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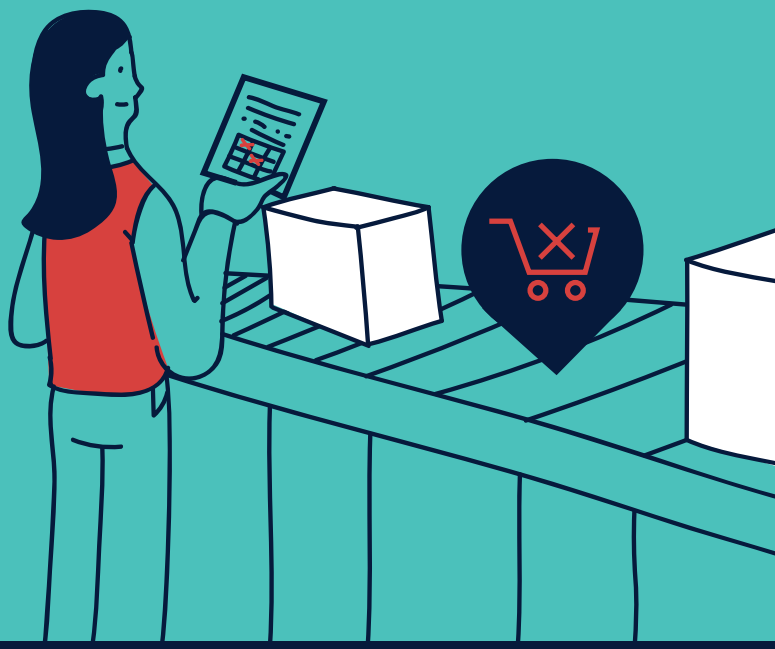

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Follow the leaders

If it's September, it must be time for Gartner's Top 25 supply chains, the lead article in this issue of *Supply Chain Management Review*. As I was reading this year's contribution from Gartner, I was struck by the number of the Top 25 that have launched NextGen Supply Chain initiatives, using Big Data, artificial intelligence (AI), robotic process automation (RPA), machine learning and the like to digitize their supply chains. It made me wonder: Is the rest of the pack falling behind or are they ready to follow the leaders?

This issue we're also featuring a look at some of those NextGen technologies through the eyes of five technologists working on the physical Internet, the Internet of Things, robotics, artificial intelligence and blockchain. They'll give you a sense of what's real today and what's coming tomorrow.

And speaking of leaders, this issue also features the fourth installment on the strategic supply chain—and the strategic supply chain leader—from frequent contributor Steve Melnyk and his co-authors. This month, Melnyk and company pose the seven questions that supply chain managers should ask to determine if their organizations are ready for a transformation from the old to the new.

In a similar vein, we're re-visiting Nick Vyas's 2015 article on the four emerging trends reshaping global supply chains. Vyas, who is the executive director for Global Supply Chain Management at the University of Southern California, originally identified emerging markets, mega cities, the Millennial consumer and e-commerce as the most important trends shaping the future of supply chain management. Based on his travels around the world in the last three years, Vyas has updated his list to include online marketplaces, the disruptions facing global trade, the adoption of emerging technologies and the omnichannel supply chain.

Bob Trebilcock, Editorial Director
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We round out the issue with a feature from partners at Tata Consultancy Services on how to better evaluate third-party logistics providers, and get better bids and contracts—advice that has never been more relevant as more organizations look to third parties for non-core activities.

I trust this month's issue will help you in your job of staying ahead of the pack, following the leaders and—with luck—blazing the next trail.

As always, I look forward to hearing from you with any comments or suggestions for future stories in *SCMR*.

Bob Trebilcock

SUPPLY CHAIN MANAGEMENT REVIEW

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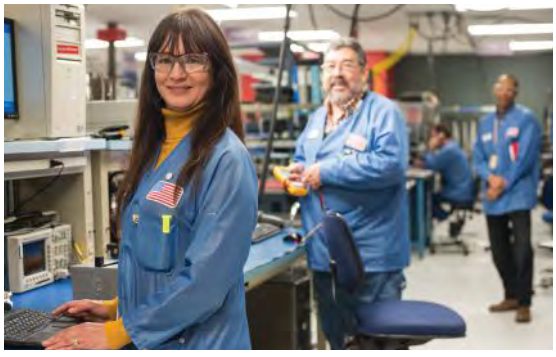
Major Aerospace & Defense Company Taps IoT Sensor Solution to Boost Productivity, Visibility and Supply Chain Management

An Inside Look at BAE Systems' Rollout of Enterprise Sensor Integration From Boeing's Tapestry Solutions

Smart factories are fast becoming a reality as manufacturers leverage Internet of Things (IoT) sensor technologies to connect people, data and processes across their factories and supply chains. This case study examines how BAE Systems is achieving IoT connectivity with the help of Enterprise Sensor Integration (ESI) from Tapestry Solutions, a Boeing Company.



THE CHALLENGE

BAE Systems, an international defense, aerospace and security company, had an immediate need to find new technologies and techniques to accelerate manufacturing production processes in response to increased customer demands. The primary task was to replace existing manual processes with an automated, Radio Frequency Identification (RFID) solution to efficiently track and manage inventory, assets and workflow processes.

The company hoped to attain a near-real-time view into its assets and processes, and integrate that data with its existing sensor technologies and Enterprise Resource Planning (ERP) systems. The company also wanted the solution to have sufficient scalability to grow with evolving enterprise needs.

Previously, the company had a largely manual process for tracking and managing inventory, assets and tools. It used a manual barcode scanning process to track and replenish inventory at multiple sites. Procurement teams released orders manually, which often resulted in longer than desired lead times.

THE APPROACH

Tapestry Solutions set out to provide an Internet of Things (IoT) solution for BAE Systems, leveraging RFID as well as Enterprise Sensor Integration (ESI) technology that it implemented across 50 factories for Boeing, its parent company. ESI is a software solution that connects myriad sensors and data sources onto a common platform.

As a sensor-agnostic solution, ESI can be integrated with an organization's legacy RFID and sensor systems – regardless of hardware or sensor types. ESI integrates that sensor data with customer enterprise systems, such as ERPs, to drive automation and efficiencies. ESI can operate in the cloud or on dedicated, on-premise servers.

Tapestry commenced work at BAE Systems in July 2017, and successfully implemented the technology by 2018 at the company's Electronic Warfare Integrated Manufacturing Center in Nashua, NH, followed by other sites. The installation supported the following business use cases: automated material replenishment, asset and calibratable tool tracking, and work-in-process (WIP) tracking.

THE RESULTS

BAE Systems reports that the ESI-enabled RFID solution has significantly increased production capability at its factories and through its supply chain. The technology provides BAE Systems with the capability to track 200,000+ assets, 30,000 parts, and an estimated 6,500 work orders at its facilities.

Material Management

To track and replenish materials via RFID, BAE Systems selected a TwinBin RFID Kanban system with specialized material-storage containers. The system sends signals to suppliers once the stock level has been depleted to the determined re-order level.

Orders are automatically generated every night, and the parts arrive at a pre-determined time at the material center. This has enabled BAE Systems to transform from a "push" scheduling process to a "pull," where there is a just-in-time inventory flow through its supply chain.

Tools & Asset Management

For asset and tool tracking, BAE Systems has applied UHF RFID tags to tools used during the assembly process. The system can also track items as they enter and return from specific zones with associated alerts. This enables users to identify any misplaced tools or materials. ESI also monitors recalibration due dates on equipment.

Work in Progress

For WIP, RFID tags are applied to printed work orders as they are initiated, which enables tracking of each open order as it moves through the production floor. The work order then follows the movement of each product as it proceeds through the assembly process, allowing the company to track an order's status and identify possible bottlenecks.

For more information about ESI, please contact Tapestry at marketing@tapestrysolutions.com *or* www.tapestrysolutions.com

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Let's talk about CRM Systems

My May/June 2018 Insights column was titled "Sales organizations shape industrial product demand." It pointed out that at consumer-product companies, forecasts and plans made by sales organizations are often treated with skepticism. At industrial-product companies, in contrast, understanding sales activities is critical to developing them.

My advice was that sales forecasting models ought to incorporate the quantitative impacts to sales of various factors about sales force activities, as well as the status of future sales opportunities (i.e., the sales pipeline) of prospective customers. I noted that in general, historical sales data drawn from transactional order management systems is critical in consumer products demand forecasting. Meanwhile, when it comes to forecasting industrial products, future prospective customer information drawn from customer relationship management (CRM) systems (such as Salesforce.com) is most critical.

While I didn't assert this in the column, I also believe that CRM systems can be extremely useful in consumer-product companies as well. This column discusses the ways in which a CRM system might be used to develop more accurate plans and forecasts.

What is a CRM system?

According to Gartner, CRM became the largest software market in 2017, with an estimated $39.5 billion in revenue, and is expected to be the fastest growing category in 2018. As a business function, customer relationship management has been around throughout history, and some server-based CRM software applications existed back in the early 1990s. The big change occurred in 1999, when Salesforce.com pioneered CRM software in the Cloud, which turbocharged growth and the pervasiveness in the use of CRM systems. That said, I wonder if supply chain managers have investigated using the vast amount of electronically-available data in these systems?

So, just what is a CRM system? Wikipedia defines it as: "an approach to manage a company's interaction with current and potential customers. It uses data analysis about customers' history with a company to improve business relationships with customers, specifically focusing on customer retention and ultimately driving sales growth."

Operationally, a CRM system is made up of three major components: 1) salesforce automation, 2) marketing automation, and 3) service automation, as follows (also according to Wikipedia):

- Salesforce automation works with all stages in the sales cycle, from initially entering contact information to converting a prospective client into an actual client. It implements sales promotion analysis, automates the tracking of a client's account history for repeated sales or future sales and coordinates sales, marketing, call centers, and retail outlets. It prevents duplicate efforts between a salesperson and a customer and also automatically tracks all contacts and follow-ups between both parties.
- Marketing automation focuses on easing the overall marketing process to make it more effective and efficient. CRM tools with marketing automation capabilities can automate repeated tasks, for example, sending out automated marketing emails at certain times to customers, or posting marketing information on social media. The goal with marketing automation is to turn a sales lead into a full customer. CRM systems today also work on customer engagement through social media.
- Service automation is the part of the CRM system that focuses on direct customer service technology. Through service automation, customers are supported through multiple channels such as phone, email, knowledge bases, ticketing portals, FAQs and more.

Dr. Lapide is a lecturer at the University of Massachusetts and an MIT Research Affiliate. He has extensive experience in industry, consulting, business research, and academia as well as a broad range of forecasting, planning, and supply chain experiences. He was an industry forecaster for many years, led supply chain consulting projects for clients across a variety of industries, and has researched supply chain and forecasting software as an analyst. He is the recipient of the inaugural Lifetime Achievement in Business Forecasting & Planning Award from the IBF. He welcomes comments on his columns at llapide@mit.edu.

The first CRM component, sales automation, is what I was referring to in the last column, because I was discussing its use for forecasting and planning in industrial-products companies—in which sales organizations are most important for the creation and shaping of product demand. However, all three components of a CRM system might be useful in consumer-product as well as in industrial-product companies.

CRM's usefulness by product market

In order to understand how each of the CRM components might support forecasting and planning in various industries, I categorize product industries as selling into four markets: industrial durables; industrial aftermarket and consumables; consumer durables; and consumer consumables.

The industrial durables markets involve selling products to companies that use them to run their businesses. That is, until the products are replaced, decommissioned or phased out. A CRM system's salesforce automation component is a major input for forecasting and planning demand. It contains useful information about prospective sales by tracking each sales opportunity along a "sales cycle."

The cycle consists of opportunity phases starting with a prospective sale until it does or does not convert into an actual one. Useful information gleaned from this system component includes: the projected size of and chance of an opportunity converting to its next phase in the cycle. In addition, as described in my last column it can be used to estimate sales productivity in terms of a sales rep's learning curve, and thus might evolve into a decision support system for sales management.

The industrial aftermarket and consumables markets involve selling to an "installed base" of customers actively using industrial-durable products. These products, for example, might be bundled into service contracts that include remedial and preventive maintenance services for them—such as on construction, mining, aerospace, manufacturing and computer equipment. Aftermarket sales might also involve the selling of spare parts, accessories and product-related consumables, such as computer printer paper and ink cartridges.

A CRM system's service automation component is the major input that might be used when forecasting and planning for these products. The system would contain transactional and planning information regarding the installed base of customers. From that, forecasters and planners can estimate future interactions with these customers, as well as the purchases of aftermarket and consumable products.

Regarding consumable products, I discussed an approach to forecasting part sales in terms of the lifecycle of a durable product manufactured with component parts in the latter products in "Lifecycle Forecasting," a column I published in the Journal of Business Forecasting in the Spring of 2008. Essentially, I noted that there are four phases of the lifecycle of a durable product starting from its initial sales and installations to its end-of-life: 1) introduction and active selling, 2) leftover selling, 3) post-sales support, and 4) end-of life support. The salesforce and service automation components of CRM can provide useful information for forecasting and planning during each of these phases.

The consumer-durables markets involve selling durable products to end-consumers, including white goods such as washers, dryers and refrigerators and electrical products like home computers, phones and vacuum cleaners. The CRM system's marketing automation component is a major input that might be used when forecasting and planning for these products. The system contains useful information regarding promotional activities like trade programs, new product launches and pricing actions that are done by the marketing organization. Information about prior promotions and their sales performance, as well as plans for future activities would most likely be found in this component. Forecasters and planners could use this information to do post-mortems on promotions, as well as estimate promotional impacts on future customer demand.

The consumer-consumables markets involve selling consumable products to end-consumers such as health-and-beauty aids, groceries, paper towels and baby diapers. Both a CRM system's marketing and service automation components might be useful when forecasting and planning for these types of products. The marketing automation component would contain useful information regarding the promotional activities of the marketing organization. Similar to the consumer-durables markets, forecasters and planners might use this information to gauge prior promotional effectiveness, as well as estimate the impact on future customer demand.

Meanwhile, a CRM system's service automation component would also be useful. It would contain information on customer-service calls from customers consuming existing and newly launched products. Information about product satisfaction, like product usage and product quality issues, and sales channel effectiveness, can support product innovation as well as forecasting and planning.

Look into your CRM systems

As discussed above, all components of a CRM system might provide useful information for improving the accuracy of forecasts and plans for both consumer- and industrial-product companies.

However, despite the phenomenal growth of this internal electronic information, I suspect many managers have spent much of the past two decades investigating external Big Data information like social media feeds. But has this taken away some of the effort that might have been better spent on the information now available in CRM systems? If they have not done so yet, they should investigate them. They might find a treasure trove of useful data in their own backyard.

Smallholder farmers can keep pace with digitalization and go global

By Katherine Tabares and Vivian Rangel

As the digitalization of supply chains progresses, how can small, less technically-sophisticated enterprises leverage the technology? The challenge is especially apparent in the agricultural industry, where resource-poor, small-scale growers in emerging economies remain tied to traditional practices. Yet without their participation, the digitalization of agricultural supply chains can't reach its full potential.

Katherine Tabares is agribusiness manager at LOGYCA. She can be contacted at ktabares@logyca.com. Vivian Rangel is the sustainability research leader at CLI. She can be contacted at vrangel@logyca.org

The Center for Latin America Logistics Innovation (CLI), a member of the MIT Global SCALE (Supply Chain and Logistics Excellence) Network, is leading an initiative in Colombia that offers one approach to the challenge. In addition to helping smallholder farmers access world markets and improve their logistics skills, the project represents a first step in introducing these growers to more advanced supply chain and logistics practices.

Market connections

The CLI project is part of a broader pilot that also involves LOGYCA/ASOCIACIÓN, the representative in Colombia of GS1 standards. Initially eight countries were involved in the pilot, including Colombia, the only country from Latin America, but the pilot is now open to all countries.

Smallholder farmers in developing countries are separated from end markets by long and complex supply chains. Moreover, a lack of education prevents them from adopting best practices that could help them sell their products in global agricultural markets. Another hurdle is that many farmers in countries such as Colombia have no or limited access to the Internet.

The effort to overcome these barriers began with a project launched in 2016 in Colombia in collaboration with the country's Ministry of Agriculture and Rural Development. Called Colombia a la Carta, the initiative encourages small and medium-sized farming operations to register with Sustainability Networks, an initiative created by LOGYCA and the International Trade Center (ITC)—a multilateral agency that supports the internationalization of small and medium-sized enterprises—to implement global sustainability and development goals.

Participant farmers also adopt the Sustainability Map. Unveiled in September 2017 by the ITC, the freely available Sustainability Map is an online gateway that connects businesses and producers.

Small-scale grower members become part of a global farm registry, and gain access to various analytical tools and information on sustainability initiatives and standards.

The platform enables these businesses to deploy better sustainability practices in international trade.

Growers are assigned a unique ID called a

Global Location Number (GLN) that identifies them in the global system. Once registered, a farm can build a profile that includes information such as location, the product it grows, the farm's output and measures taken to support environmental sustainability.

By connecting farms to international buyers, the platform bypasses many of the intermediaries in the supply chain. Also, buyers who are interested in the sustainability record of growers can readily access this information. The platform also enables growers to compare their performance with other operations.

But improved market connectivity is not the only step that smallholders need to take to raise their competitiveness. Small-scale growers also have to become knowledgeable about the latest logistics practices and related technological developments. CLI's training program fills these knowledge gaps.

Barcoding program

The program spearheaded by CLI teaches farmers about agribusiness logistics, product identification technology and the role of standards. Most growers do not have a clear understanding of basic logistics concepts such as the types of vehicles that should be used to transport different types of produce and managing inventory and transportation costs. These concepts are especially important when growers want to expand beyond their locales and sell in national and international markets.

To participate in the training program, a region needs to guarantee that a minimum number of growers in the locale will join the classes.

The use of barcodes is a key part of the initiative. Affixing barcodes to products not only improves supply chain visibility and transparency, but the technology also improves growers' access to world markets. The ID system is relatively expensive, and many farmers turn to cooperatives for support. The cooperatives invest in the required equipment and provide the required labels.

More than 122,000 smallholders in Colombia have received a GLN for their crops. Approximately 7,000 farmers have accessed virtual training and 3,500 farmers have been trained around the country in best agricultural logistics practices.

Steady progress

It is hoped that the barcode initiative in combination with the training program will make Colombian smallholder farmers more competitive. The lessons learned so far are encouraging.

One of the most important benefits is improved supply chain transparency and visibility. This is critically important on both national and international levels.

Domestically, small-scale farmers in Colombia have little visibility into the first-mile supply chain. For example, there is sparse information on the transportation and storage services provided by middlemen, and smallholders are unable to track the flow of product from the farm to the distribution center or port. These blind spots make it difficult for growers to improve the efficiency of the first mile supply chain and reduce product spoilage.

On a broader market level, a lack of visibility into product demand can be a major handicap for small-scale farmers when planning which crops to grow. Misreading demand leads to product surpluses, lower profits and missed sales opportunities.

Moreover, large buyers such as retailers have invested in systems to improve supply chain transparency. Smallholders who are unable to connect with these systems are at a competitive disadvantage—and the gap is getting wider as digitalization enables buyers to trace product back to individual growers.

Increasing consumer demand for sustainably-grown food imposes similar pressures on smallholders. In response to these demands, large buyers expect suppliers to provide information on how they support sustainable farming practices and their compliance with certification programs. Growers that are unable to provide this data find it increasingly difficult to compete in global markets.

A tough challenge is how to ensure that small-scale farmers in remote locations input the right data into information systems when required. The CLI program addresses this issue by appointing "leaders" who are responsible for making sure that the information platform is updated. Leaders are affiliated with specific regions, and input data on the growers in their area at designated locations.

Wider lessons

The CLI program has educated small-scale farms in Colombia that grow various crops including bananas, cocoa, coffee and fruits, and the initiative is expanding to include producers of meat and dairy products. In addition to its educational role, the program is gathering valuable information on challenges such as legal constraints that the country's smallholders face.

From a supply chain perspective, the aim is to provide a foundation on which small-scale growing communities

can build. First, the knowledge gained by CLI and the farmers is being used to increase the efficiency of agricultural supply chains that are largely invisible to downstream players.

In addition, LOGYCA provides networking platforms and opportunities to connect enterprises with the farmer directly through collaborative groups. Players from the agribusiness sector meet four or five times a year to build industry relationships, and develop innovative solutions to making value networks more competitive and sustainable. Events, practical workshops and visits are part of the agenda. An important aim is to measure the success of initiatives over the short-, medium- and long-terms.

Another goal is to enable growers to eventually adopt technologies such as Internet of Things sensing and blockchain-based information systems to further improve their profitability and market reach.

A problem that has to be addressed is inadequate access to wireless communications and the Internet. Many growers use smartphones, but the capabilities of these devices vary as does signal strength especially in remote areas. A 2017 survey by the Colombian Ministry of Telecommunications, MinTIC, suggests that 25.5% of farmers don't use available public Internet kiosks because these facilities are too far from their farms. Some 24.1% of respondents said they do not know how to use the kiosks to access the Internet.

Still, this picture is likely to change over the next few years as cell phone penetration increases in Colombia. A report by eMarketer titled "Mobile Colombia 2016: Updated Forecasts and Key Growth Trends" estimates that seven in 10 Colombian consumers had cell phones in what is described as a "flourishing mobile market."

Meanwhile, it is hoped that the dual approach of the CLI program—promoting connectivity to global agricultural markets while educating farmers on logistics best practices—will position smallholders to benefit from the digitalization of supply chains rather than being left behind by it.

The initiative could also provide some important lessons for small-scale agricultural communities in other countries. These businesses are a key part of emerging economies as well as the global trade in agricultural products.

MAKING THE CASE FOR

Collborative Analytics in Supply Chain

Just how many ERP screens, spreadsheets and emails between colleagues does it take to make good supply chain decisions? For most companies, the answer is "a lot." Here's how collaborative analytics bring people and data together to turn that tide.

THE MODERN-DAY SUPPLY CHAIN is an intricate animal that relies on many moving parts and pieces to align and create favorable outcomes. For most organizations, that means getting the right goods to the right person at the right time.

Inventory optimization—that delicate balance of capital investment, service levels, stock-keeping units (SKUs), and the forces of demand-and-supply—contributes to a favorable outcome by helping companies keep pace with customer demands, manage their suppliers, stay ahead of shortages, maintain optimal inventory levels, and drive continuous improvements.

These are all big tasks in today's omni-channel world, where increasingly-demanding customers require deliveries in an Amazon-like fashion—both on the B2C and B2B sides of the equation. Meeting and exceeding customer expectations in a consistent manner requires solid knowledge of everything from setting the optimal minimum/maximum reorder points; key "trigger" points; the correct order quantities; and optimal order intervals (i.e., 30 or 60 days).

