain costs.

1. A supplier of healthcare products optimized a box that contained multiple products for sampling. The client had 11 different varieties of samples and packaged them all in the same fancy shipping container. Computer analysis showed that three different box sizes were in fact the optimal solution. When we projected a $1 million cost reduction in corrugate savings, the vice president of supply chain management said that we had grossly underestimated the savings. She realized that the optimized boxes averaged 80 cases per pallet compared to the 40 cases per pallet they were currently averaging, cutting her handling and storage expenses by 50 percent. She also calculated that the increased shipment density would allow her to negotiate lower rates with her carriers. By rethinking the size of the corrugated box, she

estimated that the full supply chain savings related to optimized packaging would exceed $3 million.

2. A distributor of automobile headlights and taillights worked with its less-than-truckload carrier to optimize packaging so that shipment density increased, pallet loads could be stacked higher inside the trailer, and the pallets would also be loaded so that side to side void was diminished. The end result was that the freight class of outbound shipments decreased from 250 to 150. This represented a 40 percent reduction in freight cost that I believe is virtually impossible to obtain solely through negotiation.

3. A food processor optimized a product that was loaded with 50 cases per pallet at the start of the project. The 50-count pallet enabled double stacking in the trailer, or 100 cases per floor spot in each trailer. Going any higher per pallet was not practical because it would have negated double decking and increased freight cost per unit. By optimizing the shipping case, which entailed no change to the retail unit or the number of retail units per case, they generated a solution that allowed for 60 cases per pallet in the same unit load. While the cost of the new corrugated box went down 2 percent, the real benefit was getting 120 cases per floor spot. The result was a 20 percent increase in the payload per pallet and freight reductions by that same amount. In summary, logistics costs composed of warehousing and transportation declined by 16 percent.

4. Finally, we aided a distributor of footwear that was manufactured in Asia for sale in the U.S. Although we didn't know it at the time, our client was on the verge of running out of cash. For this $150 million business, optimization of the boxes moving across the ocean in shipping containers generated annual savings of $2.8 million. Further, the client reviewed the improved results with its largest customers, Wal-Mart and Target, because they share the supply chain and would also benefit from associated efficiencies of 15 percent reduction in corrugate expense as well as a 20 percent reduction in freight cost. Wal-Mart rewarded our client with $10 million of new business while Target gave them an additional $5 million of business. So a conservative estimate would be that packaging optimization added $4 million in profit.

Here are several important lessons that any company embarking on packaging optimization must bear in mind:

- Because this is a multifunctional process, executive sponsorship is critical to success.
- The quality and availability of client data will drive the speed and accuracy of the project.
- The key to cost reduction is the ability to manage change. Every company has roadblocks but somehow the leaders figure out how to overcome them while laggards are usually stymied from ever getting started.

The Unit Load: Take a System-Based Approach to Unit Load Design

Unit loads, materials handling systems, and transportation processes are often designed in a vacuum. Yet, each has an impact on how the other performs.

By Marshall S. White

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In today's global market, most consumer and industrial products move as a unitized load for at least a portion of the journey through the supply chain. Typically, the unit load is made up of three basic components:

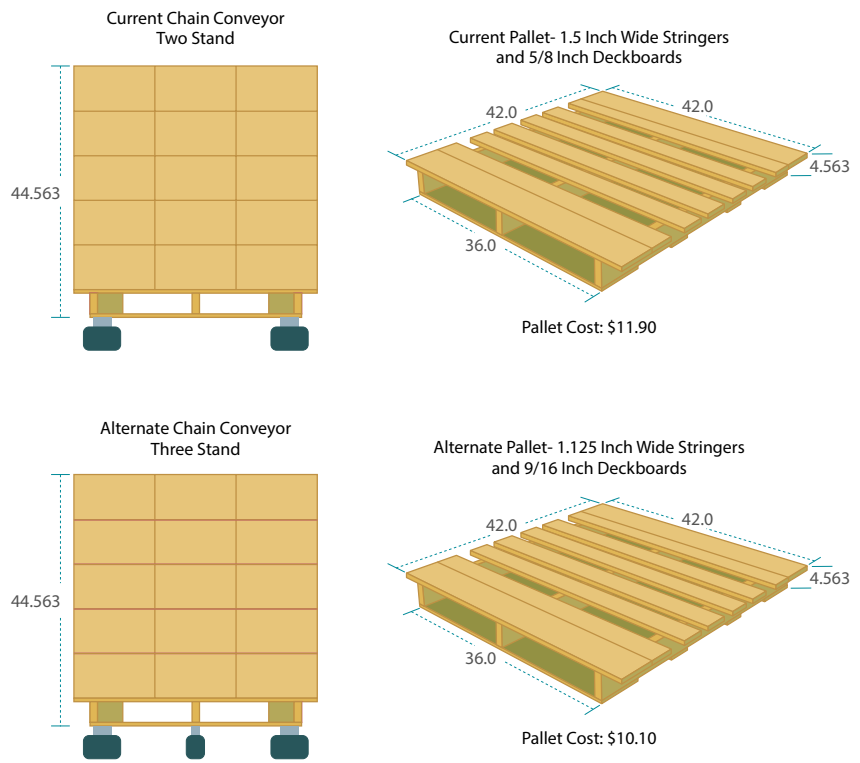
1. Distribution packaging, such as corrugated boxes, plastic pails and totes, protective films such as stretch and shrink-wrap, strapping, and other materials.
2. Pallets of various construction and materials.
3. Unit load handling, storage, and shipping equipment (including freight containers) used to store and move the unit load, as well as transportation processes.

An efficient supply chain moves the designated product from supplier to customer—damage free, rapidly, at low cost, and with minimal environmental impact. Yet handling and shipping processes naturally expose packaged products to mechanical stresses from compression, vibration, and shock that can damage the product on a unit load, slow movement of the load, and add to overall costs.

The pallet is at the center of it all; it is literally and figuratively the interface between the equipment imposing these stresses and the packaged product that needs to be protected. As the interface, the design of the pallet is critical to supply chain efficiency. Yet during the design of supply chains, the interactions between these three components are mostly ignored, leading to global supply chains operating with significant avoidable costs in terms of operational efficiency, safety, and environmental impacts.

EXHIBIT 1

Analysis of Pallet Equipment Interaction



Source: White & Company

Exhibit 1 is an example of the design phase evaluation of a supply chain utilizing a unit load of one gallon plastic pails of product that were packed in corrugated containers. The audit clearly identified process and pallet design constraints that were dictating packaging spend. The pallet deck was compressing the packaged product and the chain conveyor was bending the pallet. Using the CAD simulation, the maximum bending stress on the pallet occurred at a short section of chain conveyor. To solve this issue, the conveyor was easily modified by adding a center strand. This permitted a pallet design change that resulted in savings of $1.80 per pallet. The design changes to the pallet and conveyor permitted a total packaging spend reduction of 8.1% with a very acceptable return on investment of the conveyor modification.

This happens because today we design this "system" of interacting components one component at a time. Manufacturers using these supply chains defer the design of each component (pallet, distribution package, and unit load handling equipment) to vendor suppliers who are pressured to provide the lowest cost solution for the component for which they are responsible. Unfortunately these designers rarely interact or cooperate during this process. As such, a design change that saves cost in one component, such as the materials handling systems, ends up adding to the cost of the pallet or transport packaging. While the materials handling system is a one-time spend, pallets and packaging supplies are bought over and over.

Here's an example of how this may play out. A pallet supplier is told to design a low-cost 48x40 pallet to safely support 2,000 pounds; the designer of a conveyor system is requested to design a low-cost conveyor with a 500 pound per linear foot capacity; and the designers of the 32 ounce plastic bottle and corrugated tray pack or box are told the unit loads will be stacked three high in storage.

They each go to work. The bottle designer makes an assumption about the pallet deck design and thus the compression stress on the bottle. Meanwhile, the conveyor designer assumes a pallet bottom deck will move on the conveyor while he or she increases roller or chain spacing to reduce cost. Finally, the pallet designer designs the lowest cost pallet by adjusting the bottom and top deck of the pallet without considering the roller spacing and the compression stress on the bottle.

When these components are put together, you end up with failed pallets that lead to damaged product or a shut down of the line; the supply chain operates with significant avoidable cost. Because manufacturers spend 10 to 50 times more on the distribution packaging on top of the pallet than on the pallet, this includes 8 percent to 18 percent avoidable packaging spend. And because pallets and packaging are operating costs, targeted by buyers for annual spend reduction goals, this component-by-component design mistake continues with every supplier contract review.

There is a better way. To prevent these "component" based supply chain design mistakes, we must move to a more "system" based design method that considers how the three components mechanically

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*As named by *Trade Finance*, 2013

interact with each other. (For an example of this approach, see Exhibit 1, which details a design that takes into consideration the interaction between a palletized unit load and a conveyor system.) This includes cooperation between the designers of the pallet, the packaging, and the unit load handling equipment. Design teams are necessary. They should be led by young professionals familiar with the design of all three components, using software tools that model the mechanical interactions.

Some changes along these lines are now taking place. At institutions like Virginia Tech, academic programs that combine packaging and industrial design curricula are educating new young professionals with expertise in all three areas. Such programs offer continuing education of professionals in the work place and are researching how pallets, packaging, and equipment mechanically interact. New software that models how supply chain components interact is available for these design teams to use.

This system based approach to design can be used to significantly improve the operational efficiency, sustainability, and safety of existing product supply chains. However, to be effective, the application of systems based design to existing supply chains requires an organized evaluation using the following steps:

1. Audit. Documenting all product and packaging placed on top of the pallet and all methods of moving, shipping, and storing the unit loads.

