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SUPPLY CHAIN MANAGEMENT REVIEW

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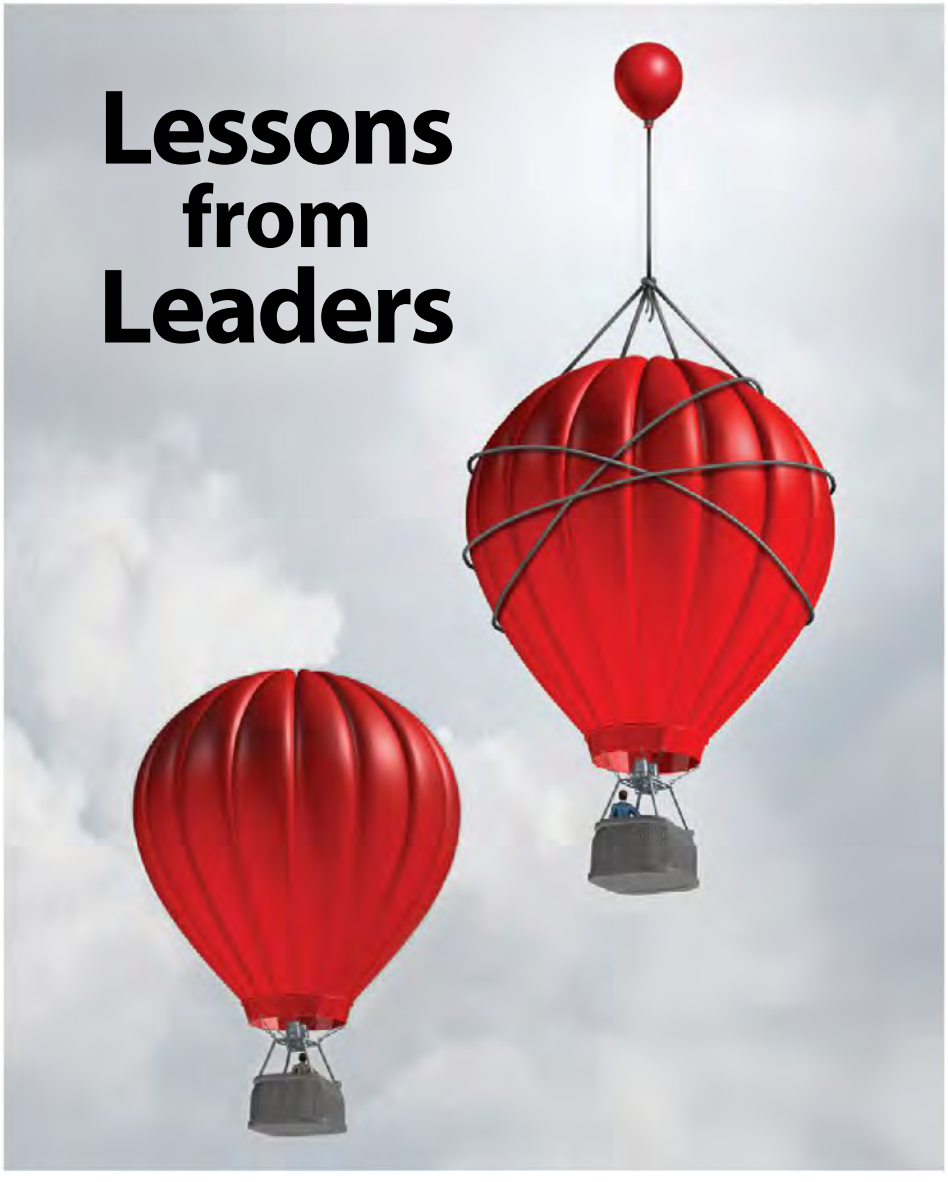

FEATURES

COMMENTARY

SPECIAL REPORTS

100% of supply chain execs think insurance is a good risk mitigation tool.

Yet most think it's not their job to buy it.

Risk from weather, theft and other unexpected disruptions is a fact of life in your supply chain. Not planning for it is an even bigger risk. That's why it's surprising that in a survey of supply chain executives, 100% said insurance was a very effective risk mitigation tool. But most thought purchasing it wasn't their job. At UPS Capital, mitigating supply chain risk is our job. We offer insurance solutions for freight and small parcels, regardless of mode or carrier. If you're not sure whose job it is, call us. We'll help you figure it out. upscapital.com | 877-263-8772

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Are you ready for the NextGen Supply Chain?

Bob Trebilcock, Editorial Director
btrebilcock@peerlessmedia.com

When it comes to the next generation of supply chain management, the future just may be now. That's one of the conclusions reached by Greg Gorbach, an analyst at the research firm ARC Advisory Group, after surveying supply chain executives, including subscribers to *Supply Chain Management Review*, on the digitization of their supply chains. In "The Great Digitization of Industry," Gorbach notes that while it may take years for the widespread adoption of new technologies such as machine learning, additive manufacturing, smart factories and advanced analytics to become commonplace, digitization across verticals is happening faster than many of us may have realized.