Getting all of these pieces in place requires moving beyond spreadsheets and manual processes. Using the same tools that have been around for decades doesn't work anymore, never mind that the information is usually static and out of date by the time it's ready for use. And to complicate the situation further, the cross-functional teams required to optimize inventory are unable to work together effectively to implement the required changes, lagging behind in who is taking which action, and agreeing on how to achieve goals.

Leveraging the core principles of Lean, LeanDNA's cloud-based predictive and prescriptive analytics incorporate the physical aspects of Lean (e.g., perform root cause analysis, set daily goals, measure the results) into software that can be up and running in a week or less.

In this report, we'll explore the key inventory optimization challenges facing companies in the current environment, show how a collaborative analytics platform can help firms overcome these hurdles, and hear from one company that has reduced its global inventory by millions within months of implementing the LeanDNA solution. •

COVERED IN THIS REPORT:

- **The road from manual process to high-speed efficiency**
- **Case Study: Using LeanDNA to save millions in inventory costs**
- **How collaborative analytics deliver real value to the bottom line**
- **Managing the ever-expanding, connected supply chain**

Go to: www.scmr.com/leandna0918 for a complete report on Collborative Analytics in Supply Chain

LeanDNA

Filling the "talent gap" is essential for procurement analytics

Supply chain industry experts and educators agree: A significant upgrade in talent will be required if companies wish to harness and use increasingly complex data to improve procurement.

When Dr. Joel Bresser began designing the curriculum for the Certified Enterprise Analytics Professionals (CEAP) at the Hackett Institute, he discovered that while supply chain managers viewed improving procurement analytics as critical, they were less confident in their ability to execute.

That conclusion was recently confirmed by the findings contained in the report, "Closing the Enterprise Analytics Talent Gap: Building the Essential Skills for Insight-Driven Businesses," co-written with Hackett's vice president of research, Erik Dorr.

Patrick Burnson is executive editor at *Supply Chain Management Review*. He can be reached at pburnson@peerlessmedia.com

"A lot of the numbers we captured indicate a genuine willingness for digital transformation in the procurement sector," says Bresser. "But there's a great deal of denial in there, too."

Procurement leaders surveyed expect significantly increased use of predictive and prescriptive analytics tools across key functional processes within the next 12 months to 24 months. At the same time, mainstream adoption of cognitive computing/artificial intelligence is expected to grow at an even greater rate, Bresser observes.

Procurement leaders surveyed expect significantly increased use of predictive and prescriptive analytics tools across key functional processes within the next 12 months to 24 months.

"Tomorrow's digital and analytic workforce will have dramatically different roles in business functions," he says. "As automation decreases the need for highly manual and task-oriented activities, organizations instead will need to create new roles and develop or acquire new skills. These include job titles like data architect, data scientist, digital partner behavioral scientist and information security expert."

The report goes on to note that these roles will require professionals to perform activities such as performing analyses, identifying and solving problems, serving as a business partner, mining data for new opportunities and developing predictive models.

"These individuals will need finely enhanced skills and competencies in a range of disciplines in order to perform those roles," says Bresser. "Many organizations, however, lack sufficient depth in these skill sets today."

Chris Sawchuk, the Hackett Group Principal & Global Procurement Advisory Practice Leader, read the report with great interest, and comes to many of the same conclusions as the authors.

"We expect to see a much more rapid acknowledgement of these findings in supply chain management in the next couple of years," he says. "Already, many companies are creating the 'chief digital officer' title."

War on talent

Michael Gravier, an Associate Professor of Marketing and Supply Chain Management at Bryant University, notes that the time of this report comes as the "war on talent" is heating up.

"Unemployment is at an extreme low and wages are starting to experience inflationary pressure," he notes. "Many of those who gave up looking for employment during the Great Recession will likely begin to re-join the workforce."

"Unemployment is at an extreme low and wages are starting to experience inflationary pressure...Many of those who gave up looking for employment during the Great Recession will likely begin to re-join the workforce."

—Michael Gravier, Bryant University

Yet Gravier observes there's a stark issue: the worker talent gap. In the general workforce workers don't have the skills to fill many jobs. In the supply chain management arena, huge shortfalls of talent have been forecast for years, and there are not enough colleges and tech schools to graduate all the required talent for future needs. The upshot will be the re-creation of old practices.

"Many companies used to have on-the-job training programs because the expectation was to have to develop the workers, especially when industries like automotive and manufacturing were relatively young, and no developed workforce existed," he says. "The rapid pace of technology will create a scenario that in some ways imitates a world where no developed human resources exist. Creating and continuously developing a workforce will require society to invest in training and education on a continual basis."

According to Gravier, several social institutions will make that happen. Companies will play a key role, with a few creating their own "universities." Organized labor and professional associations will step in to fill the role of trainer, educator, and talent bank for jobseekers and mentors. SCM professionals may also see unions reinvent themselves in ways that facilitate worker mobility while rectifying the issue of stagnant wages this country has faced since the 1970s.

"Governments at all levels will work more closely with private organizations to innovate our public school curriculum to expose the future generations to the amazing world of technology and collaborative innovation that characterize modern society," he says.

Executive search

Tisha Danehl, vice president of Ajilon—a national professional staffing firm serving the supply chain industry—agrees that employers must supplement hiring with training and other development programs to get their new hires up to speed.

"Examples include cross-functional training, mentoring programs, coaching, and online training," she says. "Increasing the skills development of existing employees can be a cost-effective way to keep up with the digitization of supply chains. To be most successful, make sure to design these training programs according to learning pace, style and personal objectives with specific goals and timelines."

Danehl also finds conclusions of The Hackett Group's research consistent with what executive recruiters are seeing in the industry.

"Apprenticeships are on the rise as companies look to reshape their workforce by training them in very sophisticated skill sets...While supply chain and procurement was once viewed as an industry with a limited career track, it is now occupied by more technical workers in higher paid, skilled positions."

—Tisha Danehl, Ajilon

"Apprenticeships are on the rise as companies look to reshape their workforce by training them in very sophisticated skill sets," she says. "While supply chain and procurement was once viewed as an industry with a limited career track, it is now occupied by more technical workers in higher paid, skilled positions."

THE 2018 SUPPLY CHAIN TOP 25

FOLLOW *the* LEADERS

Gartner unveiled the 14th annual global Supply Chain Top 25, identifying supply chain leaders and highlighting their best practices for heads of supply chain and strategy organizations.

BY STAN ARONOW, JIM ROMANO AND KIMBERLY ENNIS

In May of this year, Gartner published its 14th annual Supply Chain Top 25, a ranking of the world's leading supply chains. As always, a primary goal of the Top 25 is to foster the celebration and sharing of best practices as a way to raise the bar of performance for everyone. Another objective of the Supply Chain Top 25 is to shine a light on the importance of the function and profession—within our community certainly, but also for corporate executives outside of supply chain 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.

As with last year, we are publishing our methodology for selecting the Top 25 along with our most notable trends separately on scmr.com.

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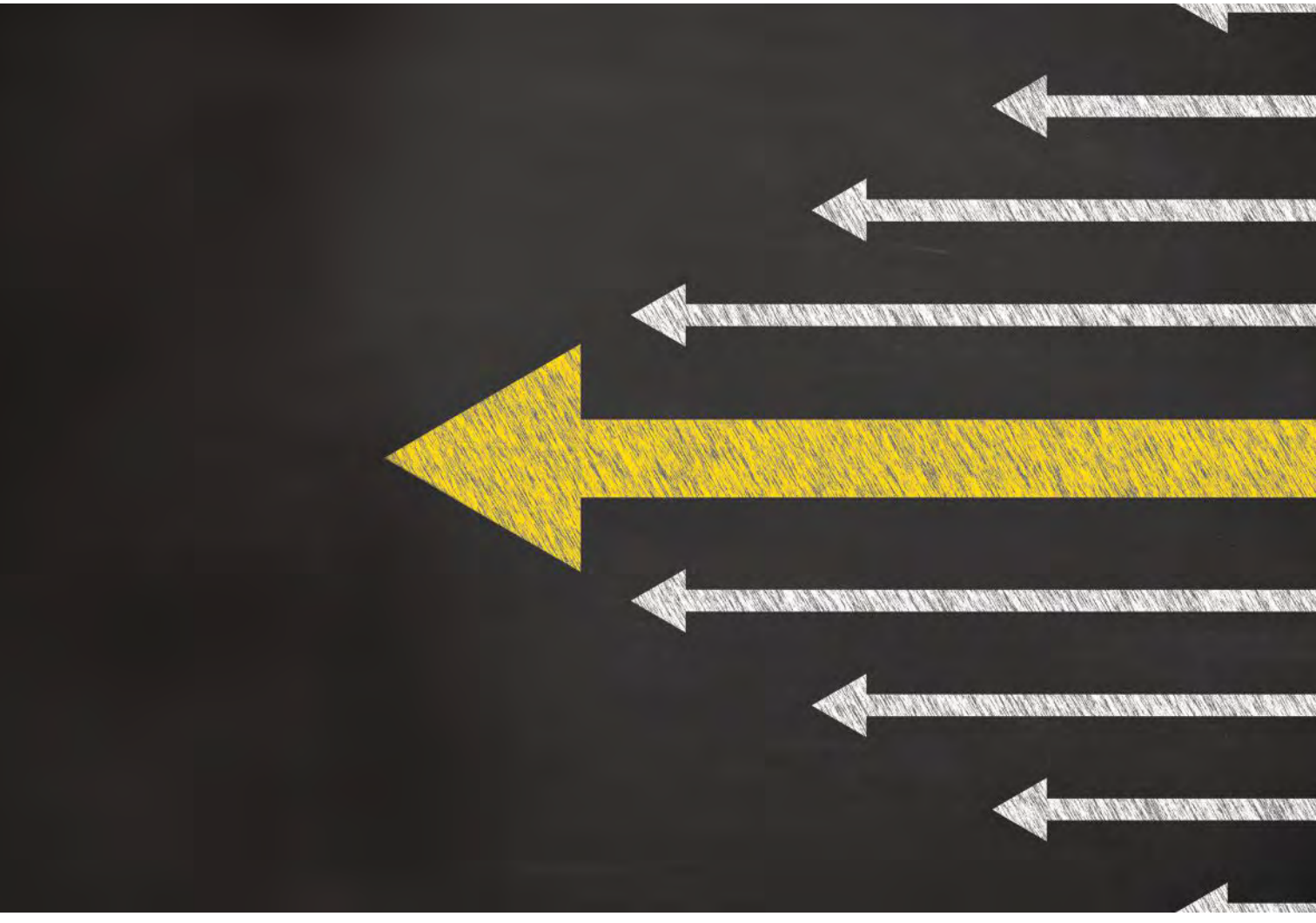


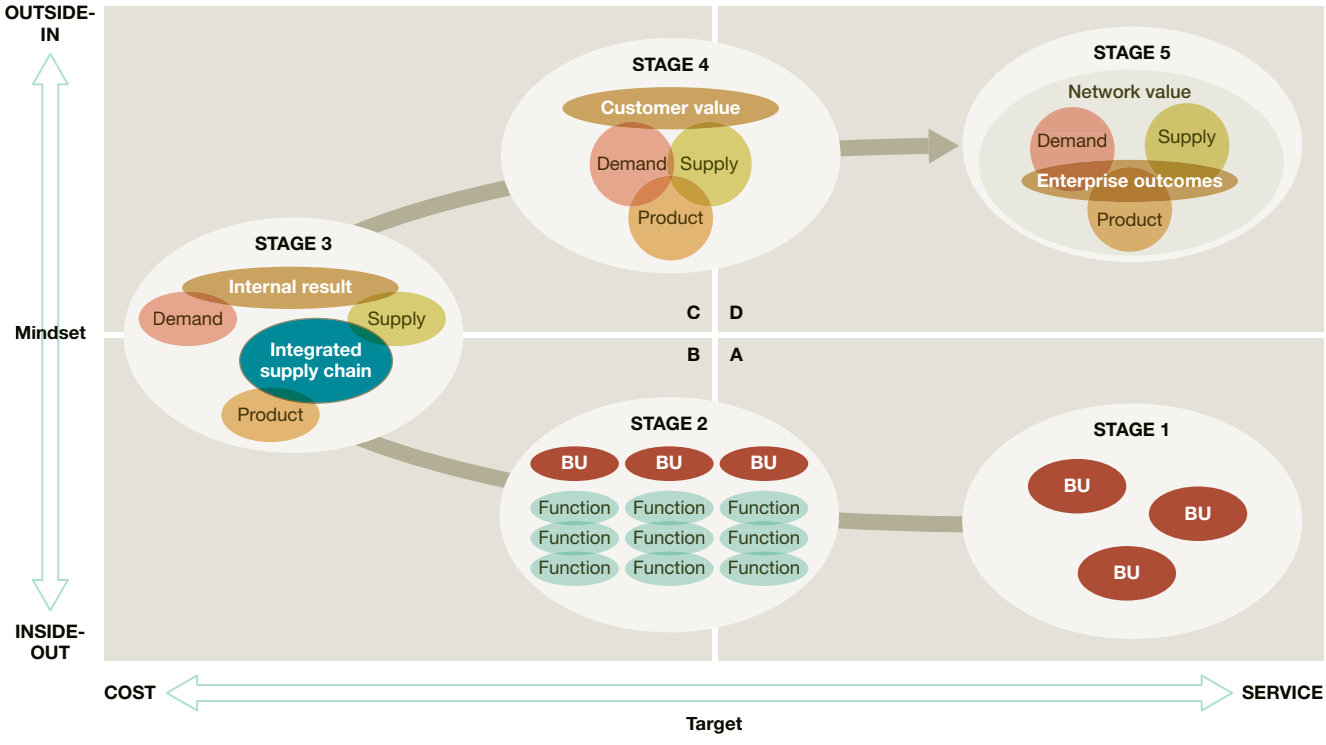
What is the definition of excellence?

Gartner defines excellence as demonstrating leadership toward a demand-driven ideal. Our Demand Driven Value Network (DDVN) model has seven dimensions with interrelated areas of capability in supply, demand and product lifecycle management, all enabled by robust strategy and governance. The maturity model follows five stages of progressive maturity along each dimension and tracks corporate supply chains through a journey from reactively operating in silos to eventually orchestrating for value across both internal and partner networks.

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

FIGURE 1

The DDVN maturity journey



Source: Gartner

Our methodology is available online, but at a summary level it operates like this. Each year, approximately 250 to 300 companies are chosen to be evaluated. 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 business performance data, as well 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.

Supply chain "masters": The golden arches joins a golden group

In 2015, we introduced a new category to highlight the accomplishments and capabilities of long-term leaders. We refer to these companies as supply chain "masters" and define them as having attained top-five composite scores for at least seven out of the last 10 years. To be clear, this category is separate from the overall Supply Chain Top 25 list, but it is not a retirement from being evaluated as part of our annual research. To the contrary, if a "master" company were to fall out of having a top-five composite score for long enough, it would lose this designation and be considered as part of the Supply Chain Top 25 ranking in the same way as any other company in our study. All of last year's masters, Apple, P&G and Amazon, qualified for this category again and were joined by longtime supply chain leader, McDonald's.

Apple continues to be wildly successful, sporting record financial results and a market capitalization of roughly a trillion dollars. One not-so-secret weapon in its arsenal is a services business that complements its hardware and continues to grow at a faster pace than the rest of the company. Apple continues to invest in advanced chip and component design and uses engineering and supply chain as levers to orchestrate the delivery of customer solutions across a wide array of hardware, software and services partners. The high-tech juggernaut has also improved visibility into its extended supply network over the years. All

iPhone final assembly sites around the world are now certified as zero waste to landfill. **Apple** recently announced that 100% of its company-owned facilities run on clean energy and that 23 of its suppliers have committed to power all Apple production using clean sources. One constant when it comes to Apple and the Supply Chain Top 25, is respect from the supply chain community, as reflected by a top-five peer vote score in 2018.

Perennial CP leader **P&G** also returns to the Masters group this year, with its ninth top-five composite score in the past 10 years. P&G continues to simplify and streamline operations to enable end-to-end synchronization. This initiative builds on the basic concept that a synchronized supply network will source, produce and ship daily what consumers require and flow demand seamlessly back through the end-to-end network. To address fast-changing consumer and retail customer requirements, it leverages the latest technology breakthroughs in automation and digitization. It runs a manufacturing of the future program focused on quality to promote growth, touchless operations and people initiatives, including citizenship and talent development. Its digital capabilities span from robotics and augmented workers in plants and warehouses to the use of AI in customer service, planning and strategic sourcing. P&G's pillars of its citizenship work include ethics and corporate responsibility, community

FIGURE 2

The 2018 Gartner supply chain Top 25

RANK	COMPANY	PEER OPINION[1]	GARTNER OPINION[1]	THREE-YEAR WEIGHTED ROA[2]	INVENTORY TURNS[3]	THREE-YEAR WEIGHTED REVENUE GROWTH[4]	CSR COMPONENT SCORE[5]	COMPOSITE SCORE[6]
1	Unilever	2,413	667	10.3%	7.5	2.6%	10.00	**6.36**
2	Inditex	1,254	345	16.5%	3.9	10.9%	10.00	**4.85**
3	Cisco Systems	785	541	7.9%	13.1	-0.4%	10.00	**4.41**
4	Colgate-Palmolive	898	324	17.6%	5.1	-2.2%	10.00	**4.40**
5	Intel	831	499	8.9%	3.6	4.8%	10.00	**4.36**
6	Nike	1,349	270	17.4%	3.8	6.8%	6.00	**4.25**
7	Nestlé	1,326	426	6.4%	4.8	-0.2%	10.00	**4.21**
8	PepsiCo	1,094	391	7.3%	8.8	-0.6%	10.00	**3.99**
9	H&M	760	193	18.1%	2.8	7.8%	10.00	**3.96**
10	Starbucks	1,040	186	20.4%	11.8	9.2%	4.00	**3.85**
11	3M	783	198	14.0%	4.1	1.4%	10.00	**3.56**
12	Schneider Electric	737	410	4.8%	5.2	-0.5%	10.00	**3.55**
13	Novo Nordisk	121	49	37.9%	1.2	5.3%	10.00	**3.37**
14	HP Inc.	390	354	7.3%	8.4	0.2%	10.00	**3.30**
15	L'Oréal	999	210	9.6%	2.9	4.6%	8.00	**3.26**
16	Diageo	651	227	9.2%	1.0	7.6%	10.00	**3.25**
17	Samsung Electronics	907	117	10.7%	14.6	9.8%	9.00	**3.22**
18	Johnson & Johnson	880	322	6.2%	2.7	2.8%	6.00	**3.08**
19	BASF	470	281	6.9%	4.4	-0.5%	10.00	**3.02**
20	Walmart	1,416	256	6.2%	8.3	1.6%	3.00	**2.98**
21	Kimberly-Clark	619	133	13.6%	6.7	-1.6%	8.00	**2.96**
22	The Coca-Cola Co.	1,558	221	4.6%	4.8	-10.1%	4.00	**2.87**
23	Home Depot	431	78	18.6%	5.1	6.7%	5.00	**2.81**
24	Adidas	821	115	6.8%	2.9	13.5%	7.00	**2.58**
25	BMW	679	118	4.1%	4.2	6.0%	10.00	**2.45**

[1] **GARTNER OPINION AND PEER OPINION:** based on each panel's forced-rank ordering against the definition of "DDVN Orchestrator"

[2] **ROA:** (2017 net income / 2017 total assets) * 50% + (2016 net income / 2016 total assets) * 30% + (2015 net income / 2015 total assets) * 20%

[3] **INVENTORY TURNS:** 2017 cost of goods sold / 2017 quarterly average inventory

[4] **REVENUE GROWTH:** (Change in revenue 2017-2016) * 50% + (change in revenue 2016-2015) * 30% + (change in revenue 2015-2014) * 20%

[5] **CSR COMPONENT SCORE:** Index of third-party corporate social responsibility measures of commitment, transparency and performance

[6] **COMPOSITE SCORE:**
(peer opinion * 25%) + (Gartner Research opinion * 25%) + (ROA * 20%) + (inventory turns * 10%) + (revenue growth * 10%) + (CSR component score * 10%)

- 2017 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.

impact, diversity and inclusion, gender equality and environmental sustainability.

Amazon returns to the Masters group this year, after eight consecutive years of scoring in the top five of our study. It has a relentless focus on the customer and a culture that is not afraid to innovate and explore new territory. Consider that the company now runs brick-and-mortar grocery stores, a Hollywood studio and a massive Cloud computing business, in addition to its unrivaled online retail operations and the myriad other business ventures it has undertaken, including its newest, healthcare.

Along with the masters category, the Supply Chain Top 25 offers a platform for insights, learning, debate and contribution to the rising influence of supply chain practices on the global economy.

Even with all these irons in the fire, at its heart, Amazon is a logistics company. It continues to grow its distribution network and has about 100,000 warehouse robots in use globally. Amazon's same-day shipping is made possible through a private fleet of delivery vehicles pulling stock from strategically placed warehouses near major population centers. While Amazon has made strides in terms of packaging waste reduction and renewable energy usage and commitments, the CSR community is waiting for fuller transparency on the span of material environmental, social and governance issues facing the company.

McDonald's joins the masters group for the first time this year, after seven consecutive years of scoring in the top five of our study. The key to McDonald's supply chain success is orchestration across a network of strategic suppliers, service providers and thousands of company and franchise-owned stores. In the past year, this council-driven system redoubled its commitment to a menu based on fresh and natural ingredients. For instance, McDonald's is switching from frozen beef to fresh in some 14,000 U.S. locations, requiring its supply chain to move these perishable ingredients multiple times faster than today and at tremendous scale. McDonald's has broadly adopted supplier segmentation to objectively evaluate business priorities and adjust its focus and resources accordingly. Supplier relationship management is supported by a collaborative online portal and supplier dashboards track operational performance and brand protection through effective risk management. Environmental sustainability is also high on the restaurant chain's priorities. It has pledged to source all packaging products from renewable and recycled sources by 2025 and will phase out foam packaging by the end of 2018.

Apple, P&G, Amazon and newly named master, McDonald's, continue to offer advanced lessons for the supply chain community. Along with the masters category, the Supply Chain Top 25 offers a platform for insights, learning, debate and contribution to the rising influence of supply chain practices on the global economy.

The top 5

Unilever scored the No. 1 position for the third year in a row. It continues to operate under its Sustainable Living Plan to halve the environmental footprint of manufacturing and use of its products, as compared to its 2012 benchmark, even as the business grows. The company has multiple programs running in the areas of sustainable agriculture, ethical sourcing of minerals and cooperation with suppliers, industry peers and NGOs on environmental and labor standards. A significant area of investment for Unilever is the digitization of supply chain in support of the broader business. Key pillars in this area include building an innovation culture that embraces experimentation, democratization of data for business users, the application of advanced analytics, such as AI, and concentration of investment in a handful of big technology bets. One of these bets is Robotic Process Automation (RPA) supporting the order-to-cash process, run from its regional service control towers. It has more than 20 "bots" that have automated hundreds of customer service and order management type processes, with a roadmap for hundreds more.