2. Analyze. The audit results are analyzed to determine which process in the supply chain is limiting the packaging and pallet designs. This is generally a process that exposes the unit load to the largest dynamic and static mechanical stresses.

3. Design. Test alternative design concepts that mitigate these constraints. This includes the use of unit load and supply chain computer models. This phase generally includes a preliminary cost/benefit analysis of alternative designs.

4. Test. Field trials of alternative pallet, packaging, and equipment design is necessary to validate design phase performance predictions.

5. Implement. Revise component specifications and implement the modified supply chain design.

If those of us who work in logistics are going to achieve significant improvement in the operational efficiency of global supply chains, it's clear that we must make a fundamental change in the way these supply chains are designed, including the way we design transport packaging, unit loads, and the processes to handle and transport them.

The current, component-by-component method must be replaced by true "systematic" design procedures based on an understanding of how the packaging, pallet, and unit load handling and shipping equipment interact. And, we must train the next generation of professionals with the technical skills to cross over the disciplines of packaging and logistics and provide them with the tools to model the interactions.

Owners and operators of these supply chains must take more ownership, actively participate in, and lead theses design efforts in partnership with their vendor suppliers. This is the future of supply chain design.

Are You Ready to PTO?

As supply chains become more dynamic, Pack to Order production processes are increasingly becoming the norm.

By V.G. Venkatesh and Rameshwar Dubey

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Most supply chain or operations managers are familiar with the four traditional approaches to supply chain operations: Make to Stock, Make to Order, Assemble to Order, and Engineer to Order.

Over the last decade, we have seen the emergence of two new subclasses under the make to stock umbrella: These are Ready to Dispatch, or RTD, and Pack to Order, or PTO.

Both are a response to the emergence over the last decade of customer priorities as a driving factor in the supply chain. The impact of this trend, especially of PTO, is visible in the areas of inventory management, packaging processes, and logistics management.

While the RTD model will be familiar to many manufacturers, a number of e-tailers have implemented PTO processes, which are likely to grow in the future. This may cause supply chain managers to rethink their packing strategies. For example, customized delivery is becoming more prominent, and is a

catalyst for PTO. Let's take a look at the characteristics of both models.

Rethinking Make to Stock

Products that are manufactured in high volume and stored until the receipt of a demand signal from downstream customers are classified as Make to Stock products—or MTS. While MTS is most commonly associated with low-cost, high-volume manufacturing operations, such as consumer packaged goods, we contend that in the future distribution centers will need to rethink the handling and storage of inventory in line with operating strategies such as postponement and e-fulfillment. That is where RTD and PTO come into play (see Exhibit 1).

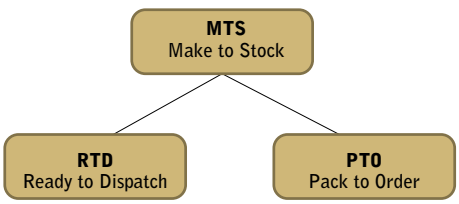
RTD is as a "push process" in the supply chain. Product is manufactured in long production runs and packaged and stored in a predefined format. When an order is received for the finished goods, the product is ready to be dispatched—or shipped—without any change in the packaging format, quantity, or quality.

In an RTD environment, the manufacturer's supply chain is dominant. Typically, the packaging form is determined by the manufacturer based on its storage and transportation requirements, although a manufacturer may receive the customer's requirements prior to production.

PTO, on the other hand, is a pull environment: Product is packaged for shipping after the receipt of a customer order. The customer requirements are dominant: When an order is received at the distribution center, products are repacked in quantities and a format that

EXHIBIT 1

Different Situations in Make to Stock (MTS)



Source: Symbiosis International University

meets the end customer's requirements and optimizes shipping, especially the last-mile delivery process. The order is typically repacked in a different quantity and in a different packaging format than the stocked product, although product quality does not change. While the distribution center usually just handles the secondary packaging of the product, for some products, even the primary packaging exercise will need to be done in the PTO situation.

While manufacturers and distributors alike are familiar with RTD, they will have to pay more attention to PTO in the future, as e-commerce continues to expand in retail and wholesale distribution or as manufacturers offer drop shipment services to their customers.

PTO Characteristics

Just what does a PTO supply chain look like? There are a number of characteristics. For one, volumes are often lower and profit margins are higher compared to RTD supply chains. Similarly, the value of the product is often higher than in RTD. What's more, demand levels are unpredictable and difficult to forecast.

Often, a great deal of research goes into designing the packaging format to lower the cost of handling and delivering the product. For example, lean, lightweight packaging is an important consideration when shipping in countries that impose duties based on the weight and cube of a package. Table 1 below tries to characterize and compare PTO with RTD products.

Future of PTO Environment

In recent years, the weight, cube, and packaging of single and multi-line orders for consumers and businesses has become a major focus of e-tailers such as Amazon and Staples. In part, that is driven by consumers that don't want to deal with excess packaging; and, in part its being driven by major parcel delivery services that are about to implement rates based on the dimensions or cube of a package and not just the weight of the shipment. These e-tailers are implementing technologies and processes to reduce the weight and cube without compromising on quality of their packages to reduce those costs. One example is on-demand packaging technologies that enable a shipper to create a custom-sized box for each order as they are received.

In the PTO environment, order histories can also be studied in detail to better understand and predict product packaging patterns. That allows a shipper to stock a range of box and packaging sizes to optimize the majority of its orders. Shippers can closely collaborate with the interested packaging material suppliers to reduce the volume and weight and improve the material handling methods for those products. Logistics partners, especially third-party

TABLE 1

A Comparison of Ready to Dispatch (RTD) and Pack to Order (PTO) Products

Operating Parameters	RTD	PTO
Time and Stage for Packaging Process Execution	Both before and after reaching DC	Will be done once the product reaches DC
Appropriateness of Customer Instructions	It's not mandatory to have customer instructions; packaging can also be done based on the manufacturer's operating effectiveness	Mandatory to have the customer preferences to pack the products
Product Handling Consolidation	Possible to have economies of scale	Product will be treated at the individual level, so fewer economies of scale
Push or Pull Situations	It is a push process; the manufacturer dominates and pushes the products to the market in the predefined conditions	It is a pull environment; customers decide on the packaging format
Packaging Material Consumption and Usage	Aggregation and usage of the packaging materials possible at the consolidated level	As the product requires individual level of packaging, the packing materials are to be handled at individual SKU level
Innovation at the Packaging Level	Low possibility as the products are handled in high volumes	High possibility of innovating the new formats at this level
Costing	It can be predicted and added at product costing level	Packaging cost is a separate component all together
Support for Postponement Strategy	Low support for postponement strategy, as the products are packed and ready to be sent	Part of the postponement strategy at the packing process level

PTO is a pull environment: Product is packaged for shipping after the receipt of a customer order. The customer requirements are dominant: When an order is received at the distribution center, products are repacked in quantities and a format that meets the end customer's requirements and optimizes shipping, especially the last-mile delivery process.

logistics providers, should also be involved in the packaging process.

In certain distribution centers, packaging consultants are being asked to manage PTO supply chains. This is very common with export-based order management as it has its own impact on product duty calculations. Because a PTO supply chain is in direct contact with the end consumers regarding their needs, the information on supply chains, difficulty in implementing packing standard operating procedures, and information pertaining to costs can be shared across their supply chains. The documentation on individual customer needs is continuously growing and it is essential to be warehoused appropriately, compared to other product manufacturing environments.

Finally, with the customized and last-mile delivery business growing on all retail fronts, the major focus would be on their product handling along with the right material packing.

Because PTO operations exhibit characteristics that are completely different than the RTD environment in the MTS situation, it should be given a recognizable space in the manufacturing environment research domain. It sets a future agenda and new dimension of research for supply chain practitioners and researchers.

Change the Incentives, Engage the Whole Organization

By Andrew S. Winston

Culture is an amorphous idea, but it infuses every organization and deeply influences how people act and how they feel about their work. Andy Savitz, a consultant and an author, writes a lot about culture in *Talent, Transformation, and the Triple Bottom Line*. Savitz describes it this way:

"When employees say: 'That's just the way we do things around here,' they are often describing the influence of culture. When they carry out some management dictates with enthusiasm, quietly ignore others, and actively resist or even sabotage still others, they are likely reflecting the values and assumptions of a corporate culture … that 'feels right' to them." Culture, in his description, seems to be a "you know it when you feel it" kind of thing.

Savitz pointed me to a well-known model developed by Edgar Schein from MIT's Sloan School of Management. The Schein model describes corporate culture in three categories, which Savitz paraphrases as follows:

What we do: The observable part of a company, its processes, and actions.

What we say: The explicit statements like "safety is our top priority."

What we believe: The "underlying assumptions," the

Andrew Winston is the founder of Winston Eco-Strategies and is the author of the bestselling book Green to Gold. The following piece was adapted from The Big Pivot: Radically Practical Strategies for a Hotter, Scarcer, and More Open World.

"unconscious, taken for granted beliefs—the ultimate source of values and actions."

This simple but powerful model captures some of what stands in the way of the Big Pivot. In most organizations, the goal of maximizing profits is clear on all three levels—it's what's done and rewarded, it's what's stated, and it's what most execs believe. But when it comes to environmental or social performance, there's a breakdown.

A growing number of organizations, but not all, are taking some actions to reduce impacts (level 1), and many are making statements and putting out sustainability reports (level 2). But the belief system in many companies (level 3) still questions the whole endeavor. In my experience, many executives still believe that these mega challenges are overblown or will work themselves out. And most think that tackling these issues will be expensive.