At *Supply Chain Management Review*, we're calling this the NextGen Supply Chain. In fact, last month we launched a new electronic newsletter of the same name. Each month, "NextGen Supply Chain" will bring you two original stories from Gary Forger, our special projects editor, on the technologies that will be shaping your supply chain today and tomorrow, along with links to articles covering topics such as artificial intelligence, Big Data, robotics and other transformative technologies. We hope you gave the first newsletter a read, found it as fascinating as we do and will continue to read it in the months to come.

Building on this transformation theme, the September issue of *SCMR* features a look at how Wal-Mart is transforming its supply chain to meet the omni-channel fulfillment challenge. The world's largest retailer has clearly had some setbacks in its early e-commerce efforts, but believes it has found the right formula. The article provides valuable lessons to any brick-and-mortar retailer in the midst of overhauling its supply chain to compete in this new world of retail. And, speaking of lessons, in "How To Build a Supply Chain Champion," frequent contributors Stanley and Amydee Fawcett, Sebastian Brockhaus and A. Michael Knemeyer teach us what supply chain managers can learn from Theo Epstein's 5R approach to building a championship baseball team.

This issue also includes more lessons from supply chain leaders in our annual look at Gartner's Top 25 supply chains. And finally, in line with the next generation theme, we're presenting in-depth research *SCMR* conducted with APICS and the benchmarking organization APQC on Millennials in the supply chain. One of the most important insights gleaned: Millennials in the supply chain buck many of stereotypes associated with their generation. If our survey is on point—and we think it is—the NextGen Supply Chain is in good hands.

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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e-Tailing Update: Learn from Sears. Really!

Dr. Lapide is a lecturer at the University of Massachusetts, Lowell 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.

Here is a sentence I never thought I would write: Sears may go out of business. Indeed, last April, *The Wall Street Journal* ranked the American retailing icon at the top of a list of the 10 retailers "most at risk to default within the next 12 months." Yet while brick-and-mortar retailers like Sears are teetering on the brink, the *Journal* later reported that pure e-tailers like Greats are opening brick-and-mortar stores. Another case in point is Amazon's acquisition of Whole Foods, demonstrating that the e-tail leader is getting serious about invading the brick-and-mortar store chain markets, at least when it comes to groceries.

Clearly, we are at an e-tailing "inflection point." The question for e-tailers jumping into the brick-and-mortar game, or for traditional retailers looking for the right supply chain formula to answer to the threat from e-tailers, is: What lessons can we learn from Sears to avoid the same fate?

A short history of mass-market retail*

Given all of the dire news, it's easy to forget that Sears was the Wal-Mart of its day, the highest grossing merchandizer, with revenues equal to about 1% of the gross domestic product (GDP). When I look back over my life and career, it seems like I see the Sears name everywhere. Whenever I wanted to purchase something for the house, like an air conditioner, refrigerator, lawn mower, car battery or hand tools, I went to Sears, which was one of the most popular suppliers of hard goods, in contrast to soft goods such as apparel. When I started my career at a consulting firm back in 1976, Sears Catalog was one of my largest clients.

But Sears didn't just sell you goods for your home—it could also sell you a house assembled from a kit for those appliances and a car to park in the garage. I just got back from a Columbia/Snake River cruise during which we visited a government site that housed its employees in mail-order homes purchased from Sears about 70 years ago. Coincidentally, in July the real estate section of the *Boston Globe*, my local newspaper, recently published "When Sears sold the American Dream" about the role Sears Catalog played in providing modular houses to the influx of immigrants that came into the United States in the early 1900s.

To put it in a contemporary light, Sears was the early version of a successful omni-channel retailer. It had two major channels: brick-and-mortar stores and mail-order catalogs—the precursor of e-commerce. Its legacy catalog business grew from the late 1880s by servicing the expanding Western frontiers.

One of the secrets of Sears' success was the result of managing two independent supply chains. The first distributed goods to stores through distribution centers (DCs), as store chains do today. The second supplied catalog items to fulfillment DCs. Rather than co-locate and co-mingle inventory in a single, omni-channel distribution facility, as some retailers are attempting, inventories for the two channels were managed separately, with different customers in mind. Merchandizing for the stores was focused on the middle-class living in cities and suburbs, while catalog marketing

was focused on the less affluent outer-suburbs and rural areas. The businesses were also operated separately to ensure that the faster growing stores business would not be adversely affected by the successful legacy catalog business.

While Sears dominated retailing for decades, Wal-Mart toppled it by going to where Sears wasn't. Instead of focusing on cities and suburbs, Wal-Mart opened its first stores in the outer-suburbs and rural areas that were largely under-served by brick-and-mortar retailers. Those locations also happened to be the mainstay market of Sears Catalog. Wal-Mart's supply chain involved building large stores and warehouses to supply them. Stores carried lots of items, but limited brands and sizes to enable economies of scale.