Inditex, best known for its Zara brand, continued its march up the ranking to land at No. 2. Inditex has been agile with its go-to-market strategy, easing the expansion of brick-and-mortar stores, shifting toward large flagship locations and ramping online sales, which surged 41% year-over-year. A large driver behind this increase was Zara's supply chain enabling "click and collect" at store capability and e-commerce orders with short delivery lead times and low fees. Zara is renowned for its fast fashion business. Leveraging an agile manufacturing base, it can move selected new designs from concept to hanger in two weeks and send garments anywhere in the world within 48 hours. Online sales now represent 10% of total revenue and one-third of those orders are placed online and picked up at the store. In support of a more efficient pickup experience, Zara has piloted an automated system whereby online shoppers scan or enter a code, which triggers a storeroom robot to locate the customer's package and deliver it quickly to a drop box.

High-tech leader **Cisco Systems** inches up to No. 3, due in part to its top CSR score and strong opinion polls. Within the last few years, it has needed tremendous agility to adapt from selling technology to selling business outcomes. In support, its supply chain team has developed a modular, "as a service" approach that allows it to combine different services from new product introduction, to traditional supply chain operations reference (SCOR)-type functions, to software licensing and fulfillment models. Cisco's supply chain priorities include a move from digitization of individual functions to orchestration across end-to-end process flows, enabling digital products and delivery across company lines with suppliers and service partners. Security is another key priority, related to the explosion of connected devices and data created by assets and digitized business processes. Underpinning the solutions offered and processes used are a focus on workforce development and the application of circular supply chain principles.

CP perennial **Colgate-Palmolive** made another jump this year to No. 4. It has long been committed to environmental sustainability and has set a future vision for zero waste to landfill. Its global factory teams are not afraid to get dirty in the process and are running trash-to-treasure events (aka "dumpster diving") to find recycling opportunities in their garbage. Colgate-Palmolive's broader sustainability efforts also include renewable energy use, reduced internal and consumer water use, responsible sourcing and eliminating empty miles in distribution. Beyond its green bona fides, the Colgate team also recently implemented an end-to-end supply chain planning process through a digital control tower. Talent management is another prime area of focus for the two-century-old CP company and its latest effort is an emerging leaders "future of work" program. Looking forward, Colgate-Palmolive is investing in smart factory technologies, including smart-sensor integration, predictive analytics and AI technologies to improve production throughput and quality.

Intel's supply chain team has honed its functional and partner orchestration skills to enable this product transition to data-based businesses, which include autonomous vehicle technologies and mobile communications.

Rounding out the top-five group this year is **Intel**. The Silicon Valley bellwether scored a 10 for CSR, based on its commitment to environmental sustainability, ethical sourcing (e.g., conflict minerals) and social equality. It has evolved from a microprocessor company to selling a complex portfolio of products and solutions incorporating partner designs and offering mass customization on a previously unimagined scale. Intel's supply chain team has honed its functional and partner orchestration skills to enable this product transition to data-based businesses, which include autonomous vehicle technologies and mobile communications. Supply

chain plays multiple roles now: component supplier, system integrator and finished solution OEM. In order to support all of the new demands on its supply chain, the Intel team is using autonomous planning, predictive analytics, AI cognitive computing and end-to-end visibility solutions.

Movers and shakers: No. 6 through No. 15

Footwear and apparel leader, **Nike**, rose to No. 6 on strong financial performance. The company has a goal to reduce order fulfillment lead times from 60 days to 10 days by redesigning its logistics network, nearshoring more facilities, improving contract manufacturer relationships and investing in automation. For instance, Nike has moved into a nearshore, purpose-built footwear factory with Flex that is delivering several million pairs to North America, its largest market. By the end of 2018, Nike plans to have installed a minimum of 1,200 new automated machines at its Asian suppliers' factories, in order to speed cutting, cementing, shoe assembly and sole creation. It has also made a significant shift from selling through its customers' physical retail stores to online, direct-to-consumer sales, which are targeted to grow to $7 billion by 2020. Its supply chain will enable this more profitable online growth through complementary in-store capabilities, support for third-party e- commerce sites, such as Amazon, and by improved demand sensing and shaping with individual consumers through mobile apps linked to its Nike+ loyalty program.

E-commerce is a vital enabler of Nestlé's growth and has doubled as a percentage of sales in the last five years, driven in part by the continued success of its Nespresso brand.

Nestlé, the world's largest consumer food supply chain, was No. 7. It is using M&A and divestiture to shed less healthy brands, such as its North American candy business, and pick up new health, wellness and nutrition-related businesses. Nestlé's supply chain continued to move the needle on customer service levels despite a hyper-competitive marketplace, rising supply costs and intense pressure from activist investors. The group's near-term priorities are on ensuring trust and preference from consumers and customers, enhancing end-to-end optimization of its process flows and driving a total delivered cost mindset. Historically a decentralized organization, Nestlé moved procurement talent into three regional hubs for economies of scale and the opportunity for standardization. While business processes are becoming more centralized, it maintains a go-to-market approach based on local ingredients, recipes and products. E-commerce is a vital enabler of Nestlé's growth and has doubled as a percentage of sales in the last five years, driven in part by the continued success of its Nespresso brand.

Food and beverage leader, **PepsiCo** climbed to No. 8. PepsiCo's customers rate it highly, as evidenced by top positions in industry rankings and surveys. Beyond e-commerce and food service, PepsiCo leverages a large direct-store-delivery (DSD) system for demand sensing and agile supply response. The company developed a device-agnostic app that takes retailer alerting on shelf outages and reframes it to exception-based prompts for frontline sales. Its supply chain has also been developing new digital shelf capabilities, including low-power Bluetooth beacons that can be attached to coolers and temporary displays to better understand consumer response to promotions. Other improvement initiatives include total portfolio optimization and mobile diagnostic kits to explore manufacturing continuous improvement opportunities. Finally, PepsiCo continues its commitment to performance with purpose and has set ambitious goals for environmental sustainability, promoting healthy diets and global empowerment of women.

Swedish fast-fashion retailer, **H&M** dropped to No. 9. In the last year, the company's rapid store expansion tapered and it lagged competitors in new e-commerce offerings. H&M maintained its CSR score of 10, reflecting strong commitment and performance in sustainability and workers' rights.

H&M wants to achieve a climate positive value chain by 2040, meaning it will save more greenhouse gas emissions than its value chain emits. The company plans to invest heavily in innovative, energy-saving technologies and to build stores using 40% less energy than those constructed today. H&M also aims to reduce energy use at suppliers, in manufacturing and distribution. In response to recent performance, H&M is investing in data analytics and intelligence to enhance retail assortment planning and sales, as well as technology investment to expand Cloud computing, RFID and 3D printing. A supply chain reorganization is another component of a broader plan to strengthen the company's competitive positioning and better mirror its customers' fast-changing needs.

Starbucks held tight at No. 10, boasting an enviable three-year weighted average ROA of 20.4% and growth rate of 9.2%. The colossal coffee chain added 2,250 net new stores globally in 2017, in addition to an installed base of over 20,000 locations. Starbucks recently announced the launch of a pilot program to incorporate blockchain technology, or "traceability technology" as the company put it, into its coffee supply chain. The effort will involve select producers in Costa Rica, Colombia and Rwanda over an initial two-year period, with a goal of improving product traceability and driving financial empowerment for farmers. On the sustainability front, Starbucks, in partnership with the Center for the Circular Economy, has invested $10 million in a competition to develop a better single-use coffee cup. The goal is a cup that can be more easily composted or recycled, since its current paper cups are coated with a thin lining to prevent leaks, which is also difficult to separate from the paper.

Longtime innovator **3M** ticked up to No. 11 on a return to growth and a CSR score of 10, driven by a strong safety and sustainability culture. Near-term priorities for the group include investment in advanced analytics to apply statistical process control and machine learning to supply chain processes, creating a digital twin of 3M's supply chain and enhancing its integrated business planning process. Another focus for the company is shifting a larger portion of its sourcing to local regions to improve lead times. One of 3M's hallmarks is disruptive technology innovation. The company has a periodic table of 46 technology platforms spanning materials, manufacturing processes, product applications, and digital and analytical capabilities. It is leveraging robotics, IoT sensors and AI-based process management in its factories. One example is a proprietary technology platform that uses digital scans and machine learning to catch manufacturing defects and adjust the control process.

Near-term priorities for 3M include investment in advanced analytics to apply statistical process control and machine learning to supply chain processes, creating a digital twin of its supply chain and enhancing its integrated business planning process.

Schneider Electric continued its rise and was up five slots at No. 12. The company has been iterating its tailored supply chain approach for several years and the current version adds sustainability and connectedness to the menu. Schneider Electric's supply chain has used this overarching initiative to drastically reduce NPI and customer fulfillment lead times, move to collaborative sales, inventory and operations planning (SIOP), and build unique capabilities for engineer-to-order, field services and special care units. About two years ago, Schneider Electric created a center of digital innovation. Since then, it has identified over 100 prospective companies as technology partners and is moving forward with about 20, specializing in areas such as AI to proactively reduce supply and transportation disruptions. The supply chain at Schneider is very committed to the principles of running a circular economy. A key pillar in this strategy is extending the life of installed equipment and reducing energy and emissions at customers.

New to the global Supply Chain Top 25 this year is Danish pharma leader, **Novo Nordisk** at No. 13. The manufacturer of insulin, hemophilia and growth disorder treatments boasts a chart-topping three-year weighted-average ROA of 37.9% and is well-respected for its ethical and sustainable supply chain. This organization leveraged its strong Lean culture to reduce average cost of goods sold (COGS) by a double-digit percentage over the last five years. It is now able to break down the cost-to-serve of its portfolio, at a SKU level. Understanding the cost of manufacturing and distribution flows has allowed for optimization of site loading and production campaign strategies. Another focus area for the supply chain team has been standardized distribution processes. It now has pallet-level visibility and a temperature trace on each lane for cold chain products. Novo Nordisk is also known as an industry leader for its product launch capabilities.

Climbing five rungs to No. 14 is Silicon Valley icon **HP, Inc**. The company is making an outsized investment in supply chain transformation, including a new, global solution for integrated business planning, a common, upgraded ERP for its print and PC businesses and an order-to-cash control tower for global visibility. After building dozens of RPA bots to automate manual order management processes, digital supply chain experts are moving to analytics and machine learning, image recognition and chat bots. Another new capability is the use of digital postponement to differentiate customers' products over the internet through software keys versus preconfiguring unique SKUs prior to delivery. HP is known for its strong focus on sustainability and workers' rights. In line with circular principles, its Envy branded printers are the world's first made with closed-loop recycled plastic. More specifically, they use plastic resin recaptured from the cases of customers' old, returned printers.

L'Oréal, the world's largest cosmetics company, leapt five places to No. 15, due to higher opinion poll and CSR scoring. Of note, the company is a constituent of the 2017 FTSE4Good global index and one of two companies worldwide rated "AAA" by CDP for top marks in climate, water and forest management. L'Oréal is undergoing a deep transformation and adapting its supply chain operating model to support increased direct-to-consumer sales, while balancing the needs of manufacturing sites. L'Oréal's digital operations strategy encompasses accelerated product development, connected products, agile factories, personalization and supply chain as a business driver. In manufacturing, it created agile lines for quick changeover to different products and formats and uses machine vision, predictive maintenance and real-time dashboards to improve performance. Downstream digital capabilities include automated stock counting through Near Field Communication and RFID-enabled cash-out at department stores.

Rounding out the list: No. 16 through No. 25

Back for another round and up seven positions is **Diageo** at No. 16. The U.K.-based beverage leader returned to growth and saw higher opinion poll and CSR scores this year. Diageo's supply chain continued its focus on supply chain productivity. Key initiatives included lean manufacturing, control towers used in planning and transportation and product BOM simplification through competitive assessments. Beyond standards and efficiency, Diageo continues to invest in supply chain innovation. Its portable (Cube) manufacturing approach is still going strong in Africa and it enabled a pop-up brewery capability in Europe and the U.S. The team also launched a digital transformation program with initiatives driven from the customer back. Example projects include on-shelf availability systems and pilot use of blockchain and track-and-trace capabilities in distribution. Diageo's CSR score of 10 reflects its work in environmental stewardship, focus on building thriving communities and the responsible use of alcohol in society.

Bouncing back from a steep drop, **Samsung Electronics** lands at No. 17. Last year, we predicted a supply chain comeback and the Samsung team certainly pulled that off with high quality launches of its latest Galaxy branded mobile devices. In 2017, it became the largest semiconductor company in

the world, surpassing Intel for the first time. It has posted record revenue and profits for the past two years, including a more than 50% revenue increase in its components business, which sells screens, processors and memory to other companies, including close competitors like Apple. This in-house capability allowed it to steal the innovation lead—in some cases, by saving leading-edge features for its own devices. Its supply chain, likewise, has a very mature logistics organization that is run as a centralized service within the Samsung conglomerate. Samsung Electronics has made significant commitments to environmental sustainability with 2020 goals that include a 95% recycling rate for manufacturing waste and a variety of emissions, solid waste and water reductions.

Renowned healthcare conglomerate **Johnson & Johnson** came in at No. 18. Its supply chain has prioritized three transformational pillars. The first is fast-track innovation to deliver product, process and technology innovations to market faster and more efficiently than peers. This has meant establishing and embracing an innovation culture that emphasizes early experimentation, new technologies and the agility to learn, fail, recover and excel fast. The second is developing and scaling differentiating capabilities that support changing channel needs, regional shifts and routes to markets. And finally, a key focus is constructing well-segmented end-to-end value chains, with clearly defined outcomes, that create competitive differentiation, drive profitable trade-off decisions and release value to fund growth. One of the outcomes of J&J's segmentation is the launch of a project enabling development and launch of new products in half or less the time of the conventional process.

Back for a third year is **BASF** at No. 19. The vertically-integrated chemical leader notched another 10 for CSR, reflecting a culture attuned to safety and sustainability. Digitization is driven at a corporate level, supply chain co-creates with the broader team and works to tailor capabilities to individual business-unit initiatives. Over the last few years, BASF has been able to simultaneously improve

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.** 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.

its customer service levels, while reducing costs and inventory through optimization and upgrading of supply capabilities. It is now digitally collaborating with several strategic customers and suppliers and has optimized manufacturing through advanced analytics and improved logistics visibility. Other investments include smart warehousing, smart site logistics and prescriptive analytics. A more recent digital experiment is the use of AR in a factory to increase efficiency and safety by visualizing real-time plant performance. BASF is also focused on running a circular supply chain. One example of this is a power plant run by steam that is a byproduct of other manufacturing processes.

Walmart has 2025 operational goals for using 50% renewable energy, sending zero waste to landfill and having suppliers remove a billion tons of carbon emissions from product value chains.

Longtime retail leader, **Walmar**t, returns at No. 20. Not surprisingly, a key focus area for its supply chain is the continued growth of e-commerce sales, in competition with Amazon and large grocery chains adding "click and collect" and home delivery services. It is expanding its grocery delivery service this year to over 800 stores that have the ability to reach 40% of U.S. households. Walmart offers 80 million items on its e-commerce site, an endless aisle that is hundreds of times longer than those at its largest format stores. It is also depending on its vendors to help with on-shelf availability through stricter OTIF policies.

At the same time, Walmart is increasing its focus on corporate citizenship and sustainability. Walmart has 2025 operational goals for using 50% renewable energy, sending zero waste to the landfill and having suppliers remove a billion tons of carbon emissions from product value chains. It has also committed to broader sustainable sourcing, forest stewardship and removing chemicals of concern from its products.

Huggies and Kleenex maker, **Kimberly-Clark**, held fast at No. 21, with a return to growth in 2017 and a continued financial discipline that raised its three-year weighted average ROA to 13.6%. The company has been focused on increasing direct-to-consumer sales through partnerships with Amazon and retailer e-commerce groups, as well as on its own sites, in some markets. In 2017, e-commerce represented a high single-digit percentage of company sales and increased more than 30% year-on-year. Kimberly-Clark has also continued its commitment to environmental sustainability. It diverted 95% of manufacturing waste from landfills and more than 5,000 metric tons of post-consumer waste through partnership programs around the world. The company says it achieved an absolute reduction in greenhouse gas emissions of 16.8% over a 2005 baseline, through reduced energy consumption and the increased use of alternative and renewable energy sources.

The **Coca-Cola Co.** moved down to No. 22, due mainly to financial results and a drop in peer opinion. The iconic brand has undergone a massive shift in focus, as the vast majority of bottling operations moved to separate regional companies. The company now runs its more profitable concentrate business and an international bottling organization. The Coca Cola Co. was born and bred as a carbonated beverage system, but has evolved to an extremely broad portfolio. Similar to other large packaged food and beverage companies, its consumers are seeking fresher, healthier options. Tea, coffee, milk, water and other non-soda businesses are now the growth drivers. Supply chain has been focused on deploying common system-to-system platforms with external bottlers. In manufacturing, they are shrinking work center footprints to increase output. Its more advanced plants use AGVs to feed lines, auto-palletize finished products and load trailers for distribution. On the CSR front, The Coca Cola Co. recently pledged to recycle a used bottle or can for every one the company sells by 2030.

Home improvement retailer **Home Depot** is back after a three-year hiatus at No. 23. It continues to

grow revenue and profits without opening any new physical stores. Home Depot has focused on delivering an integrated experience across all sales platforms, which has increased conversions on its e-commerce site. Over 40% of Home Depot's online orders are picked up from stores. The integration of online and brick-and-mortar channels has also served to make its stores more efficient. Its supply chain moved inventory and replenishment into a central team, improving demand forecast accuracy and decreasing the cost of operations for replenishment orders, through operating efficiencies and leveraged spend. This centralization also led to lower stockouts, excess and obsoletes. Home Depot has prioritized environmental sustainability, diversity and inclusion. It has been recognized as "Retailer of the Year" for the last decade by the U.S. Environmental Protection Agency.

Another newcomer to the Supply Chain Top 25 is footwear and apparel leader **Adidas** at No. 24. The company is involved in wholesale, retail and e-commerce business activities related to the distribution of Adidas, Reebok and its golf brands. Adidas is rethinking the way it develops new shoes, as well as how it manufacturers them to support local tastes. It plans to mass-produce 3D-printed soles, allowing it to go straight from designing a product to printing the finished version with nearly no prototyping needed. Adidas is also partnering with a 3D printing specialist to manufacture athletic shoes with 3D-printed midsoles for the mass market. Once production hits full scale, it will be the highest-quantity mass-produced 3D-printed product in the world. The sporting clothier has also been proactive in sustainability and social responsibility. Last year, it partnered with Fashion For Good, a global platform acting as a convener for change, to scale up sustainable innovation in the apparel industry.

German luxury automobile maker **BMW** pulled into spot No. 25 based on strong community opinion polls and a top CSR component score. Its key supply chain initiatives include connected logistics, robotics, due diligence in procurement, risk and sustainability. In its factories, BMW is leveraging digital production techniques through smart data analytics, smart logistics, innovative automation and assistance systems and the use of 3D printing. For example, it uses quality inspection algorithms to analyze thousands of bolted connections in vehicle assemblies for more reliable identification of errors, before they occur. BMW has also created a 3D digital twin of its factory space that is accurate down to the millimeter and can be used for future modifications and performance calculations. The supply chain team is a key partner supporting major shifts in the carmaker's lineup toward electric and autonomous vehicles. In 2017, BMW sold more than 100,000 electrified vehicles, roughly equivalent to the total amount manufactured by Tesla that year.

We look forward to leveraging this research to share the lessons, best practices and characteristics of leaders to inspire and challenge the entire supply chain community to new levels of performance and contribution.

Ahead of the pack

Every year, we see leading companies experiment and advance their supply chain capabilities, leaving the rest of the pack further behind. As Gartner's supply chain research organization, we remain committed to providing a platform for informed and provocative debate about supply chain leadership. In today's uncertain and complex world, our Supply Chain Top 25 research is an opportunity to learn how the most advanced companies adapt and thrive to stay ahead of the competition. We look forward to leveraging this research to share the lessons, best practices and characteristics of leaders to inspire and challenge the entire supply chain community to new levels of performance and contribution.

NextGen technologies: Building the supply chains of the future

A new crop of supply chain technologies promise to increase efficiency, visibility and speed. Five technologists share their vision of the future.

BY GARY FORGER

For several decades now, new technologies have been grafted onto the supply chain with varying degrees of success. Sure, some have had enormous impact. Just try to run any aspect of a supply chain without a computer today or to track inventory without the simple barcode. Others have failed to deliver on their promise. Remember when Walmart crowned radio frequency identification king?

Today, a new crop of NextGen technologies is sprouting across the supply chain. Artificial intelligence (AI), robots, blockchain, the physical Internet and the connected supply chain are part of the discussion. As with their predecessors, they too promise increased efficiency, visibility and speed. But no technology, no matter how advanced, exists without people. At least not yet. So, there's also the matter of how people will collaborate with these new tools.

Gary Forger is the special projects editor for *Supply Chain Management Review*. He can be reached at grforger@gmail.com.

It's also worth noting that none of these technologies is fully baked. Like those before them, tomorrow's NextGen technologies will evolve in three stages.

The first is the "what's possible" stage. That's where most of what's discussed in this article stands today. Next is the "probable use" stage. The third is the "prevalent use" stage. Those two are where many think the technologies discussed here are headed, but we aren't there yet. It's always worked that way in the past, despite our impatience to know the answers today. Now is no different.

In the sections that follow, we asked experts in the field to share their vision of where we are and where we're going with supply chain technologies.

Taylor Smith: Building the connected supply chain

The pace of change in today's supply chain is relentless with ever-increasing speed and complexity combining with continuous business pressures. With these forces at work simultaneously, existing coping mechanisms aren't good enough for today—let alone the future. There has to be a grander scheme in play. Call it the connected supply chain strategy for equipment, people and logistics.

The three pillars here are: visibility, productivity and reliability. Supply chain visibility must stretch from goods availability to equipment assets, demand and orders. Productivity is critical to the delivery stage of each supply chain leg. Meanwhile, reliability and uptime of assets maintains the flow of goods through distribution centers and across the supply chain.

Going forward, major players here include sensors, the Internet of Things to move collected data, and advanced analytics, to name three. There is also voice-directed workflow, artificial intelligence and machine learning. Clearly, this isn't easy and we're only in the early stages of building the connected supply chain.

There's a lot at stake here. Eighty percent of distribution centers today are manually operated. Yet, SKUs continue to proliferate. The average DC manages 14,000 SKUs. And 90% of consumers consider fast delivery to be within two days. But that time frame is shrinking. Meanwhile, 70% of consumers are repeat buyers based on their delivery experience. Not making an expected delivery takes on a new importance.

Connecting assets in the DC is one necessary step in building the connected supply chain. We are well beyond the concept stage on this but nowhere near broad usage. A handful of large, highly automated companies are interested in making their DC equipment fully intelligent and capable of managing that data centrally to improve productivity and reliability. Sensors and data gateways will figure prominently.