In the short run, it would seem that the what we believe level trumps the other two. But how do you change beliefs, either personal or cultural? Perhaps changing the top two levels aggressively and consistently enough can gradually move the third. If you put in place the specific incentives that drive behavior toward greener operations and—this is critical—if people start to see the benefit and the value to the company, then beliefs will change.

The first step, then, is changing incentives to encourage longer-term thinking and pay people for different priorities.

Direct Incentives for Long-term Thinking

We could talk at length about whether the absolute level of executive pay has grown to absurd heights. But for this discussion, what really matters is whether C-level execs are incentivized to do the right things. Top execs are paid mainly through bonuses and loads of options, and nearly all are rewarded for performance on short-term earnings and shareholder returns, neither of which necessarily ties to real value creation.

As Alfred Rappaport, author of *Saving Capitalism from Short-Termism*, says: "Executives may choose to delay or forgo value-creating investments to achieve their bonus targets. These vital investments include research, new product development, brand building, and product and market extensions."

Paying people for actions that support the Big Pivot sends the right signal as a direct reward, but it also triggers that sense of purpose that drives true engagement.

Even multi-year incentive plans contain the same flaws: shockingly, only 10 percent of the largest 250 companies include any nonfinancial measures of success like quality, safety, or new business development.

To solve this major problem with incentives, Rappaport offers a range of solutions, which I'll summarize in a few main ideas. We need longer vesting periods on options; delayed payout on those options (e.g., if options vest in three years, you can't sell the shares for five more years); and indexed options, which only pay off if you outperform a benchmark of peers.

These are good ways to change the time horizon on stock incentives, but there's also cash. Changing what bonuses are based on, from the very top down through the organization, can go a long way to changing priorities and indicating what the company really cares about.

Rappaport recommends paying bonuses to operational managers for driving long-term value: "Leading indicators look to the long term but demand accountability in the short term." He uses the example of a driver for PepsiCo's Frito-Lay. This employee's incentive pay could be based on metrics that measure how much shelf space Frito-Lay gets per store on the delivery route or on overall customer satisfaction and retention. For other roles in a company, the bonus could tie to the launch of a new product or to employee satisfaction.

Direct Incentives to Motivate the Big Pivot

Bonuses should encourage managers to take action on the mega challenges, not just day-to-day results. If they don't, what signal does that send about what the organization believes? Worse yet, when a company says it's committed to environmental and social issues, but does not connect compensation to those statements, the gap between rhetoric and reality may be more de-motivating than saying nothing at all.

Paying people for actions that support the Big Pivot sends the right signal as a direct reward, but it also triggers that sense of purpose that drives true engagement. I suggest linking pay to concrete actions such as reduction in material or carbon intensity (for a manufacturing manager), or how well suppliers do on the same issues (for procurement execs), or the number of open innovation ideas collected (for R&D).

But what percentage of the total bonus or incentive pay should tie to these mega challenge actions? The more the better. One mid-size company in the sand and mining business, Fairmount Minerals, has pushed the envelope on this topic. After employees suggested the idea at an internal innovation event, Fairmount made performance against key performance indicators (KPIs) for sustainability a whopping 50 percent of everyone's bonus.

As CEO Chuck Fowler told me: "We felt like we'd get exponential benefits by embedding sustainable development in our everyday work life." And the incentives are working. In

2012, the company spent $6 million on its sustainability program and achieved about $11 million in direct savings and cost avoidance—a net benefit of $5 million. Fairmount has also built deeper relationships with communities and with customers, who often ask for advice on how to build a similar program.

Fairmount has set the bar with 50 percent of bonus tied to sustainability strategy—I know of no other organization that has come anywhere close to that figure. But some large companies are starting to pay for Big Pivot action as well—including the largest of all, Wal-Mart.

Wal-Mart's 100,000 suppliers know that the retail giant wants them to improve their environmental performance. The pressure has changed how thousands of products are made, packaged, and sold. But suppliers have repeatedly voiced one critical and legitimate complaint: Wal-Mart's "merchants," the procurement managers with billions of dollars in purchasing power, didn't take sustainability into account when they made their buying decisions.

According to Wal-Mart exec Jeff Rice, suppliers have essentially told the company: "It's great to ask us questions, but it only matters if you do something with the information." In their view, Wal-Mart was still buying mainly on price. But now, in addition to Wal-Mart's laser-like focus on cost, its merchants must include environmental and social performance in their buying decisions or risk a weak performance review and lower bonus.

Using data from The Sustainability Consortium (TSC), Wal-Mart has mapped out footprint hot spots along the value chain of different product categories (for example, with a product like soda, the best place to target water and energy reduction efforts is upstream with sugar growers). Wal-Mart then uses TSC's category-specific metrics to evaluate how suppliers are handling those hot spots. Based on both the heat maps and on supplier performance against category peers, the buyers must now create sustainability targets to include in their annual performance reviews.

The first merchant who designed a performance target was Wal-Mart's computer laptop buyer. One clear hot spot in the computer lifecycle is energy consumption during the computer's use. For most laptops, a default power management setting determines how quickly the computer goes to sleep (if at all) or when the screen dims. But only 30 percent of the laptops that the merchant had been buying came pre-installed with the best energy saving settings. This wouldn't matter much if we consumers changed the factory default settings ourselves, but Wal-Mart's own research shows that most of us never do.

So the laptop buyer set a new target for herself: increase the percentage of laptops sold with the advanced power settings from 30 percent to 100 percent, a goal she achieved in 2013. Wal-Mart has rolled out data-guided, footprint-aware performance targets to 300 categories and hundreds of buyers covering 60 percent of U.S. sales volume (about $165 billion in revenue).

In addition to Wal-Mart's laser-like focus on cost, its merchants must include environmental and social performance in their buying decisions or risk a weak performance review and lower bonus.

The change in incentives is not minor. Wal-Mart's Rice told me that a buyer's performance evaluation includes just a handful of targets, and all are discussed thoroughly at annual reviews.

Sustainability performance won't determine the entire evaluation, but it's high profile enough that it will affect behavior.

Incentives matter, and cultures shift over time. Hard won operational changes like modifying performance reviews may not be sexy, but the results can be profound.

How To Execute

Every company will likely follow a different path on driving engagement. Each organization will need a different mix of rewards that

are external (concrete incentives) and internal (cultural shifts that create a sense of fulfillment and purpose). Some companies will naturally connect their operations to a broader set of goals and will need to call on specific rewards much less. But everyone should shift some of the structural incentives. The list of to-dos on that front is not overly complicated, even if there are some challenges to actually implement them:

Change options and bonuses for C-level execs

Reward broader thinking with longer-term incentive payments at the top of the company (longer vesting, delayed payouts, indexed options).

We can change beliefs over time by changing the external incentives, actions, and statements first. Many studies on changing habits—eating, exercise, and so on—show that you make a pivot in your life by starting with a concrete change.

Build green and social issues into key performance indicators and bonuses for everyone. Fairmount Minerals sets the pace at 50 percent, but Shell has sustainability KPIs at 25 percent of executive bonuses. The percentages most likely need to be this substantial to effectively make the Big Pivot.

Require operational managers to add a sustainability target to their performance reviews. Also tie operational bonuses to performance on "leading indicators" of long-term value creation and footprint reduction.

Create rewards and incentives for deep, heretical innovation. Give an award for wackiest idea or deepest heresy—even if it fails. Intuit's Swing for the Fence Award highlighted an initiative that failed miserably, but it awarded bravery for trying something new.

Try a lot, and promote fast failure. Try a lot of heretical things, but in smaller settings with low risk first, then invest heavily in the things that work. As Jim Collins and Morten Hansen describe it in Great by Choice: "Fire bullets, then cannonballs."

"Gamify" to engage all employees, and use competition

Ask employees to contribute ideas and take action to improve the company's performance and make it fun. People like to win. PepsiCo's Chicago offices ran a floor-by-floor energy reduction competition over three months. Electricity use dropped 17 percent in total and 31 percent on the winning floor.

Connect employee actions to larger issues. Caesars Entertainment's Gwen Migita told me about her efforts to engage housekeepers and help them understand why a small action—collecting used soaps instead of throwing them out—mattered to the larger world: "We showed them a video of the soaps being repurposed in Haiti and Mexico to help people stay healthy—they were brought to tears."

Ask for everyone's ideas. Being valued and heard is a prime driver of job satisfaction. The best ideas often come from those closest to a challenge, so ask the front lines for their opinions.

Track progress to celebrate wins and give credit. The U.S. Postal Service careful measured all employee-led initiatives that reduced energy, waste, water, and so on. It was able to credit employees publicly with finding $52 million in annual savings.

Get human resources involved early and often. I've probably given this point too little attention, but almost none of the above can happen without strategic thinking and guidance from HR, the group that is, in Savitz's words, "considered the stewards of culture, the facilitators of organizational change, and the experts on shaping and motivating behavior." We need HR to make environmental and social thinking a part of recruiting, training, job descriptions, reviews, and bonuses and incentives.

I'm often asked how to get people to take green issues seriously. I generally respond by asking one simple question: "What are people in your company paid to do?" It's an oversimplification, for sure, but it's at the heart of level 1 in Savitz's version of Schein's model: "what we do." And it offers a peek into the beliefs lying underneath the surface. But more importantly, if we don't pay people to tackle the mega challenges, doesn't it tell everyone that these issues are just not that central to business success? It's an issue of putting your money where your mouth is.

We can change beliefs over time by changing the external incentives, actions, and statements first. Many studies on changing habits—eating, exercise, and so on—show that you make a pivot in your life by starting with a concrete change. Get up early to take a run, do it consistently for a couple months, and the odds are better that you can turn it into a habit.