In many respects, Amazon became the "Wal-Mart of the Internet" by replicating Wal-Mart's formula and starting where today's store chains weren't—that is, by providing a nearly unlimited selection of products, brands and sizes at competitive prices no matter where a customer lived. To succeed, Amazon innovated to be the best at item (or unit) level pick, pack and ship fulfillment. Products were shipped into DCs on pallets, and then the cartons were opened and break-bulked so that individual items could be picked, packed and shipped via parcel service. These weren't competencies that Wal-Mart or any other store chain possessed.

Over time, Amazon continued to innovate. One notable innovation was selling items shipped directly from its suppliers. Its sophisticated Distributed Order Management (DOM) competency sourced orders from its DCs, suppliers and its private-label contract manufacturers in the most efficient way to still meet customer service levels. DOM is another competency that store operators didn't possess. Amazon has grown from an auspicious start just selling books on-line, to selling groceries in stores with its purchase of Whole Foods, as well as home-delivery furniture. It leads you to wonder whether Amazon's model will be the modern bi-channel icon that Sears was of yesteryear. Perhaps it will even sell consumers the homes they live in.

Are co-located inventories always beneficial?

In theory, I believe in the asset-utilization benefits of co-locating (including co-mingling) channel inventories. However, reality tells me that it is not necessarily the best solution for bi-channel, store and e-tailing supply chains. Part of my skepticism is based on what contributed to Sears' success, which was managing independent, segmented supply chains.

There were times, however, when one organization would want to "steal" parts from the other. For example, let's say manufacturing was working at fiscal quarter end, and was out of stock for in-production parts needed to complete the assembly of a computer system that would generate $1 million in sales revenue.

Another is based on my experience working in the field service division of a computer manufacturer. The overall goals of that company were to sell and service computers, and my division was primarily responsible for providing remedial services to customers using them to run their businesses. Maximizing inventory utilization (such as inventory turns) was less important than maximizing customer satisfaction. The division managed its own service part inventories to enable meeting our customer satisfaction goals.

Meanwhile, our company's manufacturing organization managed the inventory of in-production parts it needed to assemble computers. As a Fortune 500 company, its major overall goals were revenue, profit and financial performance-oriented. By not co-locating (or mingling) in-production and service-parts inventories, the two organizations were able meet individual goals without significantly impinging on one another's performance.

There were times, however, when one organization would want to "steal" parts from the other. For example, let's say manufacturing was working at fiscal quarter end, and was out of stock for in-production parts needed to complete the assembly of a computer system that would generate $1 million in sales revenue. If the service organization gave its service

parts to manufacturing, that $1 million would get counted in the current fiscal quarter, yet not affect service revenues. This would make sales and marketing managers happy.

In contrast, let's say an important service customer's critical computer system was down, with the customer losing business in real-time—a good example would be an airline's reservation system or a financial services firm's transactional system. This customer required emergency service. If the service parts needed to repair its computer were out of stock, then the service organization would want to "steal" them from manufacturing's in-production stock. This action would not affect short-term computer revenues, and would bolster strategic service customer satisfaction.

There is a saying in retail: "Retail is detail." However, store chains that co-locate inventories often fail to put in place the detailed, formal "executive-level" policies needed to prevent inappropriate cross-stealing and break-bulking from happening in their DCs/stores.

A durable product company's manufacturing and service/service parts organizations frequently run into these situations. Too often, left to their own devices, manufacturing wins out because marketing and sales managers scream the loudest. Thus, my company installed a formal system, in which only VPs could make these decisions. This helped the overall company balance the importance of short-term revenue versus long-term customer satisfaction.

Retailing needs independent supply chains

Store chains have been successful by efficiently flowing products in bulk quantities such as truckload, pallets and cartons until they get into a store, where they are break-bulked to stock items on shelves. Their supply chains are fine-tuned to get products on shelves at the lowest landed-cost and highest inventory utilization. If a product is break-bulked into an item before it reaches a store, efficiencies would be negatively affected. Meanwhile, e-tailers succeed by shipping bulk products to a DC and break-bulking them into items as e-orders are filled.

Historically, stores chains have been less than successful in using their capital-intensive infrastructure of stores and DCs to fill e-tailing orders. They typically co-locate e-tail and store-related inventories. This leads to issues similar to the service versus in-production parts decisions described above.

If e-tail stock is located in a store, associates will want to fill empty shelves from it, so as not to lose store sales. Similarly, e-tail fulfillment associates will want to "steal" items from shelves whenever out-of-stocks prevent e-tailing orders from being filled.

Similar actions might take place if e-tail operations are co-located in a DC. If a store order includes out-of-stock items, DC workers will want to "steal" the items from the e-tail stock. In contrast, if an e-tail order has a stocked-out item on it, a fulfillment manager would want to steal the item from store stock. In addition, if this manager breaks a carton to fill the e-tail order, the remaining items cost more to ship when stores need them.