The potential is enormous. On the one hand, these connections keep the facility running to fill current orders, avoiding untimely shut downs due to unexpected maintenance issues. But the horizon goes far beyond today's orders.

A highly productive DC, or network of them, opens the door to a reduction of capital expenditures down the road. Most conservatively, it could delay construction of a new facility as business expands. In the best-case scenario, that sixth or seventh facility won't have to be built. The throughput can simply be absorbed by more efficient existing DCs.

For the most part, we are in the dark today as to what happens at any given moment to a truck's cargo between the time it leaves a shipping dock and arrives at its destination.

Then there's the matter of connected workers in the facility. On the one hand, guided work directs people through their workday using technologies such as voice and software. It's much more productive than worker selected work, resulting in greater efficiency, higher quality and better compliance with company work standards. Again, we're in the early stages of what it can be with only half a million people now using guided work systems. Future developments here will likely include natural language systems that are easier to use.

When it comes to logistics, the connected supply will feature real-time tracking and monitoring of shipments on trucks. For the most part, we are in the dark today as to what happens at any given moment to a truck's cargo between the time it leaves a shipping dock and arrives at its destination.

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Early steps to shed some light on what happens in between involve several different types of sensors. Already, temperature, humidity, vibration, shock and light levels can be monitored. But each one is an endpoint in itself.

Going forward, the focus will be to build out narrowband IoT networks tied to the Cloud. Cellular connectivity will be central here. This will allow sensor data to be streamed in real time and by truck location.

Just as important, these truck-based data gateways will extend tracking beyond today's high-valuable and perishable products. Ultimately, most goods will be tracked as they move between facilities in the connected supply chain.

—Taylor Smith is president of Honeywell's Workflow Solutions division

Benoit Montreuil: The new world of the physical Internet

It all started as a headline in the *Economist* in 2006. I picked up a copy at the airport on a trip back to the United States. The idea of a physical Internet sounded interesting. Unfortunately, the articles in the magazine never explained what a physical Internet would be. But the idea was so interesting that I spent the next months shaping what it could be.

The physical Internet (PI) is a supply chain metaphor based on the digital Internet. Quite simply, the physical Internet is a ubiquitous handling and logistics system for moving, deploying and realizing goods through the supply chain. It's a true open network of logistics networks. The concept is not a whole lot different than the digital Internet's movement and management of standard data packets around the world.

Today, there is nothing standard about moving goods at any stage of the supply chain except for maritime containers. The physical Internet changes all of that. It starts with standardized modular packaging, moves up to small modular handling containers and on to modular transport containers. It's a lot like a combination of Lego blocks and Russian dolls.

But it doesn't stop there. The physical Internet is also a meshed multi-party network of hyper-connected facilities that cross-dock and store goods through the supply chain. It's a continuous-flow, multimodal logistics model with a network of open hubs on one side and open distribution and fulfillment centers on the other side.

Open hubs aren't many days of driving distant from each other. In long-haul transportation, they are 100 miles to 250 miles apart. Drivers drop their standard modular transport containers at a hub for another driver to take the next leg. Then the original driver can pick up a different load and return it to that morning's home base. In urban omni-channel logistics, open intra-city hubs are to span the city, a few miles away, allowing to cross-dock handling and packaging containers from open peri-urban hubs and fulfillment centers toward their final destination, or vice-versa, exploiting green vehicles fitted to urban settings.

In the beginning, the physical Internet lived primarily in academic research. While that work continues, industry is now leading the way in the United States, Europe and Asia with a flow of innovative hyperconnected solutions, technologies and business models. This is mostly stemming from logistics and transportation service providers; brands, manufacturers and retailers; technology and equipment providers; and platform service providers.

Around the world, industry probably has tens of explicit PI projects underway. There are hundreds that incorporate aspects of PI. For example, take a close look at the Amazon fulfillment model and it's easy to see key aspects of the physical Internet. Its fulfillment centers are open to any vendor in the same way Amazon does for its cloud computing and storage services. This enables vendors to deploy their products to ensure fast delivery across the United States without investing in facility assets.

In Europe, there is an organization called ALICE (Alliance for Logistics Innovation through Collaboration in Europe). This EU-funded European technology platform is charged with developing a comprehensive strategy for supply chains and logistics systems on the continent. It has made the physical Internet the heart of its European strategic vision with mature widespread implementation targeted by 2030. Many millions of Euros are now spent annually by the European Union and businesses to make PI-based networks a widespread reality by 2030. That's a long way from a headline in the *Economist*.

—Benoit Montreuil, Ph.D., is the Coca-Cola Material Handling & Distribution Chair and professor at Georgia Tech and originator of the physical Internet concept

CAPS Research: Blockchain's impact on supply management

Yes, blockchain appears to be a technology that will have a large impact on the supply chain at some point in the future. However, like many technologies, blockchain is likely to follow what Bill Gates, former chairman of Microsoft, calls the 2:10 rule. It refers to two years of excited talk and then an additional 10 years before the technology is actually adopted and implemented into the mainstream of business. Blockchain appears poised to follow that pattern.

Blockchain holds great promise for procurement organizations. The first applications of this technology will likely be in areas such as financial services, payment processing and tracking the physical movement of goods. New blockchain applications will evolve and may dramatically change how procurement organizations and their supply networks are managed.

Expect blockchain-enabled platforms to facilitate procure-to-pay systems. It may even be possible to facilitate decentralized progressive payments throughout the supply network between suppliers and fintechs.

The shared and permanent nature of a blockchain creates a good environment for the transfer of assets through purchasing transactions, including inventory, sourcing, distribution and financial information. Traditional central record systems only reside inside a single firm to establish ownership and trust. However, blockchain's distributed ledger allows all firms involved to exchange information and assets in a secure manner. Instead of placing trust in a single entity in the value chain, veracity of the data is maintained among blockchain network participants through cryptographic proofs and data visibility.

As a result, blockchain has the potential to dramatically simplify the integration and automation of procurement processes. In fact, blockchain stands to replace supply chain transactions loaded with unintended redundancy, inaccurate information, manual intervention and interpretation and security vulnerabilities.

We believe that blockchain has the potential to remove redundancy as it simplifies and improves various portions of the procurement process. Such procure-to-pay processes most important to chief procurement officers and chief supply chain officers include: contracting, supplier evaluation/selection/on-boarding, conflict resolution, catalog and data management, new product development and qualification, foreign currency exchange management, track-and-trace, ethical sourcing, compliance, risk management and cyber security. These may eventually all be part of blockchain-enabled systems.

Most early supply chain use cases have focused on track-and-trace, product genealogy and authentication of sourced materials. By initial indications, blockchain is exceptionally useful in supply chain applications requiring visibility. Early adopters will likely find niche areas where they can deploy blockchain and grow the functionality over time.

Blockchain-based procure-to-pay systems have begun to emerge too. Banks and fintech firms are developing blockchain-based systems that allow procurement to directly link with accounts payable and payment. Expect blockchain-enabled platforms to facilitate procure-to-pay systems. It may even be possible to facilitate decentralized progressive payments throughout the supply network between suppliers and fintechs. Fintech firms incorporate technology to support banking or financial applications and have begun to proliferate to facilitate transactions throughout the supply chain.

The track-and-trace capability is a perfect match for regulatory compliance. Blockchain provides great visibility of material flows in supply networks. Moving raw materials, components and finished goods through a blockchain also enhances traceability.

Blockchain technology is still very early in the development cycle, but it is likely to be an important technology that will evolve in interesting ways in the future. As a procurement or sourcing professional, it is vital to familiarize the organization with this evolving technology. An understanding of the frameworks and tools and ongoing developments and progress will provide opportunities.

This article is based on research conducted by Thomas Y. Choi, Ph.D., executive director of CAPS Research, along with. Dale Rogers, Ph.D. (lead researcher), Todd Taylor and Raymundo Beristain-Barajas.

CAPS Research is jointly sponsored by member companies, the W.P. Carey School of Business at Arizona State University and Institute for Supply Management.

Pieter Abbeel: The near-, medium- and long-term future of AI and robotics

We are on the verge of making artificial intelligence (AI) a core competency of robots, and that will significantly change how they perform a broad range of tasks. This is a big deal. It will significantly alter how work gets done in the supply chain. Not only will it change current practices but promises to create new applications not considered possible for robots today.

This will take some time. Our current stage is to give robots eyes. Next, we want to use experts to give robots goals. And finally, we want to make it possible for non-experts to manage robots' activities.

In traditional automation, robots do the same action over and over again. Typically, these are simple, repetitive motions previously programmed to guide the robot. Once instructed, the robot performs the activity with little or no relief. Not very human-like at all.

Around 2012 came advanced computer vision thanks to Deep Learning; this is yielding the possibility of giving robots eyes. Combine that camera input with AI for decision making, and the robot now has a chance to first see and then understand the situation, modifying its actions accordingly.

At this point, we don't need better cameras. In fact, they have been good enough for years. The big challenge now is to take that camera input and use AI to more completely interpret the image data. That information will direct the robot's next action, which it may very well have never previously performed.

Making all of this happen is very difficult and complicated. But we are now at a stage where we can construct a machine learning situation for the robot. Going forward, our path is clear: Give robots the vision processing capabilities of humans.

That's the near-term status of the capabilities of AI and robots in the supply chain. And as should be clear, we are not close to completing this stage of development. But that doesn't mean we don't already know what we want to accomplish next. Which is good, because these developments are occurring somewhat in parallel rather than sequentially.

The mid-term goal is to create systems that allow robots to adjust their behavior on the fly. There are two key phrases here. One is imitation reinforced learning; in other words, imitate for the robot what it is expected to learn. The other term is reinforcement learning; that means giving the robot the objective or goal and let it learn on its own using AI.

We are moving through the first phase quickly right now. Using virtual reality, an expert demonstrates an action it wants the robot to perform. What has typically required 90 or 100 demonstrations is shrinking rapidly to a few and even a single demo in certain isolated instances. This is a good start, but not where we want to wind up.

The big challenge now is to take that camera input and use AI to more completely interpret the image data. That information will direct the robot's next action, which it may very well have never previously performed.

Where we want to get to is only science fiction today. Now, we need experts—computer programmers, roboticists and others—to manage robotic actions. The key word here is experts.

Where we are headed is to get beyond experts; we want to make it possible for anyone to teach a robot. We can't do it yet, but there are plenty of people working toward that goal. When we arrive, robots will have a much different role in the supply chain than they do today.

—Pieter Abbeel, Ph.D., is a professor at the University of California at Berkeley. He is also founder/president/chief scientist of covariant.ai, *previously known as* Embodied Intelligence

Daniela Rus: Integrating the workforce with NextGen technologies

We are at the front end of a transformation in how the work of supply chains gets done.

On the technology side, we have robotics, artificial intelligence (AI) and machine learning. Robotics puts computing in motion to move items in the facility. AI gives robots the ability to reason as to what they should do in various circumstances. And machine learning blends the capabilities of robots and AI.

These NextGen technologies, along with many others, will automate many aspects of operations. In many cases, technology will collaborate with people, with machines doing what they are best at, such as moving with great precision, and people doing what they are best at, such as strategic planning. Machines will take on the role of assistants to people and gradually they will be able to do increasingly more tasks.

Don't look for this transformation to occur overnight. Jobs have been changing for a long time, and they will in the supply chain. Just look at agriculture, which once accounted for more than 40% of U.S. jobs and today for less than 2%. There is no question that people will shift their approach to work in the supply chain. But there are some caveats.

Technology adoption requires that the needs of the workplace are better understood. This will lead to technology that can better meet those needs. And then people will be required to develop a much better understanding of technology's capabilities. In the end, this is a great opportunity for the workforce to develop new skills and uptrain. We will need to put in place people who can get the maximum benefit from NextGen technologies.

The front end of that shift is the emergence of data scientists and Cloud computing managers, to name two on the leading edge today. These types of jobs did not exist a few years ago. Today there are many people employed as data scientists and computing managers, and many job openings in this space.

Getting to the point where the job market needs match well the skills of the workers will require a fresh approach to education and training. Key players will be academia, industry and government. Collaboration will be key and no one has a silver bullet. This will take not only on-the-job training but also different types of training. In fact, we will have to fundamentally change our view of the relationship between education and work. Traditionally, education and work were sequential. Complete the first phase then put that knowledge to work in the supply chain. In the future, there will have to be a much more parallel relationship between education and work, with people learning and improving their skills continuously.

While the transformation of work due to technology will not happen tomorrow, AI is advancing at a rapid pace. The new capabilities put in place just in the past few years are already extraordinary. Beyond improving the supply chain process, NextGen technologies will make jobs more rewarding and economically positive.

One potential solution is education through MOOCS—massive open online courses. These courses exist today and offer people an opportunity they haven't had previously. With MOOCS, people can become educated on subjects for which such education was just out of reach previously.

Just as important will be a better understanding by all of the impact of technology on work. For instance, in 2017 MIT hosted a symposium on AI and the Future of Fork (AIFUW). This symposium has become an annual tradition, with the 2018 meeting planned for November 8, 2018. AIFUM provides an opportunity for people to better understand the transformative capabilities of technology on the supply chain process but the impact on the workforce.

While the transformation of work due to technology will not happen tomorrow, AI is advancing at a rapid pace. The new capabilities put in place just in the past few years are already extraordinary. Beyond improving the supply chain process, NextGen technologies will make jobs more rewarding and economically positive.

—Daniela Rus, Ph.D., is the Andrew and Erna Viterbi Professor of Electrical Engineering and Computer Science and director of the Computer Science and Artificial Intelligence Laboratory at MIT

Four Compass Points *for* global supply chain management….revisited

A rapidly evolving and increasingly global world poses new challenges for business survival. Supply chain managers who use these four interconnected compass points can navigate these unprecedented challenges and find opportunities for innovation.

BY NICK VYAS

"The points on a compass have kept travelers headed in the right direction for hundreds, if not thousands of years, even as they sailed off into uncharted waters or ventured into new territories. Managers of global supply chains are in a similar boat as their ancient counterparts. Their world is changing rapidly as their companies enter new, unchartered territories and they confront a host of new cultures and broader trends."

That paragraph opened "Four compass points for global supply chain management," an article I wrote for the September 2015 issue of *Supply Chain Management Review.* Back then, the trends I believed were having the biggest impact on global supply chains were emerging markets, mega cities, millennial consumers and e-commerce. They were the unprecedented challenges staring down global supply chain managers as well as the areas for the greatest opportunities for innovation for those hardy souls who navigated their

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Online Marketplaces
Emerging Technologies
Omnichannel
Global Trade
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When you consider that Jeff Bezos is the wealthiest person in the world and Amazon the second most valuable company on the planet, it's hard to remember that the online marketplace as a business construct is only two decades old and most of its impact on the global economy has occurred since the end of the Great Recession.

ways through the choppy waters.

Of course, three years is a lifetime in global supply chain management. For that reason, the time seemed right to re-visit the topic. For example, technological advancement has raised consumer expectations for the rapid and convenient delivery of products, while powerful economies are reshaping the contours of global trade. A spate of geopolitical events is adding new complexity to how organizations source, manufacture and sell their products. Supply chain executives can work to maneuver through these challenges when they consider the following trends:

- *online marketplaces;*
- *global trade;*
- *emerging technologies; and*
- *omni-channel.*

As with 2015, think of them as four interconnected points on the supply chain compass—modern global supply chain managers who take them into consideration when designing their processes and networks will stay headed in the right direction. Let's take a look at each in turn.

Online marketplaces

When you consider that Jeff Bezos is the wealthiest person in the world and Amazon the second most valuable company on the planet, it's hard to remember that the online marketplace as a business construct is only two decades old and most of its impact on the global economy has occurred since the end of the Great Recession.

The advent of the World Wide Web and the growth of the Internet in the mid-90s allowed big companies, entrepreneurs and mom-and-pop-retailers to set up shop online. Most of them, including an IBM venture, failed. The present big four of e-commerce, Amazon and eBay in the United States, along with China's Alibaba and Japan's Rakuten, each started in the mid- to late-90s with limited formats. For instance, eBay launched in 1995 as a listing site for collectibles, Amazon in 1994 as an online seller of books, Alibaba in 1999 for online wholesale trade and Rakuten in 1997 as a subscription-based virtual internet mall. Their transitions into full-fledged e-commerce marketplaces saw each through the burst of the dot-com bubble in 2000 and drove their spectacular growth. In fact, Amazon turned its first profit in the fourth quarter of 2000, proving to the skeptics that its unconventional model could succeed even in difficult times.

The exponential growth in e-commerce orders in recent years has transformed distribution centers from storage facilities to order fulfillment engines and has turned last mile delivery on its head. Looked at through today's lens, it's equally hard to remember that it took more than a decade before the volume of e-commerce orders had any visible impact on the logistics industry.

When viewed from an e-commerce perspective, the two critical components of logistics—transportation and warehousing—share traits with the real estate rental industry. Both sectors involve the leasing of valuable assets and multiple layers of intermediaries, fixed-term contracts, complex taxation structures and, of course, regulatory compliances. That translates into red tape.

The implosion of the housing market in 2007-2008 cleared the road for the way ahead for the digitization of e-commerce logistics. As the writer Danielle Sacks noted in *Fast Company*: "Spawned by a confluence of the economic crisis, environmental concerns, and the maturation of the social web, an entirely new generation of businesses is popping up." This was of course, about the emergence of "sharing economy" successes like Airbnb, Uber and Lyft, or to use Silicon Valley's preferred phrase, start-ups that enabled "under-used asset utilization."

Airbnb's short-term lodging model came into being during the peak of the crisis in 2008 and had a disruptive impact on the hospitality services industry. In 2017, three

million people in over 80,000 cities worldwide spent their New Year's Eve in Airbnb apartments. A recent Morningstar Equity Research report says that Airbnb is worth about $55 billion, more than any other hotel company, including the $46 billion Marriott International, the world's biggest hotel company.

Uber, the taxi-cab service aggregator, was founded in 2009 and has been such a spectacular success that it gave birth to the term "Uberization" to refer to the use of under-utilized capacity or skills through tele-networked systems to provide highly economical and efficient services.

Now, it's the logistics services industry that is ripe for Uberization. And, without question, there is under-utilized capacity: Take warehousing, where in the United States alone there is about 4 billion square feet, or 30% of available warehouse space, lying unused on any given day—and it's worse in Asia where over half of the warehouse space goes unused. But logistics services is not an easy nut to crack. Logistics markets in developed regions like the United States and Europe have strong entrenched players in the heavy freight, last-mile delivery and 3PL segments, such as UPS, FedEx, DHL, CH Robinson and others. Logistics sectors in emerging economies like India and South Africa are highly fragmented markets made up of unorganized players. In a developed economy, a logistics service aggregator has to compete with well-established, large companies while in emerging economies an aggregator may have to onboard hundreds or even thousands of transporters and warehouse owners that operate behind a near-impenetrable wall of intermediaries.

Nonetheless, start-ups see challenges as a business opportunity and the logistics services segment is the biggest of them all. A recent Transparency Market Research (TMR) report envisioned the global logistics market, valued at $8.1 trillion in 2016, to reach a size of $15.5 trillion by 2023, rising at 7.5% CAGR.

The primary market drivers of the industry are technological innovations including inventory-aware automation, Warehouse Execution Systems (WES)—an evolution of Warehouse Management Systems, IoT platforms, improved TMS, data analytics and the digitization of the supply chain among many others.

Sustained growth in capacity and emerging solutions for cross-supply-chain visibility of shipments have birthed successful logistics e-commerce start-ups in the last five years such as Freightos, an online marketplace for freight forwarders and shippers; Saloodo, an online trucking marketplace; and DeLiv, a same-day last-mile delivery service, to name a few. The warehousing industry is witnessing its share of game-changing start-ups such as Flex, Warehouse Exchange, Flowspace, Temando—a Cloud-based fulfillment platform—and Seegrid, which has brought robotics to material handling and counts Amazon and Boeing among its users. These companies are posting growth in business and the kind of valuations one usually associates with proven e-commerce business models.

Consider that the five-year-old freight forward company Flexport is valued at over $1 billion and helped more than 15,000 companies deliver goods worth $3.8 billion worldwide in 2017 and in April 2018 secured $100 million in the latest round of funding from China's SF Express courier company. Kontainers, a UK-based company that developed the ship.mearskline.com platform for the world's most significant shipping line, has announced the launch of its ocean freight forwarding platform to be made available to European and North American forwarders in September this year.

Something similar is happening in the "warehousing on demand" space. Jonathan Rosenthal, a serial disrupter-entrepreneur, founded Warehouse Exchange (WE) last year to aggregate unutilized warehousing space to enterprises looking for flexible and agile warehousing solutions. Warehouse Exchange has partnered with Associated Warehouses Inc., a global 3PL consortium and with IBM Watson's Supply Chain Insight Group to integrate artificial intelligence and machine learning into its warehousing offerings. WE is also working on a co-warehousing concept that will help small e-commerce businesses share warehousing space and partake in the marketplace economy without having to build their supply chain infrastructure from scratch.

Online marketplaces for logistics services like these are well on their way to fulfilling a long-held promise—the Uberization of global transportation and warehousing networks—by utilizing unused capacity instead of building capacity for peak demand, and all of this at unheard of, highly economical spend.

It is difficult for global, and even domestic, manufacturers to unwind complex supply networks. General Motors' supply chain involves 20,000 businesses worldwide. Apple has suppliers in more than 30 countries across the globe. About 30% of a Boeing aircraft's parts come from suppliers outside the United States.

Global trade

Three significant developments in the last two years have turned the compass point of international trade some degrees away from globalization into the direction of protectionism.

The first occurred in June 2016, when a majority of British voters supported leaving the EU. That was followed by a "Presidential Memorandum" signed by President Trump on January 23, 2017 directing the United States Trade Representative to withdraw the United States as a signatory to the Trans-Pacific Partnership (TPP), in favor of bilateral trade negotiations "to promote American industry, protect American workers, and raise American wages." The TPP was a proposed trade agreement between 12 countries including the United States that aimed to lower tariff barriers among the signatories and establish an investor-state dispute settlement (ISDM) mechanism.

The third development occurred in July 2017, when the Trump administration revealed a detailed list of changes for an overhaul of the 24-year-old North American Free Trade Agreement. That followed a series of talks between the trade representatives of the United States, Canada and Mexico that brought to the table, among other proposals, a "sunset clause" that seeks to end the agreement in five years unless the member nations vote for an extension. Meanwhile, the U.S.-China trade row continues unabated as both sides exchange threats of new trade tariffs.

What do these recent developments portend for the future of international trade? Is this the beginning of the end of globalization? Are we going back to the pre-1950s era of economic nationalism? And, what does it mean for global supply chains? While these questions are debated by economists and policymakers across the political spectrum, we do know that international trade has contributed significantly to the growth of the world GDP. Global business accounted for 60% of the world's GDP in 2017, up from about 6% in 1820 (Figure 1). We also know that higher trade barriers may save and even increase jobs at home in the short run, but they also increase supply chain costs and decrease competitiveness.