Besides changing the external incentives, connecting people at work to a larger purpose also—and perhaps even more so—drives change. The combination of extrinsic and intrinsic motivation is key. As proof of how a Big Pivot type organization can attract people, consider the list of LinkedIn's most in-demand employers, which the networking colossus tabulates from billions of member interactions. Unilever, which I've discussed more than any other company in this book, is the third-most in-demand employer—it falls just behind two of the hottest, most valuable companies in the world, Google and Apple, and ahead of very popular employers like Disney, Nike, Coca-Cola, and McKinsey.

So if we start paying people to think about the longer term and to solve mega challenges, and if we make connections between what they do and a larger purpose, we will build organizations that regularly manage for the long term. Over time, all the other rewards of having an aligned organization will kick in. The companies that make these connections will become formidable forces in the marketplace. When people are freed up to do their work with no cognitive dissonance around their values, watch out.

Patrick Burnson is the executive editor at *Supply Chain Management Review.* He welcomes comments on his columns at pburnson@peerlessmedia.com

BY PATRICK BURNSON

China is Testing Ground for Managing Greenhouse Gas Emissions

Companies must demonstrate their commitment to long-term engagement on climate sustainability with suppliers.

The Council on Foreign Relations is among many think tanks noting that China's environmental crisis is one of the most pressing challenges to emerge from the country's rapid industrialization.

Indeed, its economic rise—which has averaged around 10 percent annual GDP growth for the past decade—has come at the expense of its environment and public health. As the world's largest source of carbon emissions, China is responsible for a third of the planet's greenhouse gas output and has more than half of the world's twenty most polluted cities. For U.S. companies sourcing goods and components from this country, reducing greenhouse gas (GHG) emissions are of particular concern.

But a recent report by BSR in San Francisco suggests that this crisis is finally being addressed—by the Chinese themselves. China's 12th Five Year Plan includes an entire section on the nation's pollution problems. This plan is the platform for government operations under China's leader, Ji Jinping.

"I am seeing more and more emphasis placed on environmental issues by local manufacturers," says China expert, Rosemary Coates, President of Blue Silk Consulting. "This appears to be partially due to the Chinese government's funding and emphasis, and partially driven by Western customers demanding it," she says.

Competing Priorities

For this to happen, however, U.S. multinationals must demonstrate commitment. According to BSR researchers, companies in many industries see the supply chain as their greatest lever to reduce GHG emissions and meet climate goals, but competing priorities and existing supply chain practices can get in the way. Therefore, companies must demonstrate their willingness for a long-term engagement on climate sustainability with suppliers.

"To further complicate matters, global standards for emissions and processes are still developing," says Coates. "European standards are different from U.S. standards, which are different from Chinese standards—if they even exist."

Other obstacles are due to confusion or lack of clarity around objectives, targets, and relevant key performance indicators (KPIs). Given these challenges, companies often underestimate the resources required to build internal capacity for supplier engagement on GHG reduction.

Researchers insist that companies must recognize the most important internal obstacles and then work internally to build alignment and capability. The Bethesda, Md. consultancy, Consero Group, agrees, noting that outsourcing requires the same vigilance as shared services.

"The shared services model has proven effective as a cost-reduction tool that allows organizations to focus on growth, but cost savings and efficiencies are less appealing if they lead to dangerous levels of legal or regulatory risk," says Paul Mandell, founder & CEO of Consero, "Reducing the risks associated with

outsourced work is an area on which these executives will need to focus their attention in the months ahead."

A recent survey by Consero found that 65 percent of shared services executives from Fortune 1000 companies do not believe their vendors are sufficiently focused on minimizing risk.

In seeking to avoid such problems, HP aligned its supplier sustainability team with the company's broader supply chain program to ensure cooperation with business units. Like other companies working with BSR, it began integrating GHG emissions considerations into purchasing decisions as a way to build momentum before working with research and development (R&D) and marketing teams.

Buyer companies may need to reorganize existing staff or hire new staff in their own organizations to increase the company's technical capability to manage energy and emissions reduction among diverse suppliers. Strategies can include consultations with buyer energy experts, third-party trainings, and assistance developing GHG reduction plans with suppliers. Companies such as Wal-Mart, HP, and IKEA already dedicate staff to provide training, assessment, and planning for modern energy management to suppliers.

Cross-Global Complications

Gaps in alignment and capability can also complicate cross-global operations. BSR researchers find that many companies do not have clear objectives for supply chain GHG management in China connecting to their broader program objectives.

Analysts say it may be useful to prioritize suppliers and categories in China, develop China-specific goals with local teams, and use Chinese language tools for measurement.

"The proliferation of training partners in China is an opportunity for connections between local teams and training providers," says Nate Springer, one of the BSR authors of its recent working paper. "Companies that ensure internal alignment and capability across multiple functions reinforce their commitment to move forward in emissions reductions with suppliers."

Springer and other BSR colleagues add that suppliers are strongly influenced by the commitment demonstrated by buyers. Although there are a few "quick-win" opportunities for companies and suppliers, integrating GHG reduction activities into supply management is largely a long-term proposition. HP, Wal-Mart, IKEA, Lenovo, and others have all made public multiyear commitments to reduce GHG emissions in their supply chains.

Most of the biggest emissions reduction investments take years to design, finance, implement, and generate. Furthermore, many companies that have been part of BSR's supply chain GHG work since they began in 2005 are just now beginning to implement large, supply chain–wide reductions.

"To further complicate matters, global standards for emissions and processes are still developing. European standards are different from U.S. standards, which are different from Chinese standards—if they even exist."

—Rosemary Coates, president, Blue Silk Consulting

"This finding is a warning to vendors who will be increasingly challenged to provide added value to their shared services clients as well," says Consero's Mandell.

BSR maintains that companies making progress on supplier emissions reduction show their good faith through actions that support most or all of the following views:

- Climate is both an urgent and long-term issue for the company that it takes seriously.
- The company is making its own progress toward integrating energy and climate considerations into its business.
- Actions are connected and reinforced through functions and business units to reach business goals.
- Corporate and regional offices are aligned and offer the same, organized, and clear message.

BSR says these are the commitments that Wal-Mart, HP, Starbucks, and other Global 1,000 companies have demonstrated. Starbucks devotes resources to building sustainability within its procurement team to reinforce supplier GHG reduction goals. At IKEA, product category leaders design programs in collaboration with the company's supply chain sustainability team for specific suppliers. Companies like HP work through their China sourcing and sustainability teams to identify qualified energy auditing and training partners.

Such actions strengthen the company's long-term engagement with suppliers, leading BSR researchers to suggest that U.S. shippers should reward their Chinese business partners—and encourage other green initiatives.

A SPECIAL SUPPLEMENT TO:
SUPPLY CHAIN MANAGEMENT REVIEW

SPECIAL REPORT

Information Management: In Search of Supply Chain Execution CONVERGENCE

The supply chain software market is evolving toward platforms that optimize end-to-end processes and juggle constraints at all levels. Here's how several leading suppliers are making progress on this vision.

By Roberto Michel, Contributing Editor

How can an organization have a full range of supply chain execution (SCE) software at its disposal, and still have massive execution problems? A likely culprit is the lack of integration and the inability of SCE solutions to work well together.

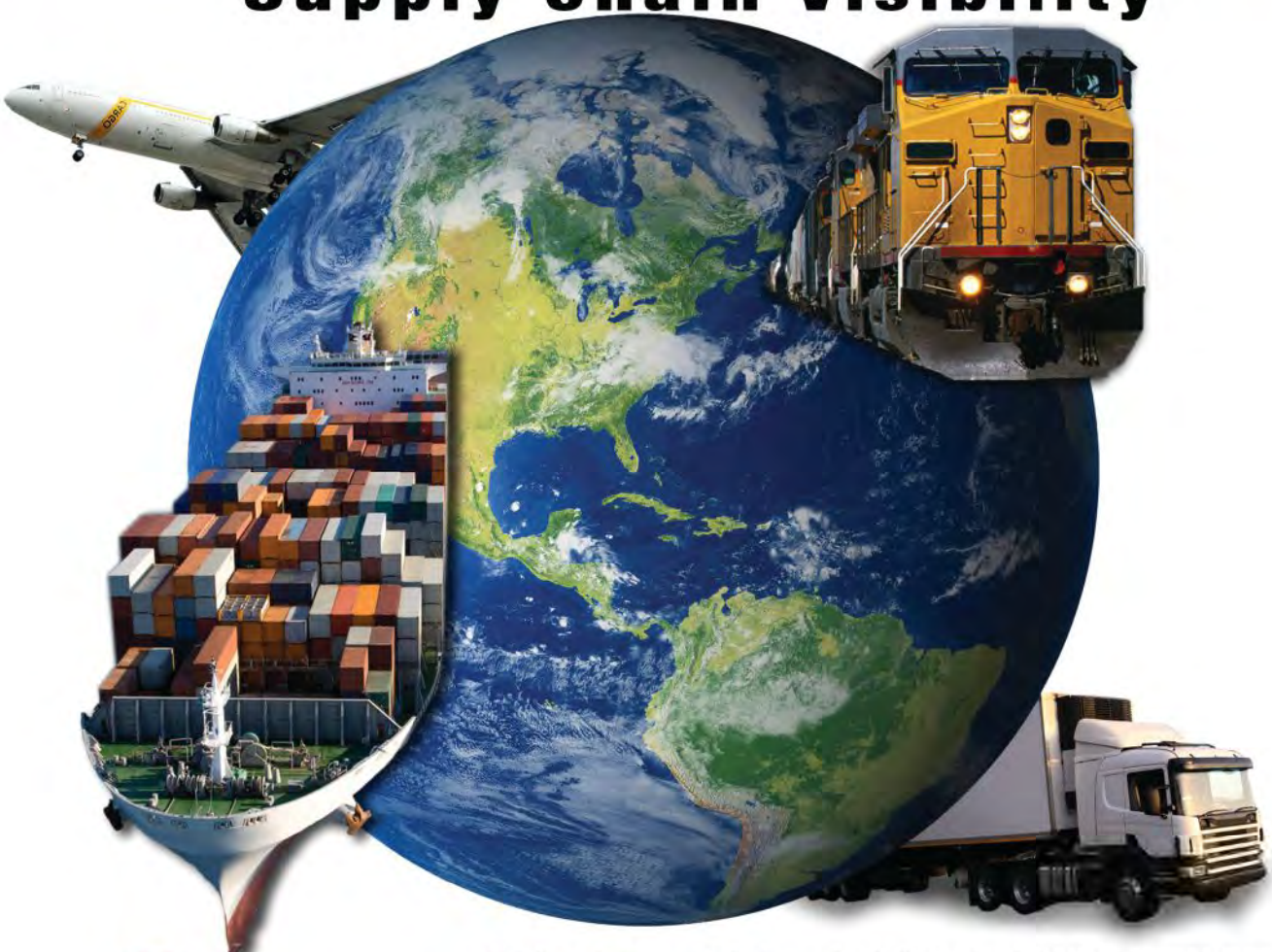
The inability to orchestrate logistics processes across the supply chain ranks as a top hurdle for companies, says Dwight Klappich, a vice president at Gartner Research. In a 2013 survey by Gartner, the inability to synchronize end-to-end business processes was named as the second biggest obstacle to reaching supply chain goals.