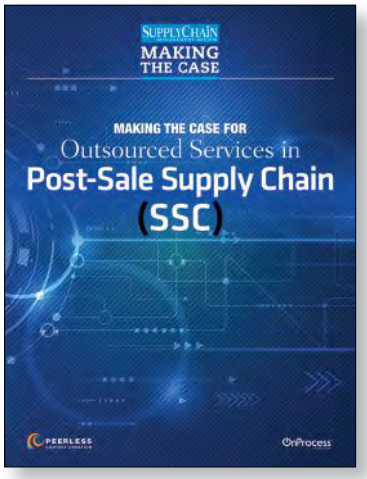
There is a saying in retail: "Retail is detail." However, store chains that co-locate inventories often fail to put in place the detailed, formal "executive-level" policies needed to prevent inappropriate cross-stealing and break-bulking from happening in their DCs/stores. They forget that associates and DC workers are hard-wired to please the customers and store orders they see daily. They are the unseen "everyday heroes" not always acting per the "big picture."** Routine actions they take can negatively affect the efficiency of legacy store replenishments and the success of burgeoning e-tail operations.

In summary, store chains need to analyze whether leveraging their current infrastructure to support e-tailing business is in their best interest. In contrast, e-tailers that plan to open stores chains might do well to operate separate store inventories and fulfillment centers, just as Sears did during its heyday.

Lastly, there's a lesson to be learned by non-retail supply chain managers. Re-analyze whether your company's co-located inventories in support of multi-channel customers are really providing the expected benefits. Or are they just negatively impinging on channel efficiencies and customer satisfaction?

* L. Lapide, "*E-commerce innovation needed by retailers*," *Supply Chain Management Review,* Mar/Apr 2015

** L. Lapide, "*Not-so-perfect order*," *Supply Chain Management Review*, July/August 2007



Making the Case for Outsourced Services in Post-Sale Supply Chain (SSC)

Improving after-sales service is essential, but getting your arms around how to achieve that is the hard part. With a high-performing SSC your organization can take out costs in spare parts inventory, spare parts logistics, and recovery of repairable assets—all while improving customer satisfaction.

THE DIGITAL AGE BRINGS OPPORTUNITY in many forms, but along with that, there's a growing set of challenges. Customer expectations are higher than ever, and not only when it comes to product quality and on-time delivery, but also servicing of products after the sale.

It's no wonder that a 2016 study from Forrester Research found that 72% of businesses say improving customer experience is their top priority. Senior executives know the effectiveness of the service supply chain—their SSC—is critical to success. In fact, a study by CFO Research found that 83% of companies believe that they can boost customer satisfaction by improving the quality of post-sales service. However, 75% said their companies could substantially improve their current post-sales service.

In short, we know that improving after-sales service is essential, but getting our arms around how to achieve that, and then having a platform to execute processes optimally, is the hard part.

The challenges are complicated because they're multi-faceted, cross departmental boundaries, and are usually saddled by fragmented data, explains Robert Kenney, executive VP of sales and marketing with OnProcess Technology, a managed services provider specializing in complex, global SSC operations—the flow of people, parts and services following the sale of a product.

"There are some real silos that exist in after-sales service, such as the divide that can happen between systems and people on the tech support side of a company, and those on the service delivery side of the house," says Kenney. "They're often operating in different systems, so the data they're looking at is different. As a result, bridging that information gap becomes a challenge."

What's the answer to this pain chain? Ultimately, it takes better visibility over service events, orders and processes, and better analytics to drive improvements. The trouble is, few companies have the necessary analytics and integrated systems to pull it all off. "The challenge is that companies have a tremendous amount of data in different systems, but it is sitting in silos and not leverageable across all touchpoints in the overall service process," says Kenney.

OnProcess also applies analytics to business processes and events, such as predicting which customers in a client's installed base are most likely or least likely to return equipment. This can make asset recovery processes more effective with less effort. It's just one example how analytics can look beyond machine failure and examine ways to optimize crucial handoffs in the service chain. •

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OnProcess TECHNOLOGY

Smart processes are redefining on-site inspections

Eliminating slow and error-prone manual inspection processes—and replacing them with real-time reporting based on mobile platforms—will improve the efficiency of industry by an order of magnitude.

By Luis Moncayo and James B. Rice, Jr.

Innovations such as mobile communications, predictive algorithms and machine learning have arrived in the multi-billion-dollar quality inspection and supplier compliance industry.

The impact will be transformational for the industry, which has been slow to adopt new technology. Companies (clients) that use inspection and supplier compliance services to inspect and evaluate suppliers' production lines will benefit as well.

Luis Moncayo is co-founder of Inspectorio. He can be reached at luis@inspectorio.com. James B. Rice, Jr. is deputy director, MIT CTL. He can be reached at jrice@mit.edu

Eliminating slow and error-prone manual inspection processes—and replacing them with real-time reporting based on mobile platforms—will improve the efficiency of industry by an order of magnitude. But even more interesting from a client company perspective is the potential for analyzing remote manufacturing operations and their impact on the efficiency of global supply chains.