What's more, it is difficult for global, and even domestic, manufacturers to unwind complex supply networks. General Motors' supply chain involves 20,000 businesses worldwide. Apple has suppliers in more than 30 countries across the globe. About 30% of a Boeing aircraft's parts come from suppliers outside the United States (Figure 2). Yet, given some of the recent geopolitical events, it may very well be time for big multinationals in the United States and elsewhere to rethink their global supply chains.

No growth without trade

Global trade, which began thousands of years ago as a means to acquire exotic commodities and technologies, has come to determine the fate of human societies. Indeed, the facilitation of commerce and trade between different countries, particularly during the last 70 years, has contributed substantially to the fast growth of the global economy and helped lift billions of people out of poverty. To quote British economist Angus Maddison: "Between 1950 to 1973, the global per capita GDP rose nearly 3% a year; world GDP rose by nearly 5% a year and world trade by about 8% a year."

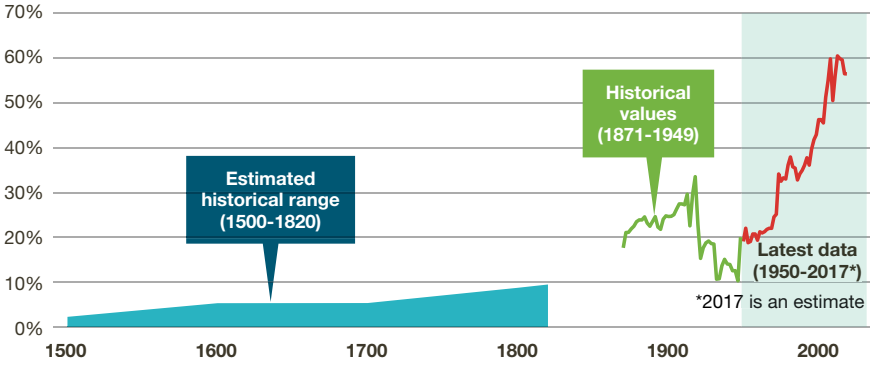
Following World War II, the rising superpower America articulated procedures for cooperation between nations as the U.S. pursued the road of liberal trade. Together with other advanced industrial economies, the U.S. set down rational codes of behavior and created new institutions of cooperation in international trade such as OEEC, OECD, IMF, World Bank and the GATT. On 15 April 1994, 124 nations signed the Marrakesh Agreement to replace GATT with the World Trade Organization, the most significant economic organization in the world that deals with international

trade in goods, services, and intellectual property, heralding in an era of multi-lateral agreements

At present, the United States has bilateral free trade agreements with 20 countries and bilateral tax treaties with 60 countries. It also has multilateral trade agreements like NAFTA and the Dominican Republic-Central America-United States Free Trade Agreement. Bilateral and multilateral trade agreements have strategic benefits of their own; however, the ongoing trade disputes indicate that powerful economies now favor the bilateral approach over the alternative, including many in the Trump administration. In a recent article, Wharton management professor Mauro Guillen noted that bilateral plans could be viewed as more manageable for negotiators and companies that rely on them to gain market access. "But bilateral deals risk treating some countries better than others. The United States already does this with its FTAs (free trade agreements) with Colombia, Israel, South Korea and many other countries in addition to Mexico and Canada. The issue [becomes whether] those bilateral agreements will be about free trade or about privileging some countries over others."

FIGURE 1

Global trade has risen dramatically over time as globalization has taken hold, but the recent stabilization in trade intensity has contributed to concerns regarding the end of globalization



Source: Estevadeordal et al. (2003), Klassing and Milionis (2014), OEDC (2013), Penn World Tables, World Bank, Macquarie Marco Strategy

Given that the United States has the highest GDP in the world, it certainly holds more cards at the negotiating table than most countries. On the other hand, U.S. multinationals would undoubtedly prefer multilateral agreements that create global standards as well as help them leverage global labor arbitrage and open up new markets.

Toward informed decision making

In a globalized world, it is imperative for governments, mainly the democratic capitalist U.S., to continue to promote fair trade and open access to the market. The U.S. must allow the ecosystem within the country to provide a competitive landscape to the multinationals, but to force them artificially through tariffs and other regulations will result in long-term damage to the fabric of the market economy.

It indeed appears that the American consumer will end up footing the cost of the ongoing trade row with higher prices for everyday commodities. It may not be evident today, but the cumulative effect will be adverse for everyone involved. The western hemisphere should find ways of constructive engagement with the world's second-largest economy and articulate fair trade practices through data-driven decision making. What is at stake is more than one person's win or lose gambit—this is about a global trade that impacts billions of lives.

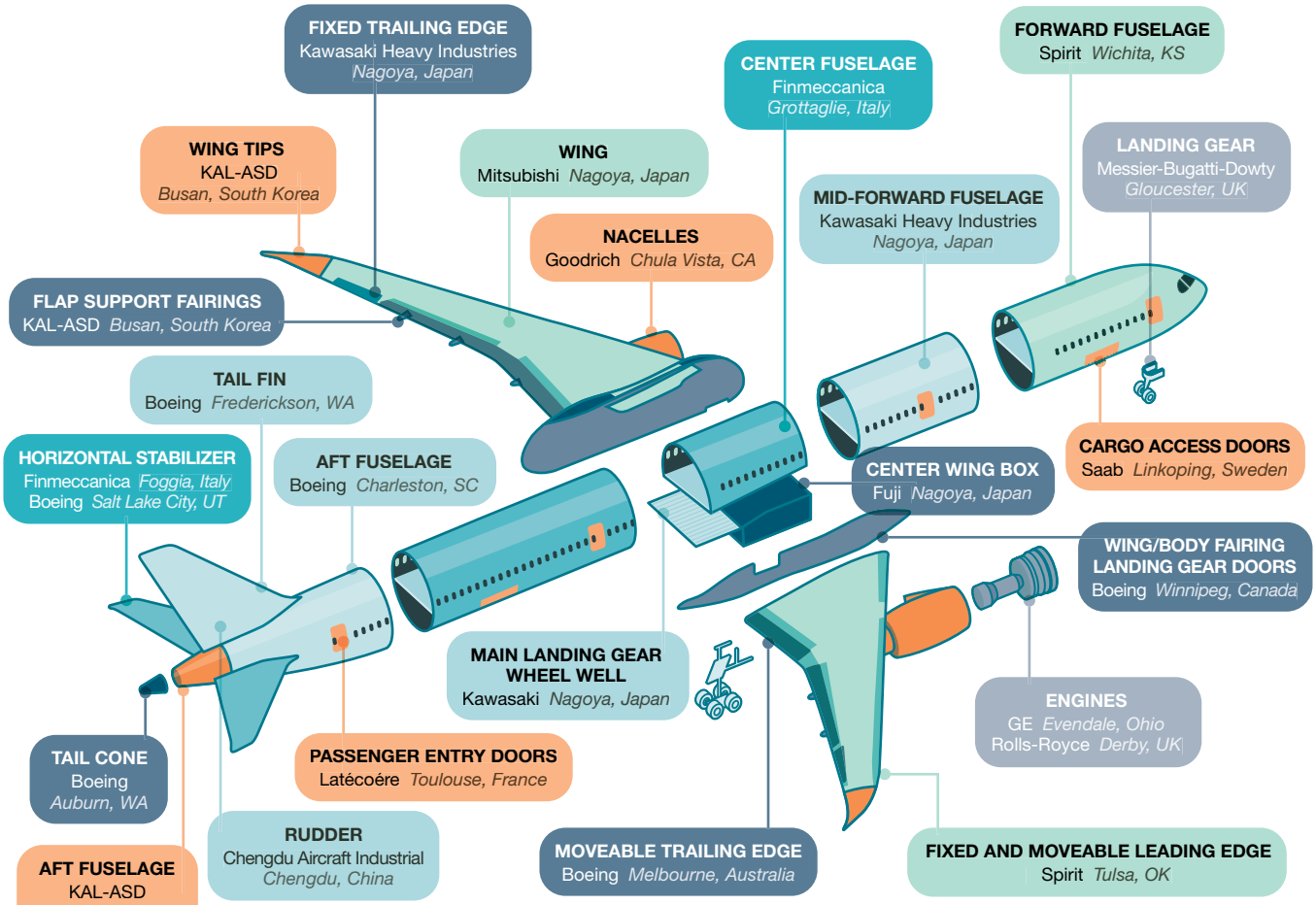
Emerging technologies

Emerging technologies are reshaping supply chain management, and attracting billions in private investment dollars. For instance, IDC estimated early this year that blockchain spending would reach $2.1 billion in 2018, more than double the $945 million spent in 2017. The study said that the United States would see the most substantial blockchain investments and deliver more than 40% of worldwide spending. Western Europe will be the next most significant region for blockchain spending, followed by China.

A number of projects have been in the news. This past August, the global shipping principal A.P. Moller-Maersk

FIGURE 2

Global supply chains explained



Source: Boeing

and tech giant IBM announced the creation of TradeLens, a global trade blockchain platform. TradeLens uses blockchain smart contracts to enable digital collaboration across multiple trading partners including shippers, shipping lines, freight forwarders, port and terminal operators, inland transportation and customs authorities. Participants can interact through real-time access to shipping data and shipping documents, including IoT and sensor data ranging from temperature control to container weight. Forbes has reported, "Collectively, the shipping companies account for more than 20% of the global supply chain market share, with 20 port and terminal operators in Singapore, the United States, Holland and more, serving 235 marine gateways around the world."

TradeLens is not the only player in the fray. Tradeshift, a supply chain payment and marketplace startup valued at over $1 billion recently reported a 350% increase in gross merchandise volume on Tradeshift's platform compared with a year ago and a 315% year-over-year rise in new bookings.

Globally, organizations have been taking advantage of blockchain technology to improve traceability in their supply chains. Last year, IBM announced that ten food companies including Nestlé, Unilever, Walmart, Golden State Foods, Kroger and McCormick and Company had agreed to identify new areas where the global supply chain can benefit from blockchain.

Walmart, for instance, sees blockchain as a way to

improve the freshness and safety of food in its supply chain. Frank Yiannas, Walmart's vice president of Food Safety and Health, revealed to an audience at an MIT Technology Review's Business of Blockchain conference that blockchain was able to shorten the time it took to track produce from six days to two seconds. In June this year, Walmart was awarded a patent for a system that would store medical records on a blockchain from a medical device. Walmart has also recently filed a patent for a blockchain-based customer marketplace for reselling its goods.

In the academic realm, this past August, the USC Marshall Centre for Global Supply Chain Management, where I am the director, brought together industry leaders, tech investors and innovators at its Sixth Annual Global Supply Chain Summit to launch IBISC, an initiative that aims to partner and collaborate with governments and multinational companies to drive future best practices and standards for the adoption of blockchain.

Artificial intelligence (AI) and machine learning are also enabling digitized supply chains to predict customer demand and integrate internal and external stakeholders for effective collaboration across the value chain. Leveraging the machine-learning capabilities of IBM's Watson, IBM launched Watson Supply Chain last year. It focuses on creating supply chain visibility and gaining supply risk insights. The system uses its cognitive technology to predict supply chain disruptions based on external data from social media, news feeds, weather forecasts and other sources of historical data. Tania Seary, the founder of Procurious, a social network of procurement professionals, reported: "Watson supported $71.7 billion in revenue, managed 150,000 contracts, and supported 20,000 professionals and 11,000 suppliers to ensure 5,000,000 deliveries were made."

Omni-channel

An omni-channel supply chain enables sales, inventory management, ordering, order fulfilment and final delivery via numerous retail channels such as web, stores and mobile. Omni-channel implementation requires an organization to integrate omni-channel retailing with IT, sales and marketing, procurement and transportation.

The advent of retail omni-channel is changing the way retailers ensure consumer satisfaction. Fulfilment centers work round the clock and have reduced errors and delays to a bare minimum. On the other hand, omni-channel retail has also changed the way customers interact with brands.

The omni-channel phenomenon was brought into the mainstream by Amazon Prime in 2005. Amazon's new program, which promised subscribers free two-day shipping on qualified items, was designed to improve loyalty and drive sales growth. Over the years, it has had a significant impact on Amazon's success.

But Amazon is not alone. In July this year, Alibaba, the Asian e-commerce leviathan, debuted its new FashionAI, a concept store that integrates smart mirror technology with RFID, machine learning and computer vision to introduce mix-and-match styling options to its consumers through every platform. Likewise, footwear leader Nike has launched a concept store in Los Angeles that utilizes digital data from the user community to bring in-store omni-channel experiences to the customers.

These are just some of the ways companies are employing the power of predictive and prescriptive analytics and machine learning to extract insights from data, increase speed-to-market and improve agility to deliver the omni-channel experience.

Navigating through supply chain evolutions

I'd like to end this article similar to the way it began—by revisiting my original piece. Despite the changes in global supply chain management in the last three years, the takeaways are still relevant.

"What then should a supply chain manager make of these trends? And, how do they use them as compass points for navigation? We believe the layering of each of these factors can assist organizations in traveling the rapidly shifting waters of supply chain. None of the four compass points of modern supply chain management are fully distinct; rather, they point to an increasingly global world that demands an increasingly technology-driven global supply chain."

In the coming years, online marketplaces, global trade, emerging technologies and omni-channel business models will continue to re-shape supply chains. The best organizations will balance these demands in order to stay relevant with their stakeholders.

Get better 3PL bids

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An improved business operating model enabled through a cost-effective 3PL agreement can be a game changer if terms are thoroughly evaluated and properly negotiated.

The rapidly growing global market for 3PL services is forecasted to be worth almost a trillion dollars by 2020. Not only is the demand for services increasing year over year, so too is the complexity of supply chain services, creating unique challenges for anyone trying to evaluate the pricing models for 3PL warehousing and fulfillment services. In this article, we will examine some of the major obstacles faced by companies that procure these types of services along with providing options to improve current practices.

Specifically, we will provide insight into ways to establish an improved and more comprehensive 3PL pricing evaluation methodology to better analyze bid proposals and maximize 3PL contract terms and pricing for all types of warehousing and distribution services.

3PL services on the rise

There are many reasons that companies are more compelled than ever to outsource their logistics needs to a third party whose core competency is warehousing, transportation and order fulfillment. For starts, ever rising customer expectations for personalized services, greater selection and speedy delivery are placing extra burdens on those companies that

BY DEANNA M. RAINWATER, ALISON SCHOCH AND SHANTANU GINODIA

try to keep order fulfillment in-house.

Furthermore, many companies need a means to increase product distribution and scale more quickly or desire to employ more innovative technologies to further optimize their supply chains without necessarily investing time and money in fixed assets, specialized systems and operational infrastructure.

Entering new markets or introducing new product lines can also lead to increased sales forecast risk and other business ramp-up considerations that may be a better match for a 3PL that already has the required expertise and infrastructure (people, processes, systems) in a specific geography or industry segment. By leveraging a 3PL provider's geographic reach and shared infrastructure a 3PL provider may be a more flexible and cost-effective solution to reduce initial and ongoing business capital and operational expenditures.

Finally, an improved business-operating model enabled through a cost-effective 3PL agreement for warehousing and distribution services can help boost overall cash flows, while also driving innovation and market competitiveness if negotiated properly.

When to outsourcing

The decision criteria for selecting a new 3PL provider typically includes both qualitative and quantitative business success factors.

While these may vary significantly from company to company, many of the commonly used qualitative factors companies consider before outsourcing include:

- service quality and reliability;
- flexibility and responsiveness;
- cultural fit and compatibility;
- security and safety;
- reputation and experience;
- trust and fairness;
- infrastructure capability (e.g. systems, facilities, manpower);
- geographic coverage and locations;
- financial viability and stability; and
- logistics innovation (e.g. analytics, technology).

While these factors are all-important in the decision-making process and the long-term suitability of the 3PL provider, the quantitative area that includes the proposed pricing terms and the bid comparison process between logistics vendors is often inadequate.

By closely examining current 3PL provider selection processes and capabilities and taking the necessary steps to upgrade current bid evaluation tools and practices, a company can better optimize future agreements. An improved bid review methodology and approach can also reduce the risk of billing surprises, or of being stuck with a contract that is ill suited or consists of inflexible pricing terms. By better understanding and quantifying the proposed 3PL

FIGURE 1

Understanding common 3PL contract types

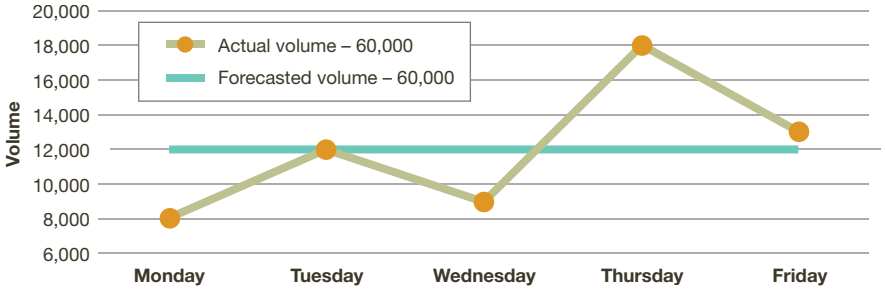
CONTRACT TYPE	CALCULATIONS	PROS	CONS
Cost plus	Actual costs + management fee = COST	▲ Quick transfer of management ▲ Deal for complex processes with no internal competency	▼ No incentive to reduce cost or increase productivity ▼ Requires constant monitoring/management ▼ Unpredictable costs as volume fluctuates
Fixed + variable combination	Fixed costs + (profile volumes x activity based rates) = COST	▲ Fixed warehouse space and dedicated staff ▲ Incentive to increase productivity	▼ Shared risk with 3PL ▼ Fixed cost as a percentage of sales increases as volume decreases
Variable (Activity based costing)	(Storage rates + activity based rates) x profile volume = COST	▲ Predictability of cost per UOM ▲ Incentive to increase productivity ▲ Limited financial risk to company	▼ Potential higher activity rates due to increased risk to 3PL ▼ Inventory management is critical for low cost ▼ Requires constant service

Source: Authors

pricing terms up front, and by understanding the potential impacts of volume fluctuations and other components such as fixed price commitments, companies can take more control in contract negotiations. That leads to improved pricing terms and a more competitive cost structure for warehousing and distribution services. Enhancing these processes can also reduce the risk of entering a sub-optimal, non-competitive contract due to primary emphasis on qualitative or subjective factors.

FIGURE 2

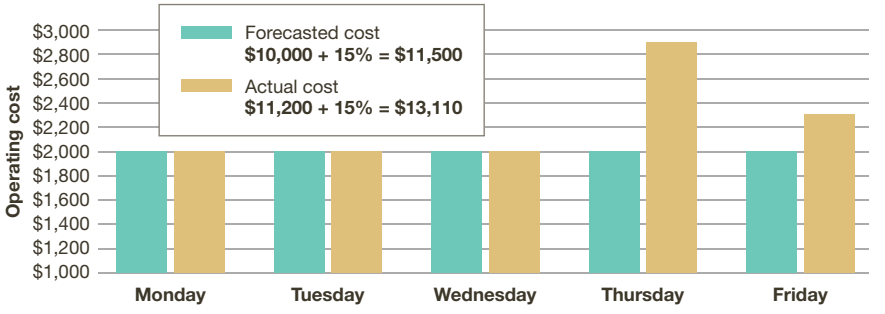
Shipping and receiving weekly volume comparison



Source: Authors

FIGURE 3

Shipping and receiving weekly labor costs comparison



Source: Authors

3PL contract types

The first step to exercising best practices in pricing analytics is to understand the multiple types of contracts that 3PL providers employ. The three most common are Cost Plus, Fixed + Variable Combination and Variable Cost (or Activity Based Costing).

A key input that 3PLs use to determine the proposed terms is the operational profile provided by the potential customer. 3PLs develop their pricing proposal based on their anticipated costs and profit margin targets. Additional services outside of the outlined requirements in the RFP may be provided to cover any other potential 3PL service charges. By better understanding the three typical contract types and the pros and cons of each (summarized below), a company is better able to evaluate and select the pricing terms that are most cost effective for their specific business model and cost objectives. Let's look at each.

Cost Plus agreements

Cost Plus contracts typically simulate the actual cost of managing the operations outlined in the RFP with a profit margin included. The 3PL estimates its operational costs using the operational profile and business process flows provided by the customer. These documents provide key volume and product handling information that a 3PL correlates to its operational work flows to approximate the required labor and operational costs. The 3PL's profit margin is then added to the simulated cost to generate a bid. Because the 3PL ultimately determines how its operations are run and factors such as volume can change throughout the year, it is much harder for a customer to forecast and control its costs.

Figure 2 and Figure 3 illustrate one of the pitfalls of a Cost Plus agreement. In Figure 2, we see that overall volumes matched the forecast volumes, but with significant daily volume fluctuations. The result, as is illustrated in Figure 3, is those fluctuations resulted in higher than forecast labor costs.

As a result, Cost Plus contracts require considerable customer oversight to ensure that only permissible costs are charged and that the 3PL is complying with reasonable cost controls. Striving for increased productivity

gains or decreasing the unit/case handling costs in future years is not incentivized for the 3PL unless it is agreed upon upfront in the contract. Lastly, Cost Plus contracts with unpredictable volumes can cause an increase in overall operating cost even when the total volume forecasts are accurate for a given period.

Still, while these types of contracts can be costlier, customers may choose them for startup operations, for a business unit that is in transition or in situations where quality is more important than the bottom line cost.

While Cost Plus contracts can be costlier, customers may choose them for startup operations, for a business unit that is in transition or in situations where quality is more important than the bottom line cost.

Fixed + Variable Combination agreements

As the name suggests, a Fixed + Variable Combination Cost agreement is a combination of fixed costs for operating the facility and activity-based costing on a per unit basis in accordance to the volume and storage forecast from the operational profile.

The fixed costs usually pertain to the anticipated overhead of the facility and often include the costs of warehouse space and any dedicated management and administrative personnel. This cost structure will, in most cases, lower the variable costs for the operational activities performed within the DC as the anticipated fixed costs have been broken out separately. If the company exceeds its volume forecasts, the overall percentage increases in cost are lower due to the activity-based component of the cost structure. Conversely, if the company is well below its volume forecasts fixed costs as a percentage of sales can increase due to potential underutilization of fixed assets. Additionally, unlike a Cost Plus agreement, the 3PL is incentivized to increase productivity because it will improve its profit margins.

While these types of contracts often result in less expense than a Cost Plus agreement, they can still be risky due to the increased business forecast risks. For this reason, they may not be a good fit if there is business uncertainty, such as what occurs with mergers or divestitures.

Customers may prefer this contract type because it includes a more accurate reflection of services rendered and actual expenses occurred, and a more realistic unit handling prices as the 3PL does not have to build excessive overhead into the handling rate to hedge potential losses related to their fixed costs.