Part of the problem stems from the evolution of SCE solutions, according to Klappich. Most medium to large enterprises historically were organized by functional domains such as warehouse operations, transportation planning, or customer service organizations, with each group having its own specialized system such as a warehouse management (WMS) or transportation management (TMS) system.

While earlier WMS solutions might be good at controlling inventory and moves within the four walls, they often didn't synchronize well with TMS. Or a TMS could devise a low-cost plan, but was blind to constraints in the warehouse. "Companies would have specialized systems that would able to locally optimize a domain, but the reality is that when you look at the end-to-end processes, companies continue to have significant challenges," says Klappich.

A case in point is how a TMS might group three orders together to cut logistics costs, without considering all tasks surrounding that grouping. For example, the

Achieve Global
Supply Chain Visibility



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Top 20 supply chain management software suppliers

No.	Supplier	2013 Revenue	Web site	SCP	WMS	MES/MRP	TMS
1	SAP	$2.138 billion	www.sap.com	x	x	x	x
2	Oracle	$1.455 billion	www.oracle.com	x	x	x	x
3	JDA Software	$445 million	www.jda.com	x	x		x
4	Manhattan Associates	$167 million	www.manh.com	x	x		x
5	Epicor	$159 million	www.epicor.com	x	x		x
6	IBM	$154 million	www.ibm.com	x			
7	Descartes Systems Group	$121 million	www.descartes.com				x
8	Infor Global Solutions	$99 million	www.infor.com	x	x	x	x
9	GTNexus	$80 million	www.gtnexus.com	x			x
10	Kewill Systems	$71 million	www.kewill.com				x
11	HighJump Software	$70 million	www.highjumpsoftware.com		x		x
12	PTC	$69 million	www.ptc.com	x			
13	Quintiq	$65 million	www.quintiq.com	x		x	x
13	Unit4	$65 million	www.unit4.com/erp-systems		x	x	
15	IBS	$55 million	www.ibsus.com	x	x	x	x
16	Totvs	$51 million	www.totvs.com	x	x		x
17	IFS	$49 million	www.ifsworld.com/en/	x	x	x	x
17	Inspur Genersoft	$49 million	en.inspur.com	x			
19	Logility	$48 million	www.logility.com	x	x		x
20	Kinaxis	$45 million	www.kinaxis.com	x		x	

Source: Gartner

warehouse might need to perform kitting on one of the orders, so you might have a carrier arriving for a grouped shipment at 9 a.m. only to find that all orders aren't ready until mid-afternoon. "These types of problems still happen day in and day out," says Klappich.

The remedy, according to Klappich and some leading SCE vendors, is better platforms for orchestrating supply chain processes. Gartner terms this concept "SCE convergence," and sees the market evolving toward platforms that optimize end-to-end processes and juggle constraints at all levels. But Klappich warns that while some suppliers are making progress on this vision, the market as a whole will take time to progress to full convergence.

Convergence is more than theory, however, and is being pursued by organizations such as Penske Logistics, a third-party logistics provider that has used a TMS from JDA Software for many years, and recently decided to deploy a WMS and a labor management system (LMS) from JDA. One key benefit of going with one supplier for multiple applications is that it simplifies integration, says Tom McKenna, senior vice president of engineering and technology for Penske Logistics. "It just smooths the path [for integration] and opens the door for increased customer savings in the long run, and greater efficiencies on our part," McKenna says.

The Vision

The supply chain software market will evolve toward convergence in phases, says Klappich, starting with a level one of trying to achieve better visibility by rolling up data into a common analytical system. The second level is tighter transactional integration between SCE applications when it comes to basic data or "objects" such as orders, customers or inventory locations. For the most part, end user organizations are "stuck" at level one or two.

Level three is where previously siloed systems still operate independently, but there is effective bi-directional communication between systems, and activities are synchronized. This level will depend on suppliers using service-oriented architectures (SOA) that support consistency for higher-level processes such as order fulfillment. The fourth and final level, converged optimization, would permit simultaneous

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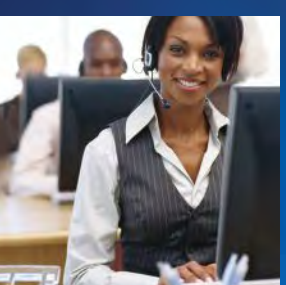

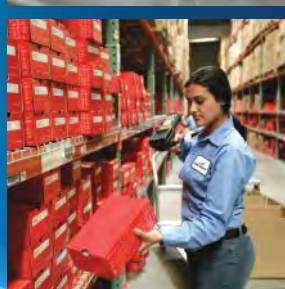

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optimization across functional domains to create feasible plans that take into account constraints across all domains. There is strong bi-directional communication for this level so that an activity in one area can coordinate activities.

At JDA, there has been extensive work to make certain applications, such as TMS and WMS, plan and execute cohesively, says Fabrizio Brasca, vice president of industry strategy for transportation. "Our point of view is to make the transportation solution 'warehouse aware' so that users start off from the get-go building much better plans that account for the constraints in warehouse execution," he says.

Brasca says that even before RedPrairie and its WMS and other SCE solutions became part of JDA, which already had TMS from its acquisition of i2, JDA had worked to make warehouse constraints part of its TMS for purposes such as dock scheduling. "Having those levels of constraints available within TMS means that when plans are created, it's done in a warehouse-intelligent fashion," he says.

JDA is continuing to make more warehouse constraints part of the TMS scope by working on a common data model. In this way, JDA's TMS has insight "into how the warehouse works" so that warehouse personnel aren't "sent scurrying" trying to adapt to siloed

Establishing a Contemporary Supply Chain

Whether it's a "must have" or "nice to have," management and execution software applications are the engine driving today's supply chains.

By Bridget McCrea, Contributing Editor

The technology that drives today's supply chains can be divided into two categories: The "must haves" (the core technologies that shippers need) and the "nice to haves" (those applications that are readily available, but not always completely necessary for every organization). "If you're ultra-small and shipping five SKUs out to your customers, then you may not need any technology at all," says Steve Banker, director of supply chain solutions for ARC Advisory Group in Boston. "As your organization begins to scale up, however, then the applications become increasingly more important."

Here, two supply chain experts give their opinions on which applications should be top-of-mind as you build your contemporary supply chain, and which can be saved for a later date.

"Must Have" Contemporary Supply Chain Technology

• **Warehouse Management System (WMS).** "On the fulfillment side, you don't have to scale up much before you would need a light WMS," says Banker. Such systems lack the labor-saving features and functions of a full-blown WMS (which can also handle yard management, third-party billing, and dock scheduling, for example), but provide "virtually 100 percent accurate inventory counts and get you very close to 'perfect order' on the warehousing side," Banker says.

• **Transportation Management System (TMS).** Once you go beyond parcel shipping, a TMS becomes necessary for managing less-than-truckload (LTL) and truckload (TL) options and managing other supply chain complexities. TMS helps companies efficiently, reliably, and cost-effectively move freight from origin to destination. Able to handle everything from parcels to bulk commodities, TMS encompasses solutions for moving freight in all modes, including intermodal movements.

• **Enterprise Resource Planning (ERP).** These systems of record are the backbone of supply chain management and serve as a platform for all of the other applications. Most include advanced planning and scheduling applications, for example, that help shippers tackle functions like demand planning, inventory planning, and inventory optimization, the latter of which sometimes falls into the "nice to have" software category, according to Chad Eschinger, vice president of research, Software & Supply Chain Management, for Gartner.

"Nice to Have" Applications

• **Yard Management System (YMS).** These systems track and report on what goes on outside of the warehouse walls and away from the dock doors. At its core, YMS handles the scheduling of inbound and outbound freight appointments while effectively managing yard resources.

• **Labor Management System (LMS).** Used to manage and track the labor activities for distribution operations, LMS typically incorporates real-time interaction with warehouse systems to report on labor activity—and then compare that activity against historical data and established labor standards. "Where you may have been running by the seat of your pants, an LMS helps you determine labor levels and the best usage of human resources," says Eschinger.