Outdated practices

Traditional on-site supplier inspections are mired in outdated practices and limited analytical capabilities.

Client companies long ago outsourced inspection and supplier compliance, and today have limited or no access to the factory inspection process. This lack of transparency and accountability makes it very difficult to manage the quality of inspection services, making them prone to error and potential corruption. For instance, there is no guarantee that an on-site inspector working independently will sample products correctly or pay attention to problem areas that the client company has flagged.

Moreover, service providers and their customers need this type of information if they are to improve inspection practices and align them with the needs of different clients—which vary widely.

Typically, providers use digital cameras and spreadsheets –or even pen and paper—to record their findings. In addition to being painfully slow (it might take a day or two before the client sees the findings) these manual

methods limit the scope for analyzing the data. Some services use online forms to record the results, which is an improvement on handwritten notes because aggregated data can be analyzed. But this method is still an inflexible and restrictive way to input inspection data and convey the findings to clients.

It might seem surprising that the on-site inspection process has seemingly been bypassed by much of the communications technology that is now a feature of global supply chain management. In our experience, a lack of awareness of how these services are performed is one likely reason why this vital activity is a laggard when it comes to adopting modern technology.

Yet the potential benefits of integrating today's mobile communications platforms and analytics engines into the industry's practices are significant. Client companies could engage with factory inspections that are both operationally and geographically remote as they take place in far-off locations. Access to digitized data on the findings in real-time can open new avenues of analysis, and may reveal ways to improve the performance of outsourced manufacturing operations as well as the companies responsible for inspecting them.

These changes are starting to emerge in industry today. One example in textile, apparel and footwear facility inspection is the high-tech inspection system developed by Inspectorio.

Major U.S. retailer Target recently appointed Inspectorio as a technology partner and the retailer is implementing the Inspectorio platform. The initial integration is in China and five other countries, and Target hopes to roll out implementation throughout all Target-contracted apparel manufacturing facilities by the end of the year.

Complimentary services such as the Cloud-based global supply chain management service offered by GT Nexus could greatly enhance this new generation of inspection services. The deep analytical capacity that these platforms enable, could marry the output from factory inspections with broader supply chain intelligence.

Innovative approaches

In the Inspectorio system, when inspectors arrive at a factory they log into a mobile communications platform via their smartphones. These devices have all the capabilities that a modern inspection process requires: the ability to record visually and in audio, a geolocation feature and plenty of data storage capacity.

All the information gathered by the application is recorded and stored in the cloud, and translated into a managerial dashboard that presents an overview of a factory's performance.

When the inspection is completed, a report can be electronically generated at the touch of a button. This is sent to the client company in real-time, as opposed to delays of many hours or even days in the traditional scenario.

The platform enables client companies to remotely monitor and participate in the inspection process in near real-time. This connectivity eliminates many of the risks associated with traditional practices, such as inspectors paying insufficient attention to specific areas of the production process. It provides documented and verifiable confirmation that an inspection took place in the manner specified by the client, with video and audio evidence. Also, the environment in which products are made can be visualized in real time, providing an immediacy that is absent from traditional inspection processes.

When the inspection is complete, a report can be electronically generated at the touch of a button. This is sent to the client company in real-time, as opposed to delays of many hours or even days in the traditional scenario. The reports contain data on the factory inspector's observations.

Beyond improving the quality and eliminating latency in the process, this innovative approach enables the use of prediction algorithms that can analyze historical data and identify common defects that might need special attention.

Machine learning capabilities continuously refine the inspection process. For example, when an inspection assignment is activated, an algorithm predicts the number and type of defects associated

with the assignment based on historical performance data of the product category and the manufacturing location. As the inspection is executed, the findings are compared to the prediction to trigger an adaptive inspection process, where inspectors are requested to further verify those product risk areas if their findings are not aligned with the algorithm prediction. As more companies adopt the system, the algorithm is fed with increasing amounts of data that improve its accuracy and ability to generate detailed predictions, based on production line, materials, season, etc.

We believe that within five to 10 years, such advanced platforms will be the norm and the manual systems that define traditional supplier quality and compliance inspection services will be a thing of the past.

Using a similar algorithm, the platform can also improve the impact of compliance verification visits. The algorithm guides the auditor to high-risk areas in the manufacturing location, increasing the efficacy of each audit.

Analytics revolution

A related and equally important potential benefit of the technology-enabled supplier inspection and verification equation is the potential for deep analytics. A digitized, real-time platform can open analytical capabilities that are beyond the reach of traditional processes. Here are three areas in which this potential in being realized.

- ***Workforce planning.*** Networks of inspectors can be managed much more effectively with the benefit of analytical data on their performance. For example, by analyzing how individual inspectors use their time in each client facility, companies can identify opportunities to improve the deployment of network teams.
- ***Product quality.*** Detailed reports on common product defects—including information on where and how faults originate—help companies to take corrective actions and improve product quality immediately, which prevents further quality failures.
- ***Trading partner relationships.*** Analyzing the performance of individual vendors and factories enables companies to evaluate supplier networks with much more rigor and with the benefit of data. And providing a solid analytical base for management decisions helps companies to build strong relationships with vendors.