Variable Cost agreements

Variable or Activity Based Cost agreements are completely variable and fluctuate in relation to the volume. There are no fixed or minimum costs that must be met, so the pricing is entirely based on the throughput activities performed by the 3PL. The pricing for each 3PL service is clearly defined and often treated as a flat fee per transaction, such as a cost for each case or unit handled. Because the total cost is entirely dependent on volume, this type of contract has a lower financial risk for the customer.

That said, a 3PL might set higher transactional rate to mitigate the risk of a forecast error and maintain its profit margins. For that reason, customers should comparison shop and must include service level agreements (SLAs) to guarantee that quality levels are always maintained.

This type of contract is the most desired and sought after of the three due to the cost savings potential. It is also one of the easiest to implement and enforce due to the pricing structure.

Apples to oranges

If an RFP is sent to multiple 3PL providers without specific instructions and protocols that facilitate a consistent response among vendors along with the preferred contract type, the proposal comparison process may be like comparing apples to oranges. Additionally, an incomplete RFP can result in incomplete bid responses prompting multiple additional information or proposal clarification requests.

To improve the effectiveness of the quantitative analysis of each 3PL bid, a well-defined methodology must be in place. This begins with a detailed and easily understood operational profile that links to a 3PL bid response template that the vendor must complete to submit their respective pricing terms and conditions. This response requirement enables the requesting company to perform

an effective quantitative analysis with scientific data driven insights—allowing for apples-to-apples comparisons.

Some of the primary components that are critical to completing a thorough financial analysis of each 3PL bid include:

- operational profile;
- bid response template;
- sensitivity analysis; and
- advanced analytics.

Providing an operational profile

As the name suggests, a detailed operational profile outlines specific functions that are needed to fulfill the company's distribution requirements categorized into multiple variables over the proposed contract period. These variables focus on different activities within the warehouse from storage requirements to product handling and can include all or a portion of a customer's distribution network.

At a minimum, the operations profile should encompass the following areas:

- inbound handling summary;
- outbound handling summary;
- customer returns volume;
- cross docking requirements;
- value-added service requirements;
- storage type requirements (e.g. ambient and temperate controlled); and
- inventory levels (e.g. positions, square footage)

Clearly outlined operational requirements give the bidding 3PLs the ability to more accurately price out and roll up the total cost of the proposed operations. Most importantly, a 3PL will know how to staff its operations for a fully functional facility. Sufficient information and understanding also decreases the probability of a disruption to the customer's business and shipments during the transition period to a new 3PL vendor.

The most effective operational profile captures all of the activities needed to receive, put away, store, induct, receive orders and ship out products to include any required value-added services such as labeling or kitting. For example, there are different costs to receive and unload a trailer of product. Pallets of a uniform product take less time and require less labor to unload, validate and induct than a pallet of mixed SKUs or a floor-loaded trailer. Value-added services can also be a huge part of the operational profile depending on the industry and specific products being handled. Outbound order fulfillment requirements must also be defined based on how product is shipped to the customer and the average size of each order. As any company transitioning to smaller and more frequent deliveries or e-commerce knows, full pallet orders are less costly to fill than mixed pallets, mixed cases and single line orders.

The most effective operational profile captures all of the activities needed to receive, put away, store, induct, receive orders and ship out products to include any required value-added services such as labeling or kitting.

Lastly, the operational profile should reflect the forecasted volume for the requested duration of the 3PL contract. As 3PL contracts typically span multiple years, a company may need to forecast out three years to five years, projecting growth rates and business seasonality.

Get a consistent bid response

The operational profile should closely correspond and link to a bid response template that is included in the initial RFP request. This template should be designed to capture all possible warehousing and distribution cost components, with clear instructions to ensure that all 3PL respondents have an opportunity to provide all associated pricing terms details.

There should be defined sections for both variable and fixed cost inputs for each function along with any company preferences regarding the type of pricing terms. Because variable pricing terms are typically the most cost-effective, the bid response template can be built to encourage this type of proposal response.

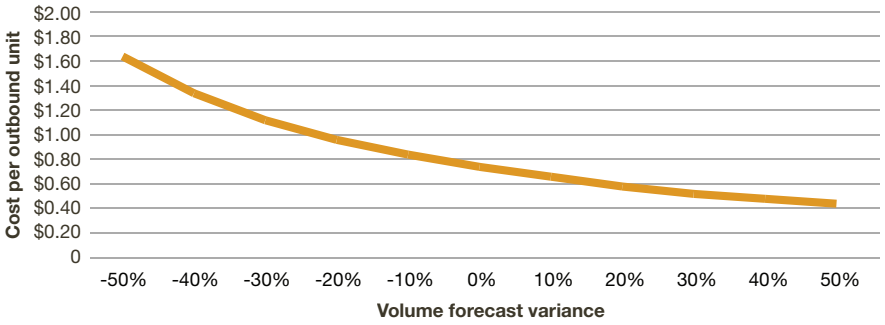
The bid response process should be designed to permit each 3PL bidder to input their pricing directly into the template or through a company designated web portal. This practice helps enable the requesting company to receive more uniform, consistent and easily comparable responses that are easier to analyze and compare. Without this standardized bid response approach, it is often very difficult

or impossible to compare the various 3PL bids as the terms and pricing typically vary significantly.

By developing an improved process that leads to more uniform responses, a company can more quickly pinpoint any pricing anomalies and quickly clarify those questions with the 3PL. This standardization reduces guesswork and ensures that each outsourced function obtains more competitive pricing over the specified contract term.

FIGURE 4

Cost sensitivity analysis



Source: Authors

Cost sensitivity analysis

By definition, sensitivity analysis is "the study of how the uncertainty in the output of a mathematical model or system (numerical or otherwise) can be apportioned to different sources of uncertainty in its inputs." The aim is to evaluate how uncertainty and potential changes to independent variables such as operational volumes will affect the total cost quoted by the 3PL vendors.

Because units and volumes are often calculated considering historical sales and forecasted growth, there is a very low probability that these future forecasts will ever be 100% accurate. For that reason, a sensitivity analysis needs to be performed as part of the quantitative analysis. This analysis provides a means to pragmatically assess the level of fluctuation in the overall cost quoted by the 3PL vendor over a wide variation in operational volumes.

By determining how the cost per handling unit varies across a wide range of volume fluctuations, such as an increase or decrease of 50%, a company can better assess how costs will trend by 3PL vendors based on their proposed pricing terms.

Additional benefits of conducting a sensitivity analysis include:

- providing a means of considering the impacts of any forecast error;
- accounting for any cost increases or decreases in specific volumes of activities;
- incorporating both fixed and variable cost of activities; and
- factoring in the cost impacts of any specified cost minimum(s) specified by the 3PL, if any.

The result of a cost sensitivity analysis considering a wide-range of volume forecast variances is illustrated in Figure 4. The total cost and cost per unit is estimated for a wide range of total volumes to include + / - 50%. The forecast as depicted in the operations profile is the baseline and assumes 0% error. By considering, a range of potential increases or decreases in volume, a company can evaluate the associated variances in cost and the overall viability of any 3PL bids received.

Leveraging advanced analytics

Sensitivity analysis helps define a standardized methodology for an apples-to-apples comparison between different 3PL bids while providing insight into how any changes in volume affects the overall cost to serve. It will also depict how bid proposals that have high fixed cost components may be cost prohibitive or riskier if volume forecasts are not met or business conditions change. To further enhance this analysis, a Monte Carlo simulation may be employed to estimate variable costs.

Monte Carlo is an advanced analytics tool used to approximate the probability of certain outcomes by running multiple trial runs, or simulations, using random variables. It provides visibility to possible outcomes of multiple scenarios and assesses the impact of risk and allows for better decision making under uncertainty.

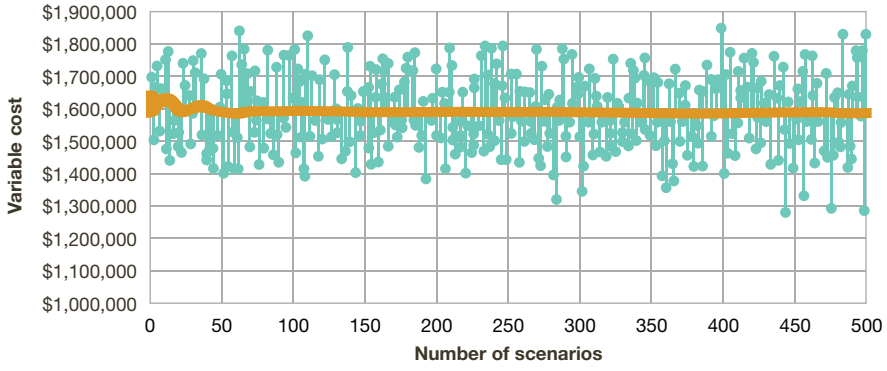
This methodology brings the analysis closer to real world variations by incorporating flexibility in the variables and making these variations independent of each other. For example, with X% change in outbound volume, inbound volume can vary from - ∞ to +∞. This concept helps determine the average cost to serve by taking a simple average of multiple variations and randomly assigning the percentage change to every variable.

A number of variable inputs can be used to model warehousing and distribution costs in a Monte Carlo simulation, ranging from the cost of purchase order processing to labeling charges for value added services to the cost of storing oversized pallets in a cooler, to name a few.

By applying this approach, which may result in hundreds of iterations for each scenario, a constant line will emerge that will indicate the average total variable cost that will most likely result. In Figure 5, for instance, the average total variable cost is estimated at $1.6 million.

FIGURE 5

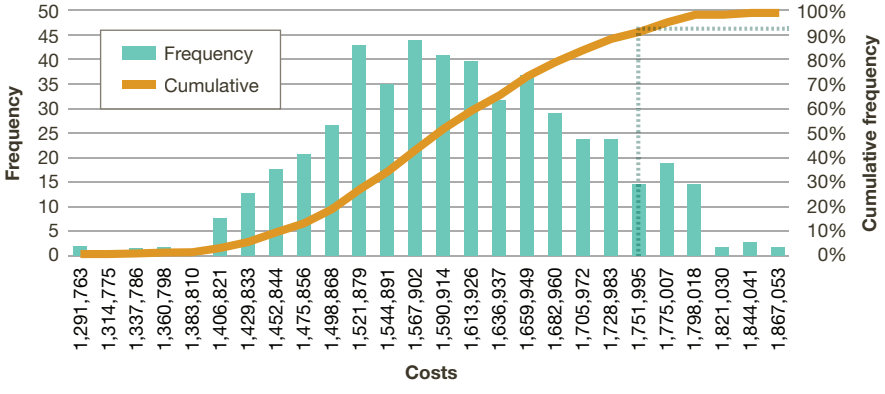
3PL vendor A – variable cost variation



Source: Authors

FIGURE 6

3PL vendor A – variable cost probability



Source: Authors

This analysis can also be expanded to help reduce the uncertainty and risk by analyzing the wide range of variable costs calculated and the frequency of each occurrence. In Figure 6, it was estimated that in approximately 90% of the situations, the total variable cost would be less than $1.8 million.

Bringing it together

There is little question that the demand for 3PL fulfillment services will continue to grow. Before beginning a 3PL bid process, a company needs to evaluate its existing RFP processes and bid evaluation capabilities. Are they sufficient or is there a need for further guidance and/or development of a clearly defined methodology that is supported by templates and other bid evaluation support tools? If improvement is needed, a company may need to develop a 3PL playbook to establish defined procedures that reinforce desired bid evaluation best practices and include supporting 3PL pricing evaluation analytics. Employing these tools can help a company better optimize any future 3PL pricing and contract terms.

So, you want a strategic supply chain?

Industry leaders view their supply chains as a strategic weapon. Is your organization ready to make the leap? Answer these seven key questions to discover the answer.

BY STEVEN A. MELNYK, COLIN SEFTEL AND NICK LITTLE

Every year, Gartner publishes its supply chain "Top 25." The list includes firms such as Apple, P&G, Amazon, Unilever and Inditex (the owner of Zara). Each has succeeded in using their supply chains not simply to drive down costs but, more importantly, to improve overall performance. In other words, these firms discovered that their supply chains are effective and efficient strategic weapons. For many managers, this goal is becoming their Holy Grail—that of turning their supply chains into truly strategic weapons.

That's easier said than done, and not every organization is ready for the transformation. We examine this challenge by framing it with seven key questions that you, as supply chain managers, must be willing to ask. These questions, based on numerous years of research and experience working with leading edge supply chain companies combined with results generated by past empirical studies such as the "Supply Chain Management: Beyond The Horizon," a joint study sponsored by the department of supply chain management and Michigan State University and APICS to clarify what is meant by strategic supply chain management. The questions address whether your firm is ready to make the transition from a conventional operational price-driven supply chain to a strategic, value-driven supply chain. In asking these questions, you will

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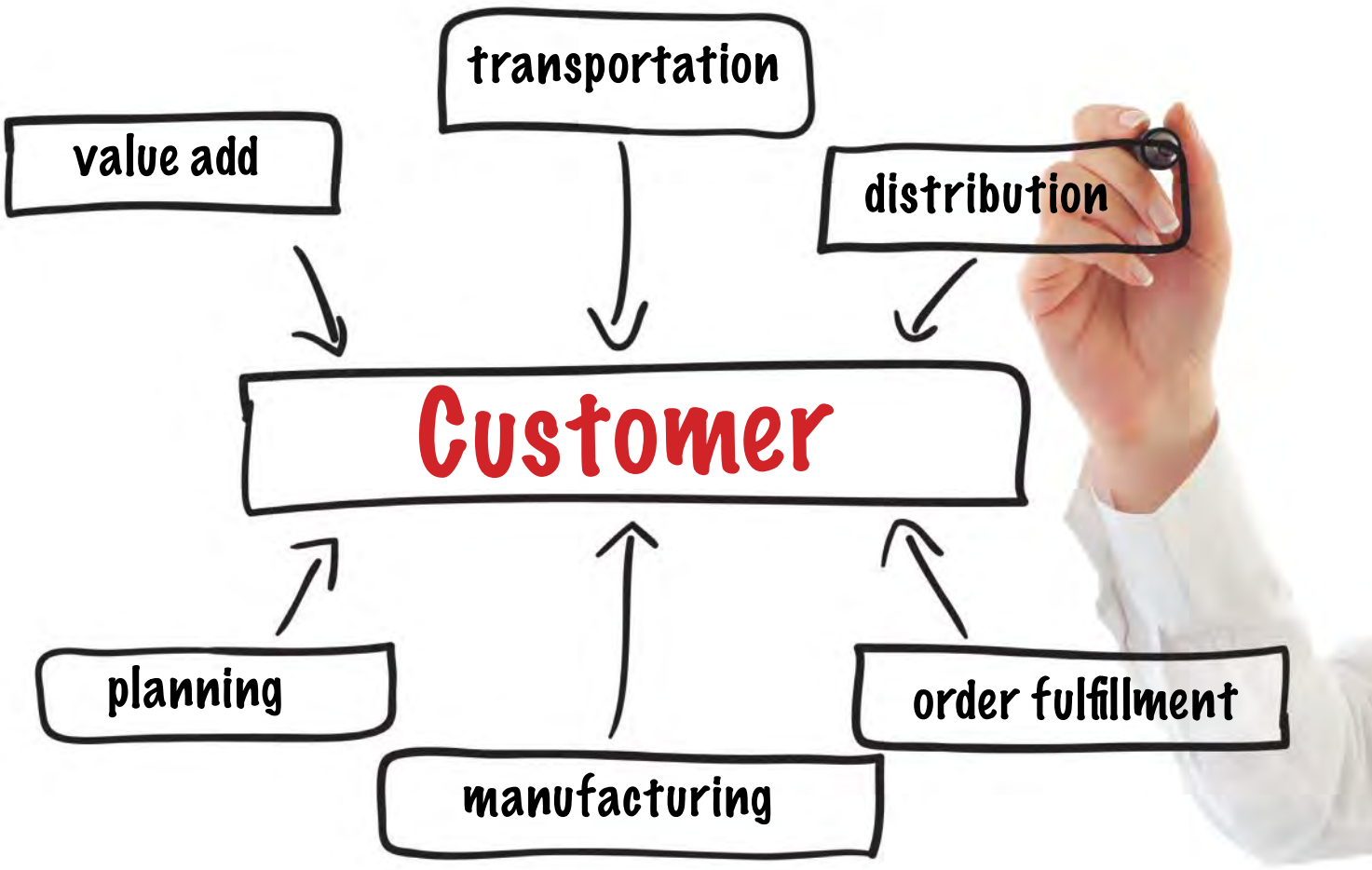


develop a better, more rounded understanding of strategic supply chain management in a way that can be immediately applied in your firm.

1. Who are your firm's key customers?

According to Gartner, top supply chains "are designed starting with what brings value to customers and then back through the supply network." But, remember that not all customers are created equal. Some are more important than others. It is these latter customers that firms strive to profitably delight.

These customers drive how your supply chain ecosystem is designed, deployed and managed. If your firm strives to treat all customers as equally important, two negative results can be expected.

First, your firm and your supply chain will be forced to compete on cost since cost is the lowest common denominator. Second, the resulting supply chain will be ineffective. Your key customers will feel under-served and ultimately will leave (after finding a better supplier), while your other customers will fail to appreciate your additional effort and uniqueness.

Identifying your key customers is not as straightforward as it may seem. First, the identification process is not as simple as determining sales by customer and then doing a Pareto Analysis. In some cases, a key customer can be a "halo" customer. This is a customer who is admired because of certain traits they possess.

When dealing with the key customer, understand some key truths. First: Don't focus on the customer's needs and wants—that is a losing proposition. Why? Because the customer wants everything, now (or yesterday) and is not willing to pay for it.

For example, in the auto industry, Toyota is widely recognized as a customer who demands high levels of performance in terms of quality, process management and reliability. In selling to a halo customer like Toyota, firms effectively signal to everyone else that they can compete effectively on those dimensions.

Second, key customers need not be current customers; they could be future customers, or customers you need to win back. Your current customer base may not be adequate to sustain future growth so new customers that can support future growth must be identified and captured. For many consumer product firms, this new customer is increasingly becoming the Millennial—anyone born between 1982 and 2004—followed by Generation Z. Baby Boomers are moving into the latter stages of their lives and buying less. In contrast, Millennials are growing in number, and in the United States now represent some 92 million consumers, in contrast to the 77 million Baby Boomers; the first wave of Millennials are raising families, earning higher incomes and spending more. As noted in our previous articles*, these are fundamentally different types of consumers. In Hollywood, the motion picture industry has been replaced in certain areas by video games in terms of spend and importance. Some firms are shifting their attention from focusing on movie stars to voice actors—critical to many video games. Millennials and Gen Zers respond to influencers they respect as "fans" of your products/services.

Third, when focusing on key customers, it's important to identify the person that your firm wants to target. This lesson was driven home to one of the authors some years ago at an academic conference in New Mexico. Talking with executives from one of the largest consumer bicycle companies whose products can be found in big box retailers such as Meijers, Walmart and Costco. Initially, the author thought that this company targeted either parents or children much like Schwinn did in the 1950s and 60s. This was not the case. This company had targeted two people as its key customers—the store manager and the purchasing agent. The reason was that parents did not go out to explicitly buy one of its products. Rather, they bought what was available in the store, and that was directed by the store manager and the purchasing agent.

Fourth, when dealing with the key customer, understand some key truths. First: Don't focus on the customer's needs and wants—that is a losing proposition. Why? Because the customer wants everything, now (or yesterday) and is not willing to pay for it. Rather, as Anthony Ulwick discovered in his book, *What Customers Want*, it is more important to understand what outcomes these key customers want to achieve and then to work on designing and implementing a supply chain that can make these desired outcomes inevitable. Often these outcomes are not goods or services but solutions.

When describing outcomes, it is important to remember that not all outcomes are created equally. Terry Hill, a UK professor and author, discovered in the 1980s the taxonomy of order winners, order losers and order qualifiers. Order qualifiers identify what is acceptable; once this level of acceptability is reached, the customer may not be sensitive to any further improvements. In contrast, order losers identify those areas in which poor or unacceptable performance causes the firm to lose either the current order or future orders. Finally, order winners occur after the firm has met the order qualifiers and avoided the order losers. These are the features or qualities that significantly differentiate a product or service and win the sale.

These traits cause your key customers to select the

offerings of your company over those of another. To understand the differences, consider the act of buying a pizza. When you place the order, you expect it to be hot, cooked, prepared with fresh ingredients and delivered within a reasonable time. These expectations are the order qualifiers. If delivery takes two hours and it's cold to boot, these are order losers. As you think about pizzerias, you consider the ones that have met the order qualifiers and avoid the order losers. From this set, you may decide to place your order with a specific pizzeria because they have announced a new type of pizza—that is an example of an order winner. These traits are important, as we will show later, because they influence how you develop your value proposition, what type of supply chain investments you make and how you develop your performance measures.

Finally, there is no magic formula for identifying a key customer. Rather, it's up to the firm to identify that person or group that significantly affects the buying process and over which the firm can develop some influence. It's then up to the firm to learn as much as they can about this key customer and how to better satisfy their needs relative to the competition.

The firm and its management must identify these key customers, achieve consensus (especially at the top management team level) and then communicate this awareness to the rest of the firm. Without this understanding, the result is confusion and frustration internally and loss of customers externally.

2. What is your value proposition?

The prior question targets the "who;" now we must develop the "what." That is the function of the value proposition. The value proposition is the promise that your company makes to your key customer regarding what they—the customer—can expect when dealing with your firm. The value proposition must satisfy five critical requirements:

- **The customer must be willing to pay for it.**
- **It must satisfy strategic and financial considerations.**
- **It must differentiate the firm in the eyes of the key customer(s).** This requirement is critical. Firms compete not by being "same as" but by being "different from." Recently, one of the authors met with a major department store. The store had decided to compete on being fast. "We'll be another Zara," announced one of the managers, referring to the Spanish clothing and retailer known for its fast-fashion supply chain. They didn't have an answer when challenged: "Then why should you shop at your store rather than get the real thing from Zara?" A firm can be same as when it comes to order qualifiers and still lose the business; it must be different when it comes to the order winners.
- **It must be consistent with the firm's values on its core issues and social responsibility.** This is becoming increasingly important to Millennials—the emerging growth market.
- **It must be supported by the firm's capabilities (that include the supply chain).**

The value proposition is the promise that your company makes to your key customer regarding what they—the customer—can expect when dealing with your firm.

The value proposition is critical because it defines and differentiates the firm. Zara recognized that its key customer, women aged 20 to 40 who wanted new fashion delivered quickly. In response, Zara reduced the two key times: (1) the time to go from design to production (it has reduced this lead time down to about one week); and, (2) the time to replenish (about 72 hours). In a market dominated by six-month design to production lead times, Zara was able to attract new customers and retain existing customers by offering new designs on the shelves every time a customer visited a Zara store (thus encouraging more frequent visits). It is no surprise that Zara's supply chain has been designed to strongly support this value proposition.