• **Global Trade Management System (GTM).** For managing global trade, these systems help shippers gain visibility, collaborate with trading partners, and "get better control over goods in motion as they come into port," according to Eschinger.

• **Automated Procurement System.** Used to manage both direct and indirect spend, platforms like Ariba "automate the process for tendering offers and putting orders out for bid," says Eschinger.

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Global Trade: America's Leading 3PLs – Technology

Armstrong & Associates: Top 50 North American 3PL

Inc 5000: Fastest Growing Private Companies

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Global Trade: Leading 3PLs for Midsize Shippers

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plans, according to Brasca.

Penske Logistics, which started the rollout of a WMS in Q1, is optimistic that this sharing of key constraints across domains will bring benefits, according to Eric Hepburn, vice president of distribution center management for Penske. "In a streamlined world, where we are managing the transportation, and we have an understanding of what the capacities are within the warehouse, and [TMS and WMS] systems are talking to each other, then the workforce that needs to be there to receive trucks, and do everything surrounding that activity is there and ready," Hepburn says.

For Penske, getting fully onto the new platform will take some time. Today, even within warehouses that use Penske-owned systems, three different WMS systems are running. But eventually "everything that's on a Penske solution will be going toward one platform," Hepburn adds.

Different Methods

SCE suppliers tend to emphasize different technologies in the pursuit of convergence goals. Oracle, for instance, offers a logistics orchestration solution built on top of its business process management (BPM) engine. The solution is called "Oracle Fusion Distributed Order Orchestration" and enables companies to cohesively manage orders across diverse systems, according to Derek Gittoes, vice president of logistics product strategy for Oracle.

The solution's scope spans all the way up to order promising, but also helps orchestrate execution solutions such as TMS and WMS. "The reason we built a system like Distributed Order Orchestration is so that organizations can have that end-to-end view of all those steps in the process, and to be able to instruct all those previously siloed systems to do what they need to do in a coordinated way," Gittoes says.

Oracle has also worked to build tighter integration between its TMS and WMS solutions, Gittoes says, but the orchestration solution is unique in that it provides a platform for coordinating many types of systems. He also emphasizes that the solution is not a raw BPM engine that needs to be configured by tech experts, but an application with predefined content and easy-to-use setup tools "that are done in a language that an order fulfillment or logistics person understands."

At Manhattan Associates, several years of work have gone into its Supply Chain Process Platform, a common foundation for optimization and integration for all its SCE applications, says Eric Lamphier, senior director for product management with Manhattan. The platform supports workflows that can be either "warehouse initiated" or "transportation initiated," and which consider constraints across multiple domains regardless of which solution is kicking off the workflow. "When other products are being asked to respond to a workflow, they have to honor their own capacities and thresholds," he says.

Aiding the effectiveness of cross-domain workflows, says Lamphier, are the years of work Manhattan has put into creating a set of common business objects. Creating a common data model is a significant undertaking that is difficult to accomplish, especially for suppliers who keep acquiring solutions or haven't committed the development resources to the effort, he says. "Without that

IN CASE YOU MISSED IT:

11th Annual Software Users Survey Shows That Caution Lingers

According to the findings of sister magazine *Logistics Management's 11th Annual Software User Survey* published in the June issue, more shippers are scrutinizing their investments, moving forward cautiously, and upgrading existing solutions versus acquiring new software packages.

Conducted annually by Peerless Research Group (PRG), the survey explores intentions of readers regarding supply chain software, the key solutions they're using and considering, and offers insight into how their habits and intentions have changed.

Shippers may say they're focused on improving supply chain visibility and avoiding potential disruptions in their end-to-end supply chains, but those efforts have yet to show up in their companies' software acquisition strategies.

More than 50 percent of survey respondents say that their use of supply chain software has stayed the same for the last two years, while 45 percent cite an increase. About 70 percent of firms have been using the same software packages for the last two years, while 26 percent are now using more than they were in 2012.

When asked why they aren't using more solutions, respondents largely blamed the presence of disparate systems and integration challenges for curtailing their software investments.

Just 26 percent of shippers plan to buy supply chain software in the next 12 months, while 74 percent say their firms have no such intentions. Warehouse management systems (WMS/46 percent), transportation management systems (TMS/39 percent), and inventory optimization applications (30 percent), rank as the top three solutions that the 26 percent are planning to purchase or upgrade.

The national economy may be closely creeping back up to affable levels, but that doesn't mean companies' technology purse strings are loosening yet.

In fact, a common theme across this year's users study is replacing or upgrading what's already there, versus focusing on new and more innovative investments. This frugal mindset may give way to different approaches as the economy continues to improve, but for now it's the name of the game.

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common data model, the other building blocks you put on top of it are hard to keep in place," Lamphier adds.

SCE solutions at SAP also make use of a common data model and workflows, says Markus Rosemann, vice president of the global solution management team for logistics and order fulfillment SAP. The supplier's most recent set of SCE solutions also are built on SAP's HANA in-memory data platform, a data management foundation that he says handles real-time analytics while simultaneously handling real-time transactions.

According to Rosemann, HANA will spot patterns in SCE processes that can be used to improve planning and adjust execution. "With our HANA platform, we can really support Big Data, recognize patterns and learn," he says.

Rosemann also contends it's vital to use today's platforms to improve higher-level processes such as order-to-cash or trade compliance, or to help manage the complex fulfillment networks which are arising due to the demands of consumer digital commerce. "You want to be able to make the [execution] picture more holistic and have all of this information in a common technical platform, but also relate everything back to the overall business processes," he says.

End Goals Entice

Klappich sees technologies such as workflow and BPM as key to helping fulfill the convergence vision, but he warns that such technologies require effort to properly configure to meet the most pressing needs of a supply chain. "You've got to be careful not to over-engineer this," he says.

The promise of better integration and orchestration of platforms, however, is that the managers in the trenches will spend less time expediting and fixing flawed plans. As Gittoes sees it, it will make life easier because "there will be fewer mismatches between what is going on in the different silos of the organization."

Penkse's McKenna is enthusiastic about the possibilities of having WMS, TMS, and LMS working in concert without painstaking integration work. "Where we are headed is exciting because it's going to make it easier to get systems up and running, and because we'll be able to be much more precise in our planning and execution," he says. ☐

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SUPPLY CHAIN MANAGEMENT REVIEW

FREIGHT FORWARDERS: Leaders Prepare For Demand Surge

With most economists forecasting robust growth in U.S. manufacturing, global freight intermediaries must be prepared for a spike in new business—and concurrent expectations for higher levels of performance.

By Patrick Burnson, Executive Editor

Productivity of U.S. manufacturing for domestic and global markets boomed over the past two quarters, increasing at a 3.6 percent annual rate and up 2.1 percent from mid-year 2013, note prominent trade analysts. In the coming months, these same analysts believe that productivity will be one of the more-watched global economic statistics.

"This is not only true for manufacturers and retailers moving freight, but for freight intermediaries," says Doug Handler, chief economist for IHS Global Insight.

Rob Knigge, the leader of Accenture's freight and logistics group agrees, noting that freight forwarding and contract logistics continues to be a growth industry based on the uptick in manufacturing. "Manufacturers and retailers are relying more on freight forwarders to be the managers of their intercontinental supply chains," he says. "Governments are more concerned about safety than ever before, and are thus demanding more transparency of information."

For prominent middlemen, that means staying in front of the ever-evolving supply chain management challenges and getting ready for advanced data, says Brandon Fried, executive director of the Airforwarders Association (AfA). "Most of our economic indicators suggest sustained growth and consumer spending," he adds. "And this means more business and opportunities."

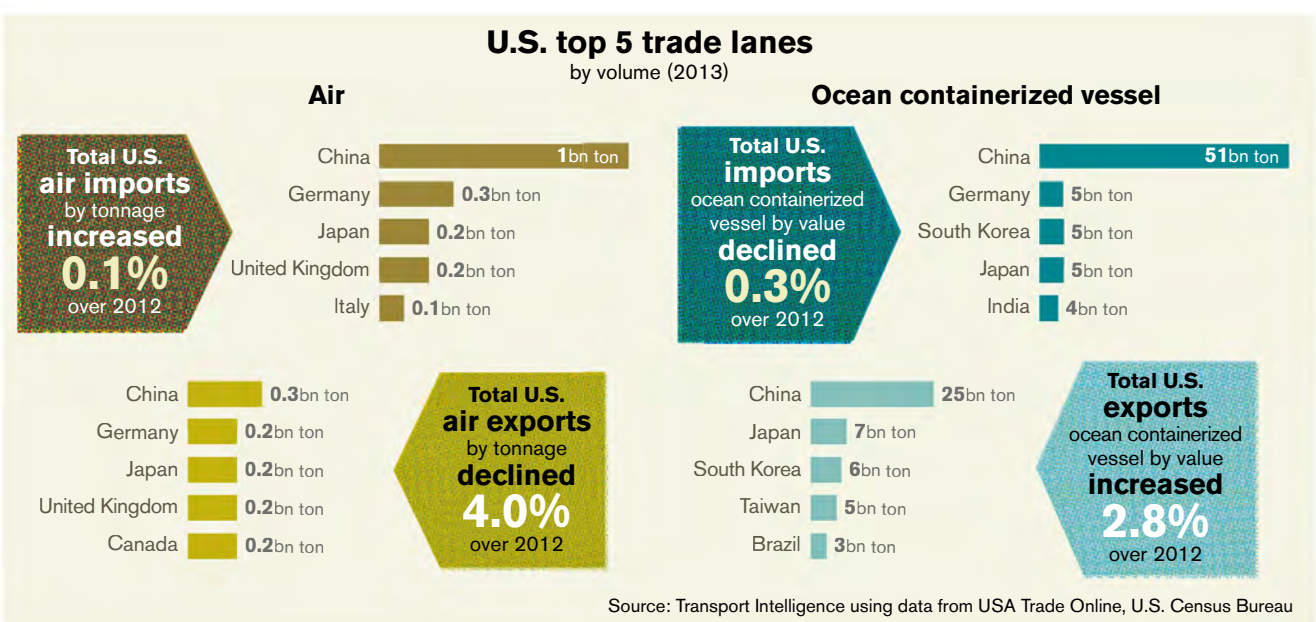
Top 25 "Get It"

Manufacturers and retailers are also forcing forwarders to respond to the new marketplace by restructuring their logistics functions. "They're consolidating service providers and functions, sharing logistics facilities, and centralizing management all in an effort to become more efficient," says Evan Armstrong, president of the leading third-party logistics provider (3PL) consulting firm Armstrong and Associates.