Transformative change

These are important advances, but this is only the beginning of the journey. Future inspection models could connect into more data sources and even more sophisticated analytical capabilities. As the models evolve, they may redefine the role of supplier quality and compliance monitoring services in global supply chains.

For instance, Inspectorio is developing a sensing system that automatically monitors the flow of raw materials such as fabrics in the early stage of production. Data from the system would be used to inform and streamline the quality inspection process. This is useful where a client company specifies that product quality inspections can only be carried out when 50% of a production run is complete. Without such a monitoring system, it can be difficult for inspectors to judge when production volumes have reached that halfway stage. The monitoring system issues an alert when the minimum production quantity required for an inspection to proceed has been reached.

In the future, systems like these could be part of broader communications platforms that monitor and analyze every aspect of factory operation. In effect, the platforms now being developed for supplier compliance and quality inspection purposes, will likely become a vital interface between remote manufacturing facilities and client companies. And they can play a key role in the management of global supply chains.

The platforms could also fulfill a wider inspection and compliance role. For example, it may be possible to share intelligence on the performance of suppliers across industries and between competitors, by establishing protocols that prevent commercially sensitive information from being shared.

Manual methods short-lived

We believe that within five to 10 years, such advanced platforms will be the norm and the manual systems that define traditional supplier quality and compliance inspection services will be a thing of the past.

As a result, these services will become fully integrated into global supply chain management systems, and function as a key source of information on the efficiency of factory operations.

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Creating holistic supply chain sustainability: not a choice, a given

Recent research and studies indicate that integrating sustainability into every decision and process in supply chains will be essential in the coming years. Such a strategy not only mitigates risk, say experts, but also contributes to the bottom line.

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

When the Sustainability Consortium (TSC) released its "2017 Impact Report" last July, supply chain managers were presented with evidence that the act of integrating sustainability into every decision and process in their network helps companies avoid risks to their bottom lines and creates more sustainable products for the environment.

According to "The Call for Collective Action Across Supply Chains," over 2,000 suppliers used TSC category sustainability surveys to report their progress to retail buyers—a 25% increase from the year before. These suppliers represent over $200 billion in sales to their retail partners.

TSC notes that supplier engagement has not only increased, but 40% of suppliers surveyed replied positively that they had taken action to improve their sustainability survey scores. These actions by suppliers include creating internal data collection and communication systems, engaging suppliers, changed products or processes or have started communicating publicly about their sustainability efforts.

The "2017 Impact Report" also dives into why almost 40% of suppliers often answer "we are unable to determine at this time" to many sustainability survey questions. This shows that suppliers are not afraid to say they do not have the data to answer, and that they want to go on record that they plan to obtain the data in future years. To have more suppliers begin to fill out surveys, even with this answer, shows that there is gaining momentum for more companies to begin their sustainability journey.

"This year has seen an unprecedented increase in the implementation of our work. The heart of what TSC does is harness the demand signal from retailers, brands and other major purchasers to super-charge the implementation of sustainability improvements right across the value chain," comments TSC Chief Executive Euan Murray. "If done right, a collective-action model can make rapid, marketing-changing improvements to unlock growth."

Supply chain "architects"

The same conclusion was drawn by The Economist Intelligence Unit, which recently published "No More Excuses: Responsible Supply Chains in a Globalized World."

According to Michael Spence, professor, New York University and 2001 winner of the Nobel Prize for Economic Sciences, the timing for such a study could not be better.

"The recently-elected administration in the United States has declared its lack of support for multilateral frameworks, preferring instead a bilateral approach based on the search for mutually beneficial relationships," he says. "For large countries and economies, such an approach may help rebalance growth patterns."

But he also notes that in a world of bilateral and regional frameworks (a process well underway) there will be a much more complex environment for multinational companies to navigate, and a difficult one for smaller countries to engage with.

The Trump administration has also issued negative signals with respect to the U.S. commitment to the climate change agenda, and hence to the sustainability of a rapidly growing global economy.

"Multinational firms are the architects of global supply chains," says Spence. "As such they must deal with the shifting economic, technological, political and social forces and pressures operating on their supply chains, employees, customers and regulators."

He adds that it is not much of an exaggeration to say that their ability to navigate and respond will be one decisive factor for the future of a reasonably integrated and sustainable global economy.

Richard M. Locke, provost and professor of political science and international and public affairs at Brown University, observes that the integration of developing country producers into supply chains is having a "transformative effect" on local economies, allowing poor countries to develop.

He adds: "At the same time, however, the social and environmental consequences of this particular pattern of development have provoked significant controversies over the role of global brands and their local suppliers, often seen as exploiting developing countries' low wages and weak social and environmental regulations to produce low-cost goods at the expense of local workers' welfare."