3. What are the desired outcomes and priorities of your key customers?

Your value proposition must focus on the desired outcomes offered by your firm to your key customers. These outcomes are based on the six outcomes first described by one of the authors in 2010.

• **Efficiency:** meeting demand at the lowest total cost.

• **Responsiveness:** being fast to respond to customer demand.

• **Sustainability:** meeting demand in a way that reduces the impact of operations on the planet while ensuring appropriate development and respect for the people involved in the supply chain.

• **Resilience:** the ability to protect the key customer from any adverse problems taking place in the supply chain.

• **Security:** focusing on quality and on protecting the integrity of product quality, intellectual property, information technology and operating processes from external intervention.

• **Innovation:** offering value through the design and delivery of new goods and services through changes in product, process, customer experience, business model and the supply chain.

Performance measurement and measurement systems play a critical, often under-appreciated role in any company or supply chain. Too frequently, they are afterthoughts—add-ons done after everything else has been completed.

While focusing on costs is still relevant, it is not the only outcome that firms can promise and supply chains can help deliver. More importantly, when taking this outcome perspective, it is necessary to recognize that these outcomes are "blended" in ways that differentiate firms perceived as playing in the same competitive space. One way of thinking about how to blend outcomes is to use the 1-2-3 approach outlined below.

• **1: Outcome is critical to the firm—it defines what the firm offers.** Performance here should be in the top 5%.

• **2: Outcomes are important.** When combined with the prior outcome, it defines the essence of the value proposition. Performance on this dimension should be in the top 20%.

• **3: Outcomes are necessary.** We don't have to be the best but we strive not to fail here. Performance is in the top 50%.

This approach can be best illustrated by how it was applied at a drug company located in the American Southeast. There, it was found that security was critical and that resilience and responsiveness were important. In other words, they offered their key customers high quality drugs available wherever and whenever they were needed. This approach also told management that focusing on cost, sustainability and innovation, while somewhat important, were not critical to this company's success.

With the answer to this question, the supply chain manager now knows what to emphasize and where to invest.

4. Do your measures effectively communicate the desired outcomes and align with your underlying business model?

Performance measurement and measurement systems play a critical, often under-appreciated role in any company or supply chain. Too frequently, they are afterthoughts—add-ons done after everything else has been completed.

Measures enable control; they evaluate performance; they identify gaps (between actual and desired performance) that need management analysis and intervention. Most importantly, they communicate. It is the measure that makes the value proposition meaningful and concrete. It is the measure that enables everyone in the organization to answer a simple but critical question – given the value proposition, what do I have to do well so that the value proposition is realized?

When we measure something, we are telling everyone that the component being measured is important. Conversely, if we don't measure an activity, it is perceived as not important. Consequently, there must be very strong and clear alignment between your value proposition and the measures you use both in terms of number and focus. Remember the drug company previously described where top management had determined that their priorities were security and resilience/responsiveness? When they looked at their performance measurement system, they

found that there was only one measure dealing with security—and that measure was mandated by the FDA. In contrast, there were over 400 measures dealing with cost. Suddenly, it became clear to management why their key customers were upset: What was being promised and what was being measured were not in synch with each other.

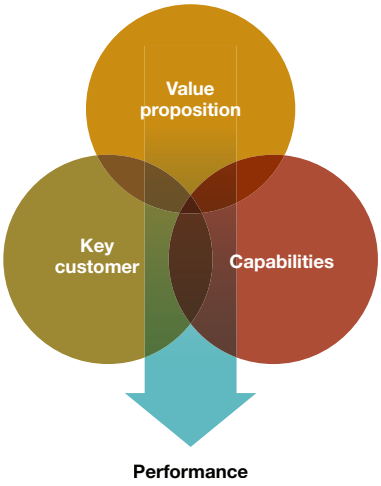
Instead of security, responsiveness and resilience they were actually delivering low cost—something that the customer was treating as an order qualifier. Management forgot the adage coined by Oliver Wight, a production and inventory management consultant, many years ago: "You get what you inspect, not what you expect."

5. Do your supply chain capabilities support your value proposition and the desired outcomes of your key customers?

There is a tendency to confuse capabilities with capacity (type of equipment, level of output). Capabilities are far more: They are the result of past decisions regarding manufacturing processes, capacity, facility locations, the type of suppliers that the firm has picked to supply it and culture to name a few dimensions. Capabilities represent the specific skills and competencies your firm has developed over time to better serve your key customers. More importantly, capabilities define the specific types of outcomes (which of the six supply chain outcomes previously discussed) that the firm and its supply chain can best address and the types of outcomes that it cannot address well. Capabilities recognize that firms cannot excel on all six outcomes. Rather, they must focus. Capabilities are strategic; capacity, in contrast, is tactical.

For most supply chain professionals, there is a tendency to focus on capabilities in isolation. This approach is fundamentally flawed from a strategic perspective because it ignores the potential negative impact of decisions made by supply chain management personnel when acting in isolation. There is no better example of this phenomenon than what happened to John Deere in 2010. Deere had made major investments to implement lean in its supply chain, and had successfully driven down inventories by 28% in the prior 12 months. However, this focus limited Deere's ability to respond to the rapidly increasing demand faced by American farmers in 2010. As a result, it lost out numerous sales to competitors. As one farmer put it in *Business Week*, "I used to be blind to all colors but [Deere's] green and yellow. My color blindness is now gone."

FIGURE 1
The business model



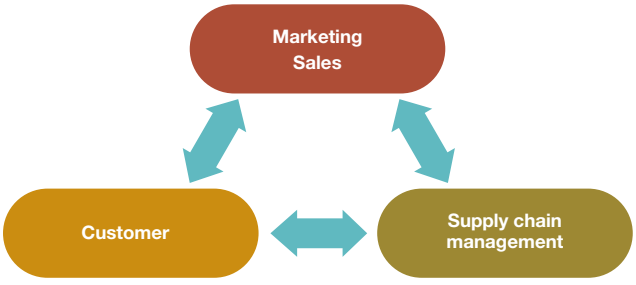
Source: Authors

To be effective, your supply chain capabilities must fit with the requirements of your business model (see Figure 1).

These capabilities help support your firm's value proposition and must meet your key customers' expectations. When the three elements overlap—when what the key customer expects and wants, what the firm promises and what the firm can deliver—you have created and delivered value. This view of capabilities also extends to how supply chain managers make investments. These investments should not simply focus on reducing cost or increasing output; they should help the firm in order of decreasing importance by:

- enabling the firm to satisfy a customer expectation previously left unmet (the highest level of profit);
- enabling the firm to satisfy a customer demand currently being met poorly by either our firm or our competitors; or,
- producing its goods and services cheaper, faster, and with higher quality (the lowest level of profit).

FIGURE 2
The business model



Source: Authors

In other words, the business model becomes the beginning and ending point for decisions made by supply chain management.

6. Are you willing to "work at the edges"?

This question is getting at whether supply chain managers will be allowed and are willing to work at the inner edges (i.e., with finance, engineering, marketing or top management) or at the outer edges (directly with the key customers). A strategic supply chain requires both of these interactions. Actions taken internally by marketing or finance or engineering will directly affect how your supply chain performs.

Similarly, actions taken by people within your supply chain can and will affect these other groups. In working at the internal edges, supply chain managers are learning about what these other groups want and how they operate. They are also educating these other groups about the capabilities that your supply chain offers—what your supply chain can and cannot do. Finally, they are helping the other groups understand unusual trade-offs.

This last issue was observed in a large fashion jobber located in the Midwest. The jobber had been able to better manage flow of inventory from the warehouse to their stores. The result was higher sales resulting from better product mixes at the stores. A consequence was that transportation costs went up significantly. Finance complained. Had the supply chain worked at the inner edge, it could have shown finance in advance how the higher shipping costs were more than offset by the higher sales and higher profits.

Conversely, working at the outer edges means working directly with the key customers. As noted in the "Customer Centric Supply Chain," an article published in the July 2017 issue of *SCMR*, working at the edges means changing the traditional linear relationships (the key customer talks to marketing who then talks with the supply chain) to triangular relationships (the key customer talks simultaneously to both marketing and the supply chain), as shown in Figure 2.

It also means that supply chain managers are hearing directly what the key customers want (and don't want); they are also identifying from direct observation those desired outcomes that the key customers would like to see but that are not currently being addressed. These insights can significantly influence actions of the supply chain; they can also influence supply chain innovation and supply chain investments.

In working at the edges, the supply chain is no longer siloed; rather, it is an integral element of the firm. By working at the edges, the supply chain shifts from becoming reactive to becoming proactive.

7. What are the major future challenges facing your firm and supply chain?

This last question is an appropriate one to end this article. Implicitly, it is based on one of the most important of supply chain truths: Today's supply chain is a result of decisions made in the past; tomorrow's supply chain will be the result of decisions made today.

In other words, your supply chain must be, by its very nature, forward looking. It takes time to change capabilities; it takes time to identify and assess the changes taking place in either your key customer or in the value proposition. Therefore, your supply chain must also be looking forward to identify and evaluate new technologies and developments. You must be willing to evaluate these new developments not in terms of their "newest and greatest" element but rather in terms of how they affect capabilities, as previously noted under question five. It also means that supply chain management must be willing to take risks and to incur "smart" failures (we did everything right but something

unexpected took place). When supply chain managers are not willing to take risks, by the time they are sure of the changes taking place, it will be too late—the window of opportunity will have closed.

This last point can best be illustrated by the following example. The team visited a fashion chain, whose headquarters were located in the Midwest. This is a company with a strong presence both on the Internet and in brick and mortar stores. It also competes directly with Amazon. The reason for our trip was to see the newly opened distribution center. While there, the team was shown the newest investment: a $1.7 million line. The manager leading the visit asked us how long we thought it had taken to go from the initial idea to being up and functional. Our answer: two years plus. The manager shook his head and told us that it had taken only seven months. We asked how the firm knew it was making the "right decision?" The answer was a surprise: He said they did not. However, by the time that they would be sure, it would be too late. If they were to survive in this new, more turbulent environment, they had to take a chance. The cost of being sure was competitive death. To the management of this firm, when thinking about how to structure their supply chain and how to make investments, the future was the appropriate frame of reference.

This is a very different orientation for many supply chain management systems, which live for today. They are concerned primarily about managing for stability. Yet, as the rate of change accelerates (due to factors such as faster rate of technological innovation and emergence of new global competitors), supply chain management must become skilled at managing the supply chain paradox: Managing for stability in the short-term; planning for change in the long-term.

What do these questions mean for you as a strategic supply chain manager?

When taken as a whole, these questions help managers understand what strategic supply chain management entails. To summarize, strategic supply chains are:

- Built around key customers and desired outcomes (questions 1,2,3).
- Recognize the law of criticality—not all capacities are equally important, not all customers are equally important, not all customer demands are equally important (questions 1,2,3).
- Future oriented—it takes time to change and to ensure that the right capabilities are available when needed (question 7).
- Recognize the importance of fit—capabilities and measures must fit the business model (questions 4,5).
- Highly integrative both internally and externally (question 6).
- Highly dynamic (questions 1,2,3,4,5,6,7).
- Never studied in isolation but as part of the business model—at the intersection of key customers, value proposition and capabilities, where the supply chain is part of the capabilities (questions 5,6)
- More versatile than simply cost driven (question 3).

Supply chain managers are hearing directly what the key customers want (and don't want); they are also identifying from direct observation those desired outcomes that the key customers would like to see but that are not currently being addressed.

The answers that you get to these questions determine more than whether or not you understand strategic supply chain management. They assess whether you and your firm are ready and capable to transition from the tactical supply chain to the strategic supply chain.

Based on your answers to these questions: Are you ready?

Editor's note: *This is the fourth in a series on the strategic supply chain by Steven A. Melnyk and his co-authors. You can read them on scmr.com:*

The emergence of the strategic leader by Steven A. Melnyk from November 2016

The customer-centric supply chain by Steven A. Melnyk and Daniel J. Stanton from July 2017

Serving up experience by Steven A. Melnyk, Clay Vorhees and Nick Little from March 2018

A SPECIAL SUPPLEMENT TO:
SUPPLY CHAIN MANAGEMENT REVIEW

Where is supply chain software headed?

Industry leaders discuss the key trends, capabilities and innovations that will shape the future of supply chain software.

By **Bridget McCrea**, Contributing Editor

Real-world advances in machine learning, deep learning and artificial intelligence (AI) are bridging the gap between fact and fiction in the supply chain—a place where science fiction is literally *coming to life* to help companies work smarter, more efficiently and more economically. From autonomous robots that work on the dock to drones that manage yard inventory to sensors that track shipment condition during transport, supply chain technology is

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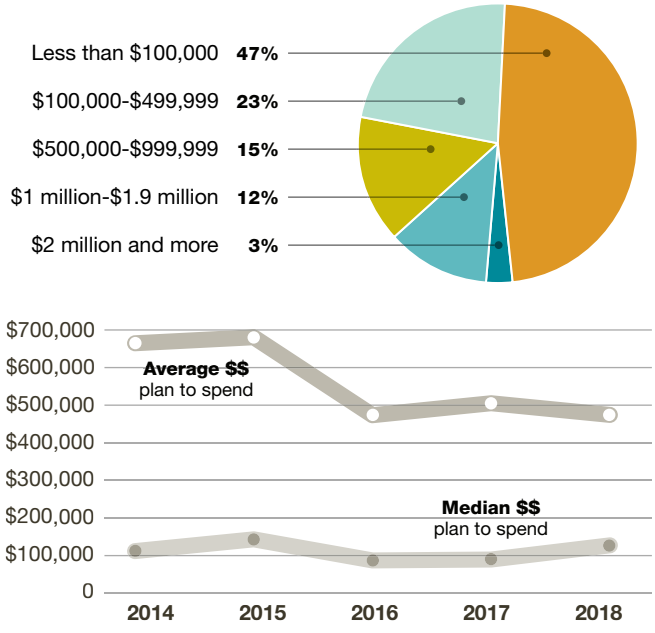
proliferating on two fronts: the equipment itself and the advanced software that runs the equipment.

Using AI, or the theory and development of computer systems that can perform tasks that normally require human intelligence, for example, machines can think about—and solve—problems at the individual item level and store level. This presents clear advantages for companies struggling under the current labor market constraints and the ongoing need to scale up and meet customer demand.

Approximately how much will your company spend on supply chain software for your operation including license, integration and training in the next 12 months?



Source: Peerless Research Group (PRG)

"Companies can't just increase their workforces by 100% in this environment; it's not economically feasible," says Puneet Saxena, JDA's GVP of product strategy, supply chain planning. Add AI and machine learning (the science of getting computers to act without being explicitly programmed to do so) to the mix, however, and software developers gain the power of being able to model supply chain problems in more granular detail.

"Machine learning allows us to scale the elastic computational power that we have available in the public Clouds now, and provide answers," Saxena explains. "Humans can't digest those volumes of data, but machines can. And, they can learn how to figure out discrepancies."

Take the company that's trying to nail down a specific inventory goal, but that can only get within a few thousand units of its target. Demand may currently be 10,000 units per week, but in reality, that number fluctuates between 7,000 and 13,000. The more precise the number, the better the directions that are relayed back to the production department. But nailing down a more precise target is difficult for the human mind to do, says Saxena. However, it becomes more doable with machine learning and AI, both of which are increasingly being folded into the modern-day supply chain software applications.

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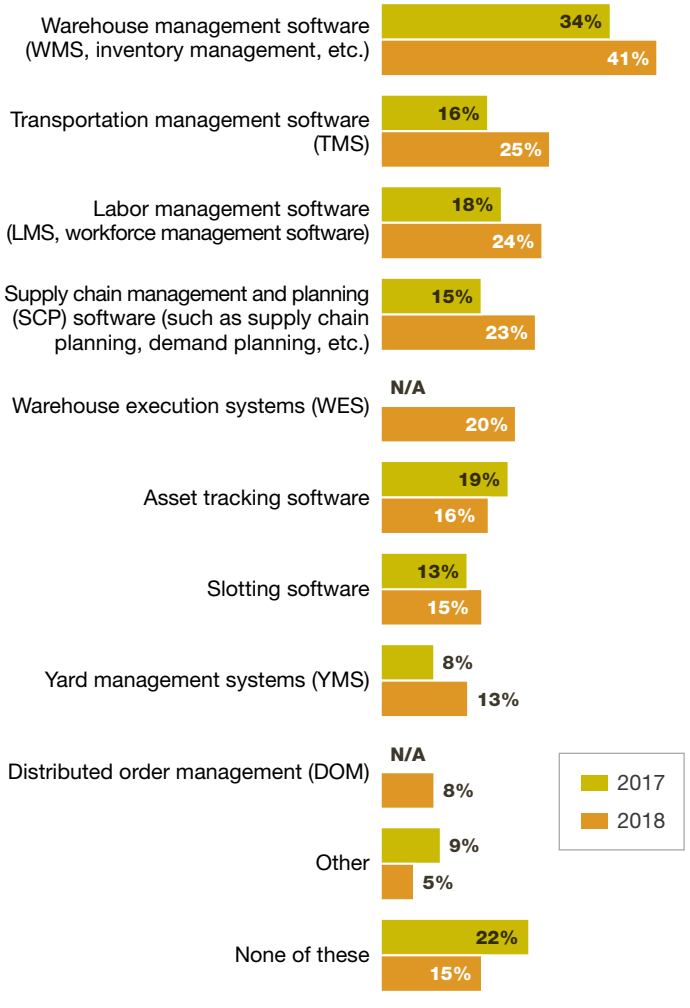
Source: Sealed Air Customer Research

simplification of real-life mathematical models becomes much easier," says Saxena, who acknowledges that just a few years ago these processes would have been a far-off ideal for most supply chain managers. "All of this would have sounded like sci-fi, but we're already working with grocers in Europe that are improving the quality of their demand forecasts and upping service levels as a result of this advanced software. It won't be long before that extends beyond groceries and into different retail, manufacturing and distribution verticals."

Which are you planning to evaluate, purchase or upgrade within the next 24 months?



Source: Peerless Research Group (PRG)

The stars are aligned

Sometimes it takes a tractor-trailer one day to get from Atlanta to Miami, and sometimes it takes two. Seemingly innocuous, this variation can make a big difference in performance levels, service levels, customer satisfaction and how the truck itself is moved (interstate drivers can only be behind the wheel for 11 consecutive hours at a time). Add weather and traffic conditions to the equation and exact shipment arrival times become even fuzzier.

"In real-life, everything is a distribution vs. a static number, and yet in the mathematical models, everything from cycle times to transportation times to human production rates to machine production rates are modeled as static numbers," Saxena explains. "In reality it's a distribution." Put simply, next generation software understands patterns in the supply chain (e.g., how much was the factory supposed to produce versus what it produced? How much was the transportation cycle time versus what it was supposed to be? What is the inventory level at the DC vs. what it was supposed to be?), examine those patterns, and predict, say, whether a stock-out will or

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won't happen two weeks from now.

"It's almost as if the stars are aligning when you can say, 'when this, this and that happens two weeks from now, I'll see something,'" says Saxena. "Humans cannot see this, but machines are very good at it."

The intelligence-driven supply chain

In assessing the current state of supply chain, it's no secret that procurement is another discipline that's moving from being a largely static model to one that's much more dynamic and intelligent. At Jaggaer, CTO Zia Zahiri says his company takes a holistic view of the data-driven supply chain when developing software, knowing that today's supply chains—and those of the future—are fueled by real-time information, compliance, guidelines and guidance.

Take the Internet of Things (IoT), for example. The interconnection of computing devices embedded in everyday objects via the Internet, IoT allows those devices to send and receive data without much human intervention (if any). "Thanks to IoT, we see a lot of the physical, day-to-day procurement that doesn't really require human intervention," says Zahiri. "That concept can be easily moved into automation, where robots can handle simple tasks and/or repetitive tasks."

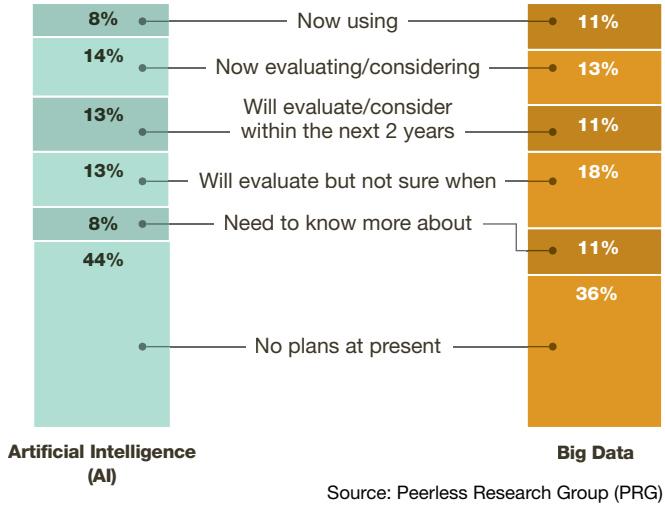
Looking ahead, Zahiri says the time when the same robotics can help optimize workloads isn't that far off. And on the procurement front, the same capabilities will be folded into everything from compliance to contract management to ordering processes. "This advancement will change and shift the way [companies] procure their products," Zahiri says.

Companies that want to leverage the intelligence-driven supply chain should start by considering the meaning of "true digitization," says Zahiri, and figuring out what that means to them. In other words, what will it take to truly reinvent current supply chain processes and make them more digitized? And what current, manual approaches can be replaced and digitized? "Start by putting in place the processes and strategies now," says Zahiri, "with the ultimate goal of working toward more digitization, workflow processes, and automation."

Predicting the future

A type of algorithmic decision-making that helps firms optimize inventory

Which best describes your company's adoption of AI/Big Data?



Source: Peerless Research Group (PRG)

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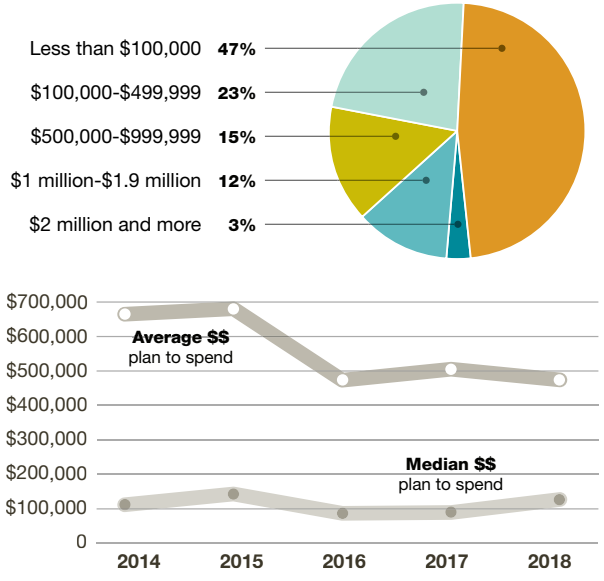
decisions while also providing specific actions that they need to take to improve their bottom lines, predictive analytics (here's what will happen) and prescriptive analytics (here's what you can do about it with the goal to changing the outcome) are converging to help companies reduce shortages and stock-outs, improve inventory turns and gain visibility.