Each year Armstrong's firm compiles *Logistics Management's Top 25 Freight Forwarders* list for a closer analysis of industry trends and how those leading forwarders are meeting these evolving shipper needs.

"The world's major forwarders are way ahead of the curve on compliance and technology," says Armstrong. "That's a big reason why they are so successful," adding that this trend will only gain more momentum. Yet, he also notes that the glory days of international transportation management (ITM) companies are fading fast.

"Because the threshold levels of IT and value-added services capabilities are higher, the big guys will grow



Source: Transport Intelligence using data from USA Trade Online, U.S. Census Bureau

Top 25 Global Freight Forwarders

Largest Providers by 2013 Gross Revenues and Freight Forwarding Volumes*

A&A Rank	Provider	Gross Revenue ($M)	Ocean TEUs	Air Freight Tonnes
1	DHL Supply Chain & Global Forwarding	31,432	2,807,000	2,215,000
2	Kuehne + Nagel	22,587	3,578,000	1,134,000
3	DB Schenker Logistics	19,732	1,891,000	1,092,000
4	Panalpina World Transport (Holding) Ltd.	7,293	1,495,400	825,100
5	Sinotrans Ltd.	7,738	8,668,000**	396,100
6	Nippon Express Co., Ltd.	17,317	776,576	668,522
7	Expeditors International of Washington	6,080	916,168	764,376
8	SDV (Bolloré Group)	7,263	790,000	522,000
9	CEVA Logistics	8,517	730,750	513,000
10	DSV A/S	8,140	772,142	259,365
11	Hellmann Worldwide Logistics GmbH & Co. KG	3,433	684,156	549,948
11	UPS Supply Chain Solutions	5,492	450,000	775,000
12	Kintetsu World Express, Inc. (KWE)	2,718	493,000	924,000
13	UTi Worldwide Inc.	4,441	547,000	368,000
14	Damco International A/S	3,212	791,535	226,626
15	Pantos Logistics Co., Ltd.	2,546	1,753,547	224,865
15	Yusen Logistics Co., Ltd.	4,042	550,000	310,000
16	C.H. Robinson	12,752	515,000	115,000
16	Kerry Logistics	2,575	774,000	278,000
17	Agility Public Warehousing Company	4,415	420,000	375,000
18	Geodis	5,828	420,000	210,000
18	Toll Holdings Limited	6,266	494,493	104,740
19	Logwin AG	1,620	530,000	143,000
20	NNR Global Logistics	1,745	120,137	252,068
21	Dimerco Express	481	128,000	176,000

*Revenues and volumes are company reported or Armstrong & Associates, Inc. estimates. Revenues have been converted to US$ using the average exchange rate in order to make non-currency related growth comparisons. Freight forwarders are ranked using a combined overall average based on their individual rankings for gross revenue, ocean freight TEUs and air freight metric tons.
**TEUs shown are a combination of freight forwarding, NVOCC, booking agent and custom broker activities.
Source: Armstrong & Associates, Inc.

at the expense of small operators particularly in customs brokerage, transportation management, and end-to-end service," says Armstrong.

However, while the Top 25 have fine- tuned their ability to generate volumes for ocean and air, the industry is changing in ways that puts added pressure on gross margins and further challenge earnings. "We estimate that the market will increase 4.5 percent for this year in the U.S.," says Armstrong. "Other analysts estimate that ocean freight revenue markets alone will rise by 3 percent to 5 percent. Individual company results are a mixed bag, however."

Underlying this mixed bag for forwarding is the relationship between the gross domestic product (GDP) and world trade, adds Armstrong. "World trade once represented two or three times the GDP," he says. The last numbers I saw showed slippage of the two indices, so now they're just about equal."

Top Level Observations

By way of ranking the three leading freight forwarder players, Armstrong and his staff of analysts provide these anecdotal asides:

• DHL Global Forwarding grew through the acquisition of highly respected companies like Danzas. DHL currently has more than 30 global carrier partners with more than 80 contracts on a multitude of trade lanes and more than 330 gateway facilities.

• Kuehne + Nagel has outpaced the volume growth of the market in all its fields of activity. Sea freight and airfreight business units again led the way. In both areas, high internal productivity and strict cost management compensated.

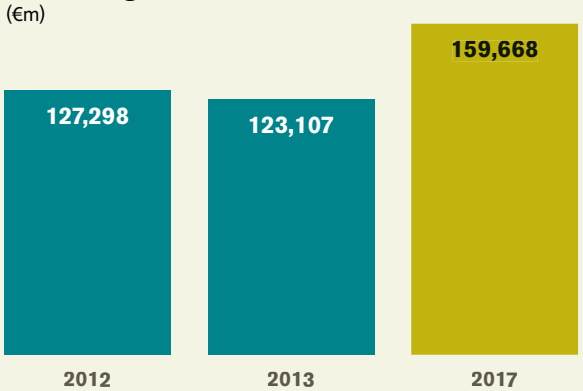
• DB Schenker's German operations, including Europe's largest rail freight and trucking operations, are over 70 percent of total revenues.

For these three leading players in the rankings, "anticipatory logistics" has become a new part of their strategic plans. "The logistics industry is undergoing rapid and profound changes," says Matthias Heutger, DHL's senior vice president of strategy. "This is especially true when it comes to multi-channel retailing or predictive purchasing."

Markus Kückelhaus, director of trend research at DHL, maintains that forwarders, irrespective of size, will have to prepare for these changes or be left behind. "We live in a dynamic and disruptive world," he says. "And forwarders must do their best to anticipate and adjust to it."

Dr. Thomas Lieb, chairman of Schenker's management board, believes in the power of anticipation, noting that his company has expanded operations in Southeast Asia, the Middle East, and Africa based on that premise.

"In line with our growth strategy, we continue to intensify our own presence in interesting markets," says Lieb. "Freight forwarders need to manage the sale and deliverance of a complex service that includes more than just the movement of goods, but also emphasizes technology, reporting, systems



Note: The global market size has been restated for previous years because CEE and Russia figures have been restated.

Source: Transport Intelligence

integration, compliance, risk management, and often global coordination."

Compliance Pressure Remains Prevalent

Meanwhile, regulatory agencies are bearing down on U.S. exporters, says Beth Peterson, president of BPE, Inc., a consultancy specializing in import/export operations and the development of global supply chain security programs. She says that forwarders of all sizes are increasingly challenged to align compliance with logistics operations.

"All of this means that export teams need to be involved early and significantly in discussions about new products, new markets, or new acquisitions," says Peterson. "Unfortunately, many export compliance teams find themselves excluded from key strategic considerations, despite the ramifications that it presents to an export program."

Virtually every global freight intermediary and shipper would benefit from automation, adds Peterson, but many companies still don't fully recognize the value of moving to an automated environment.

"Perhaps no other aspect of global trade has more latent value than the automation of compliance processes," Peterson insists. "It reduces the need for both shipper and forwarder to devote human resources to manually re-keying data in documents, or collating spreadsheets from different departments or regions. It simply improves compliance accuracy."

Globalization to Localization?

In its annual report titled Global Freight Forwarding 2014, analysts for London-based Transport Intelligence (Ti) maintain that some supply chains could undergo a complete circle–from globalization to localization.

"One thing that's for certain is that the global logistics industry of the future will be largely unrecognizable from what it is today" says report author, Michael Nordmann, adding that forwarders are also looking at new industry opportunities at the same time. "To boost airfreight revenue and tonnage, forwarders look to the perishables and pharmaceuticals industries. For sea freight, it's oil and gas, retail, and e-commerce."

And while freight forwarders target new markets and industries, economic forces are underway, favoring a return to regionalization from that of globalization, adds Nordmann. So, how will this affect the freight forwarding market?

"It's still too early to say, but solutions such as multimodal transportation options will likely be one means of survival," offers Nordmann.

Much of the growth within North America is from the U.S., and for Canada and Mexico, the majority of trade is dependent on this country. The North America Free Trade Agreement (NAFTA) has been hugely successful in fostering more hemispheric commerce, thanks in large part to intermodal transport.

"Forwarders are helping shippers expand into Mexico to meet the increasing demand for automotive parts," says Cathy Roberson, a Ti analyst based in Atlanta. "For example, Kerry Logistics announced the acquisition of a majority stake in Cargo Master's Group [CMG], a Mexico-based logistics and freight forwarding company. CMG has a domestic network of six offices throughout the country, including Guadalajara, Queretaro, and Monterrey."