Circular economy

Arguably, there are few global brands more widely recognized than those of Oracle—a major player in the supply chain industry. Jon Chorley, the company's Chief Sustainability Officer, notes that minimizing environmental impact and addressing global climate change continue to be a priority.

"Sustainability is everyone's business," he says. "We also develop products and services that support sustainable operations—our own and those of our customers."

When Oracle OpenWorld's annual conference convenes in San Francisco this October, you can bet that sustainable supply chains will be high on the agenda. The reason is simple: A global survey of attitudes and future plans for the adoption of supply chain management solutions in the cloud conducted by IDG Connect on behalf of Oracle, mirrors this sentiment.

Oracle's values around "sustainability procurement" include, but are not limited to, ethical business conduct and the responsible sourcing of materials throughout its global supply chain.

The report states that Oracle's "2020 Goals" include a renewable energy target: "The future for cloud-based supply chain management solutions." In addition to its internal initiatives, this report addresses how Oracle technology helps other organizations better execute and measure their own sustainability efforts.

"As Oracle shifts its business to the Cloud, we also recognize the opportunity to design our hardware for the environment and contribute toward establishing a more circular economy," says Chorley.

The company's commitment to "global citizenship" includes its procurement activities as it recognizes that purchasing decisions present an opportunity to have both a social and environmental impact. Oracle's values around "sustainability procurement" include, but are not limited to, ethical business conduct and the responsible sourcing of materials throughout its global supply chain.

"On issues ranging from factory safety to conflict minerals, we work in our own hardware supply chain and across our industry to advance responsible practices," says Chorely.

Finally, Oracle's direct hardware suppliers must also acknowledge their commitment to the EICC Supplier Code of Conduct, which is designed to promote worker safety and fairness, environmental responsibility and ethical business.

The 2017 Supply Chain Top 25: LESSONS *from* LEADERS

BY STAN ARONOW, JIM ROMANO AND KIMBERLY NILLES

In May of this year, Gartner published its 13th 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.

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For more on Gartner's Supply Chain Top 25 Methodology, visit scmr.com.

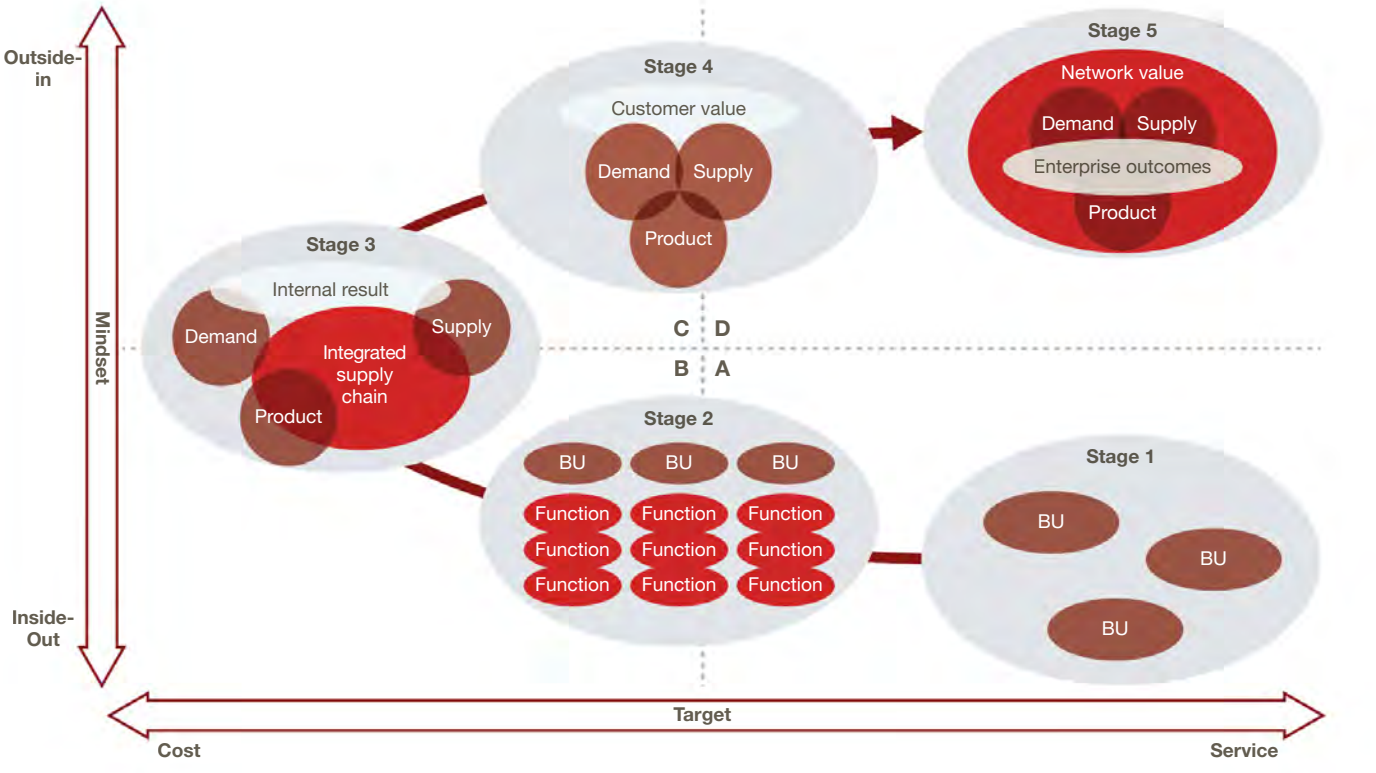
What is the definition of excellence?