Expect this trend to continue as more software developers incorporate predictive analytics capabilities into their applications. "As inventory and supply chain systems become more complex, they actually require more advanced processes to translate the data and insights to help reduce inventory, improve performance, and increase efficiency," says LeanDNA CEO Richard Lebovitz, who sees the expansion of global supply chains as one key driver of software innovation right now.

"Over the last 20 years, we've seen companies go from being very vertically integrated (e.g., a manufacturer made the steel and then assembled and handled all of the machining for its products), to working with hundreds and even thousands of suppliers around the globe," says Lebovitz. "This move toward less 'localized' factories will continue as more companies work 'virtually' with one another."

That movement affects the vice president of supply chain who is now being asked to manage activity in a more distributed environment. Through a combination of Cloud computing, Big Data and AI, software is helping a smaller group of people manage multiple sites all over the world. Add advanced analytics to the mix and even the company that uses multiple enterprise resource planning (ERP) systems in those locations can pull together, analyze, and use intelligence (i.e., standardized practices and benchmarks) across the entire organization. "From there," says Lebovitz, "the ability to drive gains across any part of that organization becomes faster and much more effective."

Approximately how much will your company spend on supply chain software for your operation including license, integration and training in the next 12 months?



Getting to the "full view"

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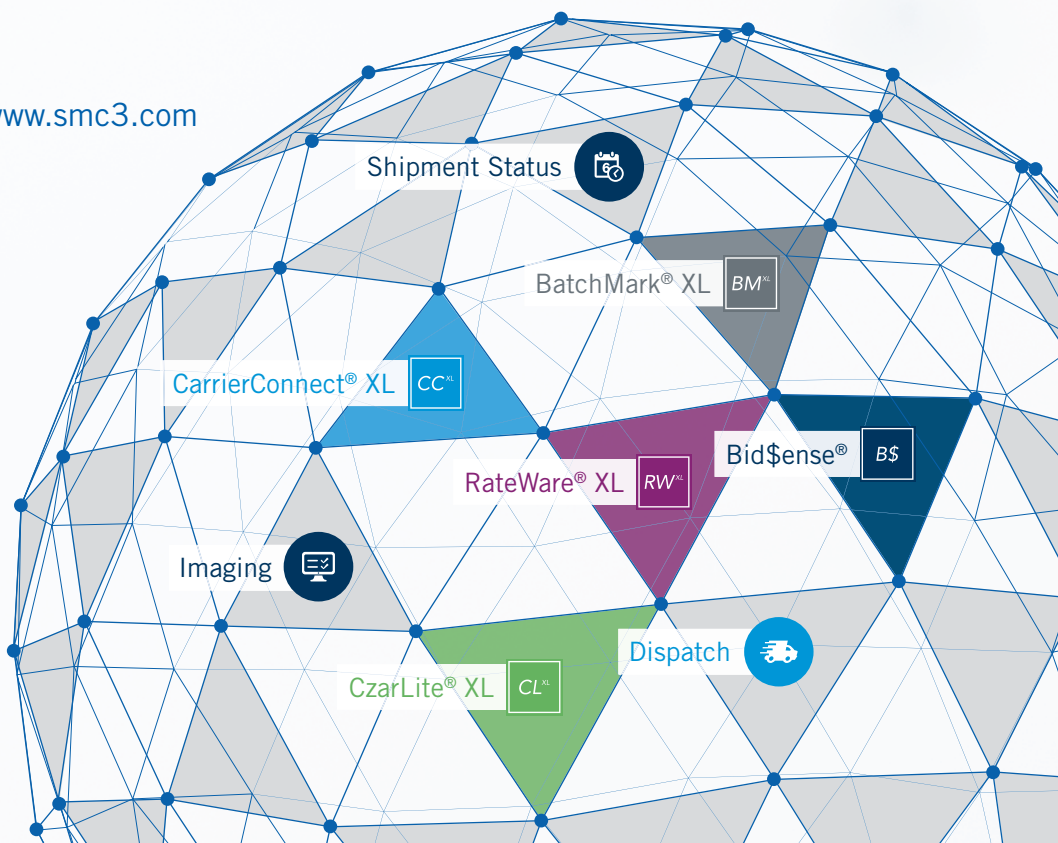

Scott Wahl, vice president at Dematic's Software Center of Excellence, credits Cloud-based platforms, analytics and IoT with helping companies gain those "full views" while at the same time increasing their overall effectiveness.

"It's no longer about individual processes and silos," says Wahl. "The Cloud platforms and IoT are maturing to the point where it's now viable for companies to pull the data they need from disparate systems and processes in order to get full visibility."

Dave Adams, Dematic's director, global software solutions, says the same innovations are helping companies tackle day-to-day manufacturing and distribution challenges. "There's a lot of interest in using IoT sensors and devices to help manage intermittent problems (i.e., an unusual vibration in a particular motor)," says Adams. Using IoT and sensors, the same problem that would have required a maintenance professional to "stand over it and watch it to see what's wrong," he says, "can now be handled by throwing a few sensors on it and monitoring it on a 24/7 basis."

There's more to come in this realm, says Adams, who adds that combining sensor data that's installed on equipment and machines with data generated by a Warehouse Execution System (WES) or Warehouse Control System (WCS) into a single data warehouse—and then using that data for real-time decision support—is the next step. "There will be no need to pull four or five people into a conference room to discuss an issue or look at a potential 'problem area,'"says Adams. "A few people can just look at a screen of data to see what's going on, and proceed from there."

Bridget McCrea is a contributing editor to SCMR

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As consumers demand more, the last mile becomes an opportunity

Meeting consumer expectations is never easy. Savvy shippers need to disrupt their fulfillment strategies before Amazon does it for them.

By Michael Hu and Korhan Acar

It's easy to think of Amazon.com as the greatest disruptor of business the world has ever seen. But if you think about it, the real disruptor is the consumer who wants limitless retail inventories, seamless web services and video on demand. Amazon's next-day and same-day delivery service offerings are really just a response to disruptive consumers who want their stuff as soon as possible.

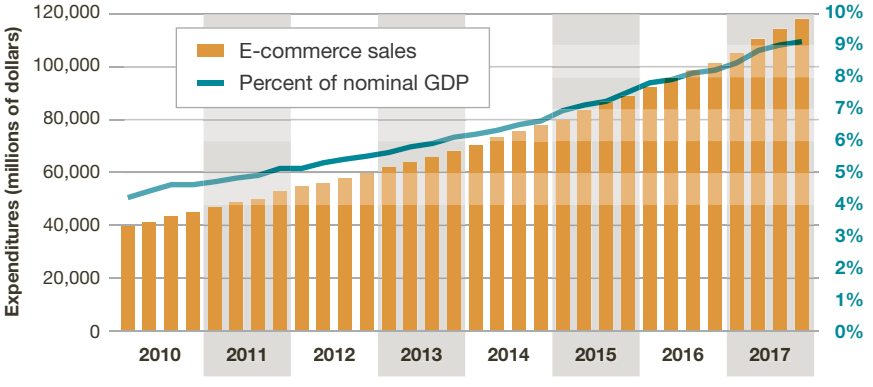
As we documented in our State of Logistics 2018 report, e-commerce sales grew 15.5% year-over-year in 2017 to $448 billion, while the retail industry as a whole grew by just 4.9%. With the 2017 holiday season notching a record 16.6% growth, the trend shows no sign of tapering off.

The public's embrace of e-commerce is driven in part by the fact that the delivery window is narrowing to days—or hours—rather than weeks. Indeed, Amazon is seeking to establish same-day free delivery as an industry-wide baseline. To meet these demands, shippers must find more efficient ways to operate in the last mile. We've identified a number of factors that shippers should consider to disrupt their own fulfillment operations—before Amazon does it for them.

Michael Hu is a partner in the operations & performance practice of A.T. Kearney. Korhan Acar is a consultant at A.T. Kearney. They can be reached at michael.hu@atkearney.com and korhan.acar@atkearney.com.

FIGURE 1

E-commerce sales and e-commerce as a percentage of nominal GDP



Source: Census.gov Quarterly E-Commerce Report

Last-mile solutions

Furious innovation surrounds the last-mile sector, with options such as click-and-collect, lockers, Amazon's Pantry concept and dozens of start-up companies. In an area that was once the domain of FedEx, UPS and USPS, we're now seeing crowdsourcing and regional carriers competing for business. Other carriers are specializing in niches like oversized goods and real-time delivery.

The proliferation of options demonstrates two major points. First, to meet consumer demand, shippers need to build solutions for last-mile delivery. Second, given the capital investment and operational expenses involved, the path to cost-effective delivery will likely require a mix of available options. Shippers must ask questions such as: What's the optimal cost per package (CPP)? Which product segments need same-day or two-hour delivery? What is my optimal supplier mix? Where should I locate my inventory to provide the expected service? How agile is my last-mile supply chain? And most importantly: Who will bear these costs? An opportunity exists: The smart company that finds the most consumer-friendly way to quickly increase last-mile capacity at the lowest cost will have a leg up on its competitors.

Idealized future; steep grade ahead

In and of itself, the last mile is not a single supply chain sub-segment, but rather a collection of mini-segments where optimal solutions differ. Geography is key, whether delivery is to urban, suburban, rural, or pick-up locations, such as retail or dark stores.

Technology may play a role in the future. Autonomous delivery technologies, such as drones and driverless vehicles, promise to fill a gap that exists today: finding cost-effective ways of delivering to geographies with low population densities. Wearable technologies can empower, direct and connect employees. Collaborative mobile robots are already powering some pick-pack-and-ship warehouses. Advances in chip and sensor technologies will also help to automate movement and reduce costs. Meanwhile, artificial intelligence (AI) will lead to better predictive demand forecasting.

Yet, technology is no silver bullet to today's problems. A.T. Kearney analysis indicates that most autonomous technologies are three years to seven years away (with Level 4 autonomous trucks at the mid-range of that time frame), absent regulatory concerns. Today's shippers must make the right, smart, timely investments to reach that golden plateau. But the steep path to get there is also fraught with other difficulties.

The biggest short-term crunch is talent. For instance, more technological operations will require workers with unique skills. In an era when logistics workers enjoy unprecedented competition for their services, talent is already scarce. The same is true when it comes to delivery. In 2017, amid low unemployment and rising wages, delivery labor costs increased by almost 9%. Delivery companies are competing for drivers from a labor pool that is experiencing a historical drought.

Meanwhile, the shrinking delivery windows also call for repositioning distribution centers closer to customers, resulting in higher capital expenses, plus factors that can drive up operating costs, such as higher inventory levels and a fragmentation of assets.

Further, putting warehouses closer to customers may mean putting them in more expensive neighborhoods where available storage space is at historic lows. Six of the 10 global markets with the sharpest increases in warehouse rents last year were in the United States, including the top three: Oakland, New Jersey and inland Los Angeles.

In so many ways, the steep grade ahead may preclude some companies from achieving the promise of long-term prosperity.

Putting warehouses closer to customers may mean putting them in more expensive neighborhoods where available storage space is at historic lows. Six of the 10 global markets with the sharpest increases in warehouse rents last year were in the United States, including the top three: Oakland, New Jersey and inland Los Angeles.

Capitalize on advantages

Despite these challenges, smart companies should welcome these conditions as opportunities to weed out their less-savvy competitors. High customer expectations represent an opportunity for established companies to use their expertise and financial strength to solve difficult problems ahead of their competitors. With that in mind, you might ask: What does your company do well? Are you good at innovating quickly? At making smart capital investments? Attracting talent? Executing a detailed strategy across multiple divisions?

Predicting technological change? Executing efficiently on omni-channels? Whichever strengths you possess, the last-mile problem is multifaceted enough that you can find a way to apply those strengths to solve it.

Extended supply chain

The key to solving the last-mile challenge in the direct-to-consumer market lies in a holistic supply chain that extends all the way to the customer's delivery location of choice.

The variety of options now available extends beyond traditional carriers to include 3PLs, non-asset companies and crowdsourcing. Finding the optimal mix requires know-how in the marketplace and advanced allocation logic that enables pricing of important dimensions such as reliability.

Many retailers and brands have already begun to forward-deploy a wider mix of product to fulfillment centers located closer to their customers. Companies with retail locations are fulfilling e-commerce orders from these stores as a way to leverage current inventory that is close to demand. Brick-and-mortar retailers with suitable dark-store locations are favored in this scenario. These are smart moves that are likely to improve bottom lines.

Neither short-term crises nor long-term techno-wizardry should obscure the fact that shippers are faced with an imperative: to give consumers the goods and services they want—as quickly as possible. By making smart and creative investments toward that goal, the best companies will find the last-mile challenge is an opportunity for growth.

Broadening e-commerce

The e-commerce "revolution" has mostly addressed how customers place their orders and not how they're shipped. Many current last-mile innovations, from lockers to pantries, represent attempts to shorten the scope of delivery operations and not to electronically transform the delivery function.

One example of how that transformation might look was developed by Homer Logistics, which utilizes software to identify the best route and method for a given last-mile delivery. The transportation modes aren't revolutionary: In New York City, for instance, the preferred method often turns out to be a bicycle. Perhaps the way to win the last-mile challenge is to use technology to rethink the deployment of the varied existing delivery methods. With creative approaches, e-ordering can mature into genuine e-commerce.

Partnerships and acquisitions

The last-mile challenge might encourage creativity, partnerships and acquisitions in the logistics industry. Indeed, recall what a surprise it was when Amazon acquired Whole Foods in 2017. E-commerce had previously seemed irrelevant to Whole Foods, while high-end niche brick-and-mortar groceries had seemed irrelevant to Amazon. But in conceiving of the merger, the two companies creatively saw potential value that others had missed. Who will make the next such bold move?

Segmentation is key

Challenges in last mile require a thorough segmentation of products and an allocation of orders across the mix of delivery options rather than from a single source. And, given the significant impact of service on delivery costs, companies should build networks based on future expectations of service, not today's averages. Changes in last mile are expensive and mistakes in planning will be costly. The research shows that there is still an unexpectedly high number of companies that have yet to design last-mile networks, while others are doing it in panic mode—a result of Amazon entering their turf—which certainly means choppy waters ahead.

The shipper's next move

There is no question that rising consumer expectations will fundamentally reshape logistics in the future. Coming technological leaps, such as autonomous vehicles, are still in early stages, and regulatory ripples or the rumored global trade war could put up barriers before the leap can be accomplished.

Yet neither short-term crises nor long-term techno-wizardry should obscure the fact that shippers are faced with an imperative: to give consumers the goods and services they want—as quickly as possible. By making smart and creative investments toward that goal, the best companies will find the last-mile challenge is an opportunity for growth.

Sales order automation benefits the supply chain

Automating order processing can shorten cycle times and reduce errors that affect the supply chain.

By Becky Partida, APQC

Efficient order fulfillment is a key factor in maintaining strong relationships with customers, whether or not they are strategic partners. Yet many organizations struggle with getting this right, as they rely heavily on manual processes with significant data entry. Manually processing orders can lead to significant disruptions caused by order input errors, a lack of integration between the order database and other internal systems, and a lack of visibility into the end-to-end process of creating, filling and delivering orders.

Becky Partida is senior research specialist, supply chain management, APQC

Sales order automation offers the potential for eliminating many of these errors and interruptions. This in turn can provide quantifiable benefits to the organization. When adopting sales order automation, APQC recommends automation specifically for processing sales orders, not solely adopting an electronic data interchange (EDI) for sales orders or an enterprise resource planning (ERP) system for inventory control. Both internally developed systems and those purchased from an external vendor offer benefits over organizations relying on manual processes.

APQC recently conducted research on this topic in partnership with Esker, a document processing automation solution provider. The goal of the research was to identify how different sales order automation practices affect performance on key measures. For the supply chain, automating sales order processing can lead to benefits with regard to order cycle time and perfect order performance.

Evaluating first-time data accuracy

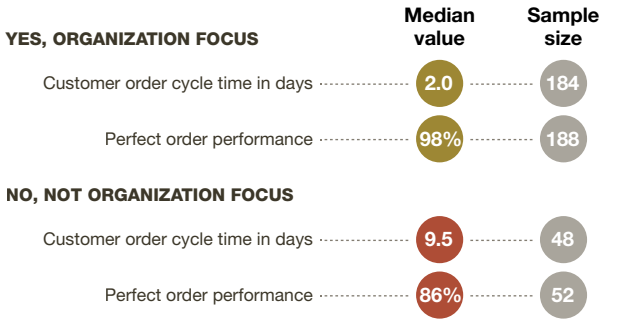
Organizations changing from manual order processing and fulfillment to an automated process will see improved accuracy. However, an organization wanting to evaluate its automated process can track first-time data accuracy for quotes and order management. An effective order fulfillment system typically provides standard forms, drop-down menus and preset order numbers to minimize input errors and thus increase first-time data accuracy. APQC has found that organizations that measure, track and reward first-time data accuracy are 2.8 times more likely to find their order management extremely effective at improving order fill rates and on-time delivery compared with organizations that do not.

As shown in Figure 1, those organizations measuring first-time data accuracy have much shorter customer order cycle times, or the time between order placement and delivery. At the median, their cycle time is about one week shorter than that of organizations not focusing on first-time data accuracy—indicating a significant impact from eliminating manual processing time and errors.

These organizations also have higher perfect order performance than their counterparts that do not focus on first-time data accuracy. At the median, organizations that focus on first-time data accuracy achieve a perfect order performance of nearly 100%, meaning that nearly

FIGURE 1

Impact of focus on first-time data accuracy



Source: APQC

Measuring and rewarding accurate data can motivate employees within the organization to embrace automation and highlight automation's benefits across functions responsible for processing and shipping customer orders.

all of their orders arrive to customers complete, on time, damage free and with correct documentation. By contrast, organizations that do not focus on first-time data accuracy have a perfect order performance of only 86%. Although this number is still high, the potential impact of orders that are not perfect should make organizations strive to achieve as high a perfect order performance as possible.

APQC's data indicates that sales order automation and a focus on data accuracy can spur organizations to make significant strides in performance. Measuring and rewarding accurate data can motivate employees within the organization to embrace automation and highlight automation's benefits across functions responsible for processing and shipping customer orders.

These results are not limited to the organizations in APQC's data. In its work with organizations, Esker found that the medical device organization MEDRAD Inc. decreased its order entry errors from 1.6% to less than 0.4% by focusing on first-time data accuracy. Furniture manufacturer Kimball International achieved and maintained an order entry accuracy rate of 99.6% after adopting a focus on first-time data accuracy.

Reducing human intervention

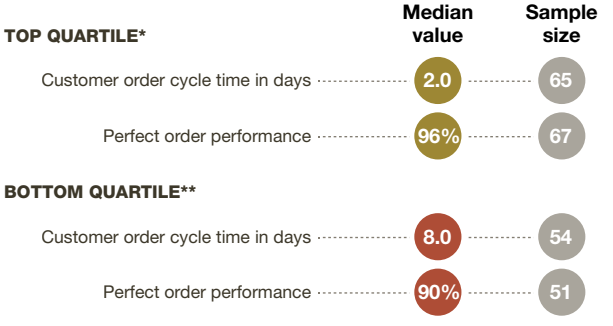
Ultimately, the goal of automating sales order processing is to reduce the amount of human intervention needed in the process. APQC's analysis found that organizations with a lower degree of human intervention perform better than their counterparts requiring more human intervention. For its analysis, APQC identified the group of organizations in the top quartile (meaning they have a high percentage of sales orders requiring no human intervention) and the group of organizations in the bottom quartile (meaning they have a low percentage of sales orders requiring no human intervention).

As shown in Figure 2, organizations in the top quartile perform better with regard to customer order cycle time and perfect order performance. At the median, organizations in the top quartile have a median customer order cycle time of two days, whereas those in the bottom quartile have a cycle time of eight days. The nearly one-week difference between the two groups is a strong indicator that, to realize the full benefits of automation, organizations should make an effort to limit the amount of human intervention needed to process sales orders.

Organizations in the top quartile also have a greater perfect order performance rate than their counterparts in the bottom quartile. At the median, those in the top quartile have a six percent higher performance rate than those in the bottom quartile. At 90%, the perfect order performance of bottom quartile organizations is not disappointing, but

FIGURE 2

Impact of reduced human intervention



* High percentage of sales orders requiring no human intervention
** Low percentage of sales orders requiring no human intervention

Source: APQC

to maintain positive relationships with customers and an advantage over competitors, organizations would be wise to take measures that could improve their perfect order performance.

APQC's data clearly shows the advantages of sales order automation. Esker has found that these results hold true with organizations across industries. For example, the pharmaceutical company Accord Healthcare automated its order processing to a moderate degree, with just under 65% of orders having no manual intervention. Even with this degree of automation, the organization was able to reduce its order processing time. Food distributor SanLucar automated its largely manual order fulfillment process and experienced 84% faster order processing times. Shorter order processing times themselves are a benefit to these organizations, but they also create benefits through the supply chain, resulting in greater percentages of on-time deliveries.

Selecting a sales order automation system

Automating order processing can reduce headaches for functions from production to logistics. Not only does a reduction or elimination of manual processing reduce errors in data entry, it also enables organizations to fill orders faster and thus make more of their deliveries on time. The practice also reduces the amount of returns caused by errors in order fulfillment.

Organizations should note that when implementing automation, they have a choice between using an internally developed system or an externally developed system they can purchase. Both enable benefits over manually processing orders, but there are performance differences between the two types of systems.

In fact, APQC has found that organizations using order processing automation experience an average of 80% faster order processing speeds, as well as a decrease in order delivery times by several days.

Organizations should note that when implementing automation, they have a choice between using an internally developed system or an externally developed system they can purchase. Both enable benefits over manually processing orders, but there are performance differences between the two types of systems.

Organizations with a complex intake process and numerous intake channels may be best served by an externally-developed system.

Organizations using externally developed systems tend to have shorter customer order cycle times than their counterparts with internally developed systems. However, 75% of organizations with a commercial system find their order management extremely effective, whereas only 59% of organizations using an internally developed system feel the same way.

In determining the type of system to use, organizations should, of course, consider whether they have the resources needed to develop an internal system, or if it makes more sense from a financial and resource standpoint to adopt a system created externally. A system customized to the organization may be impressive, but it is not always necessary. They should also consider the complexity of their order intake process and the number of channels an order enters through. Organizations with a complex intake process and numerous intake channels may be best served by an externally-developed system.

About APQC

APQC helps organizations work smarter, faster, and with greater confidence. It is the world's foremost authority in benchmarking, best practices, process and performance improvement, and knowledge management. APQC's unique structure as a member-based nonprofit makes it a differentiator in the marketplace. APQC partners with more than 500 member organizations worldwide in all industries. With more than 40 years of experience, APQC remains the world's leader in transforming organizations. Visit us at apqc.org, and learn how you can make best practices your practices.

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