Within the same time frame, Kuene + Nagel acquired Perishables International Transportation of Vancouver, Canada. The ports of Vancouver and Prince Rupert give North American forwarders some nice ocean freight options, says Roberson. "And that keeps Asia in the global framework. China maintains the largest market share in the region for freight forwarding, with Japan a distant second," she adds.

Yet even within the Asia Pacific, localization may be gaining traction. Ti analysts forecast that slight gains will be noted by 2017 by Indonesia, Vietnam, and the Philippines. "For each of these countries," says Roberson, "manufacturing is on the rise and will increase freight forwarding activity."

—Patrick Burnson is Executive Editor of Supply Chain Management Review

Make Data One Part of a Strategy

Access to real-time demand and inventory data gives a more accurate picture of customer needs. But for real operational improvements, data is only one part of a strategy. Processes should be part of the focus too.

By Becky Partida, Research Specialist—Supply Chain Management, APQC

Many organizations seek to benefit from information transparency, especially in their supply chains. One approach organizations have taken to achieve this goal is to share real-time, electronic demand and inventory levels within the enterprise and with external partners. The belief is that making this information available will enable organizations to shorten order processing times through improved inventory levels and deliver a more accurate picture of customer needs.

While it may seem counterintuitive, our research indicates that organizations that focus on data sharing without also addressing their underlying processes sometimes end up with less efficient supply chains than other organizations. In other words, while access to real-time demand and inventory data gives a more accurate picture of customer needs, information alone is not enough. What then is the current state of the market?

Data from APQC's Open Standards Benchmarking in logistics indicates that a slight majority of organizations (59 percent) have adopted the sharing of real-time, electronic demand and inventory data within the enterprise and with external partners (see Exhibit 1). Of organizations that do make this data available, 26 percent have done so extensively.

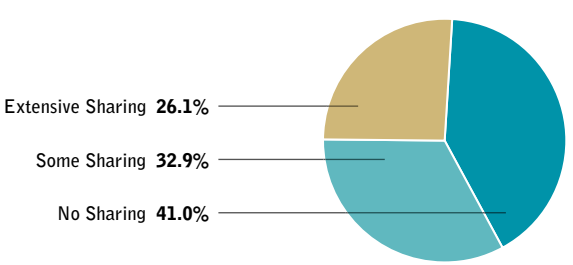
To determine the potential impact of sharing demand and inventory data, APQC compared the logistics performance of organizations that have adopted this practice against the performance of those that have not. The results call into question whether organizations have sufficiently developed their logistics processes to get the full benefit of information visibility.

Speed in Fulfilling Orders

APQC's data indicates that organizations sharing demand and inventory data take longer to prepare orders for shipment and must take extra steps to ensure timely delivery of customer orders. These organizations have higher pick-to-ship cycle times and expedite more of their sales

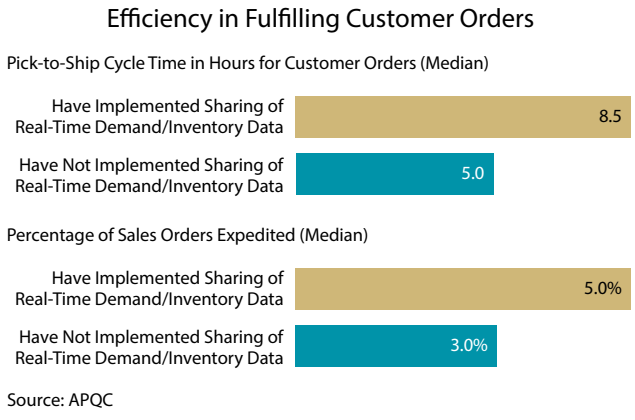
EXHIBIT 1

Extent to Which Organizations Share Real-Time, Electronic Demand/Inventory Data



Source: APQC

EXHIBIT 2



orders. As shown in Exhibit 2, these organizations take a median of 8.5 hours to pick materials in the warehouse, prepare them for shipping, and then place them with a carrier.

Perhaps as a result of their slower pick-to-ship cycle times, organizations that share demand and inventory data expedite 2 percent more of their sales orders at the median than organizations that do not share demand and inventory data. One would expect organizations with access to real-time inventory data to be able to pick and prepare customer orders for shipping faster (and thus need to expedite fewer orders) than organizations without this access. It is possible that organizations that share data do not fully utilize the information available to them when processing customer orders and thus are not able to prepare orders quickly. It is also possible that these organizations rely solely on access to data rather than making an effort to streamline any of their logistics activities that are less efficient. These results hint at the importance of focusing on both information and processes when seeking superior logistics performance.

Staffing in the Logistics Function

APQC's data also indicates that organizations sharing real-time demand and inventory data need more full-time equivalent employees (FTEs) to manage logistics and warehousing than their counterparts that do not share this data. When referring to the activities that go into managing logistics and warehousing, APQC includes defining the organization's logistics strategy, managing inbound and outbound transportation, and managing warehousing. APQC excludes returns management and reverse logistics activities from this particular definition. As shown in Exhibit 3, at the median, organizations that share demand and inventory data need almost 18 more FTEs for the logistics function per $1 billion in revenue than organizations that do not share this data.

However, when breaking down the number of FTEs needed to complete specific aspects of logistics, APQC's data indicates that organizations sharing demand and inventory data perform better than organizations that do not with regard to warehouse operations. At the median, organizations sharing demand and inventory data need 49.8 FTEs per $1 billion in revenue for this task, whereas organizations that do not share data need 53.4 FTEs per $1 billion in revenue. The lower number of FTEs these organizations have dedicated to warehousing operations may lead to the higher pick-to-ship cycle times that these organizations achieve. They may expect their access to information to drive performance rather than considering whether their current processes and staffing levels are adequate for the number of customer orders they receive.

It is possible that organizations that share data do not fully utilize the information available to them when processing customer orders and thus are not able to prepare orders quickly.

Organizations that share demand and inventory data need more FTEs to operate outbound transportation (19.6 per $1 billion in revenue) than their counterparts that do not share this data (13.0 FTEs for $1 billion in revenue). The larger number of FTEs needed by organizations sharing demand and inventory data may be related to the higher percentage of sales orders that these organizations expedite. With less efficient operations related to picking customer orders and preparing them for shipment, these organizations may need more staff to accommodate faster deliveries.

EXHIBIT 3

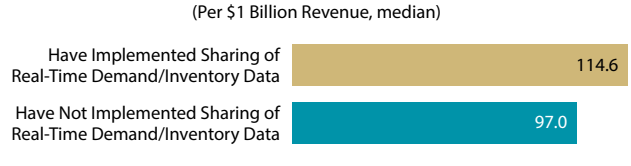
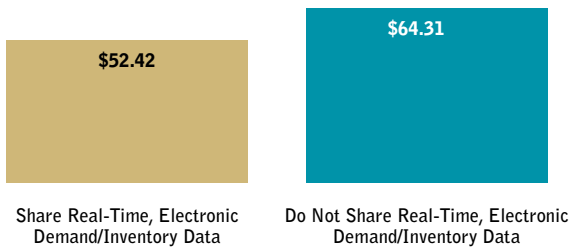


EXHIBIT 4

Total Cost to Manage Logistics and Warehousing

(Per $1,000 Revenue, median)



Source: APQC

Logistics Costs

Despite the need for more FTEs for overall logistics functions and having more expedited shipments, organizations that share real-time demand and inventory data spend less to manage logistics and warehousing than their counterparts that do not share this data. As Exhibit 4 illustrates, at the median organizations sharing data spend $11.89 less to manage logistics and warehousing per $1,000 in revenue than those that do not. For an organization with $5 billion in annual revenue, this would result in a savings of $59.45 million in logistics costs associated with sharing real-time demand and inventory data.

Organizations sharing real-time demand and inventory data have made cost reductions in other aspects of their logistics functions that have enabled them to reduce the amount they spend to manage logistics and warehousing.

These results hint that organizations sharing real-time demand and inventory data have made cost reductions in other aspects of their logistics functions that have enabled them to reduce the amount they spend to manage logistics and warehousing. However, these reduction efforts may be part of the reason these organizations take longer to prepare customer orders for shipment. It may also be that these organizations have implemented improvements to other activities within the logistics function that have not directly impacted their ability to pick, package, and ship orders quickly. These organizations should consider whether these lower costs outweigh their lower performance in packing and shipping customer orders and the larger number of FTEs they need for the logistics function overall.

Streamline While Using Data

Having access to real-time demand and inventory levels can give an organization the ability to better meet the needs of its customers. However, simply having access to the information is not enough. In order for information visibility to have value, organizations must make sure their logistics processes are efficient and the information is strategically leveraged. APQC's data on pick-to-ship cycle time, the amount of sales orders expedited, and the number of FTEs organizations need for the logistics process indicates that organizations sharing demand and inventory data may not have reached the point at which they use the data to its full potential.

Although APQC's data indicates that organizations sharing demand and inventory data have a mix of both leading and lagging performance, other organizations looking to gain access to real-time data should not let the performance of this group deter them. Rather, they should consider the potential benefits of sharing demand and inventory information both within the enterprise and with external partners. They should also ensure that they have well-defined strategies for the use of this information by internal business units and external partners.

Finally, these organizations should consider that simply accessing the information will not be enough to secure the full benefits of supply chain visibility. Focusing on logistics activities and making any adjustments necessary to streamline these activities will ensure that the logistics function can use the data in a way that maximizes its benefit.

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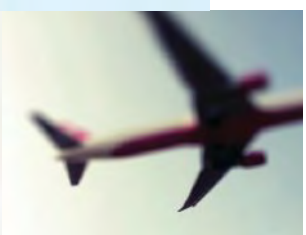

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