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.

In 2017, Gartner unveiled the 13th annual global Supply Chain Top 25, identifying supply chain leaders and highlighting their best practices for heads of supply chain and strategy organizations.

FIGURE 1

The DDVN maturity journey



Source: Gartner

Leading companies have achieved a much higher degree of visibility, coordination and reliable processes both within and across the "plan," "source," "make," "deliver" and "return" functions, but also in partnership with sales and marketing and product management organizations in lines of business. Their supply chains are designed starting with what brings value to customers and then back through the supply network. The ability to sense, translate and shape demand, and pair up appropriate supply is also improved and both demand and supply are determined in close collaboration with customers and upstream suppliers.

Our methodology is detailed below, but at a summary level it operates as such. Each year, approximately 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 as an opinion component, providing a balance between objective and subjective perspectives. In completing their ballots, voters are asked to identify those companies they believe are furthest along the journey toward the demand-driven ideal, as defined in Gartner research and on the voting Website.

Masters: And then there were three

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 study. To the contrary, if a Master company were to fall out of having a top-five composite score for long enough, they 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. Both of last year's Masters, Apple and P&G, qualified for this category again and

TABLE 1

The Gartner supply chain top 25 for 2017

Rank	Company	Peer opinion[1] (169 voters) (25%)	Gartner opinion[1] (38 voters) (25%)	Three-year weighted ROA[2] (20%)	Inventory turns[3] (10%)	Three-year weighted revenue growth[4] (10%)	CSR component score[5] (10%)	Composite score[6]
1	Unilever	2074	649	10.2%	6.8	1.9%	10.00	**6.39**
2	McDonald's	1264	442	13.9%	174.5	-4.2%	3.00	**5.27**
3	Inditex	1192	337	16.3%	3.7	12.0%	10.00	**4.98**
4	Cisco Systems	1018	524	8.3%	13.5	0.8%	10.00	**4.82**
5	H&M	901	208	22.0%	3.0	12.5%	10.00	**4.63**
6	Intel	952	486	10.5%	4.0	4.6%	7.00	**4.42**
7	Nestlé	1159	345	7.9%	5.1	-0.6%	10.00	**4.10**
8	Nike	1290	207	16.2%	3.8	7.9%	6.00	**4.07**
9	Colgate-Palmolive	843	313	18.0%	5.0	-4.9%	6.00	**4.03**
10	Starbucks	926	143	20.3%	11.1	12.7%	4.00	**3.80**
11	PepsiCo	974	356	8.5%	9.0	-1.8%	6.00	**3.67**
12	3M	553	210	15.3%	4.2	-1.1%	10.00	**3.54**
13	Johnson & Johnson	878	269	11.8%	2.6	0.4%	7.00	**3.50**
14	Coca Cola Company	1579	232	7.8%	5.7	-4.2%	4.00	**3.46**
15	Nokia	315	133	5.8%	5.6	46.3%	10.00	**3.32**
16	BASF	579	298	6.1%	4.0	-10.6%	10.00	**3.21**
17	Schneider Electric	546	325	4.2%	5.1	-0.3%	10.00	**3.15**
18	Wal-Mart Stores	1312	225	7.5%	8.0	0.6%	3.00	**3.11**
19	HP Inc.	399	275	6.6%	9.8	-5.4%	10.00	**3.06**
20	L'Oréal	657	174	10.4%	2.8	5.1%	5.00	**2.72**
21	Kimberly-Clark	607	163	11.8%	6.5	-2.6%	5.00	**2.68**
22	BMW	681	129	3.7%	4.1	6.6%	10.00	**2.62**
23	Diageo	481	190	8.9%	0.9	-1.7%	7.00	**2.57**
24	Lenovo	498	223	1.5%	14.0	7.2%	7.00	**2.50**
25	Samsung Electronics	958	100	7.3%	15.1	-3.6%	4.00	**2.46**

[1] **Gartner opinion and peer opinion:** based on each panel's forced-rank ordering against the definition of "DDVN Orchestrator"

[2] **ROA:** (2016 net income / 2016 total assets)*50% + (2015 net income / 2015 total assets)*30% + (2014 net income / 2014 total assets)*20%

[3] **Inventory turns:** 2016 cost of goods sold / 2016 quarterly average inventory

[4] **Revenue growth:** (Change in revenue 2016-2015) *50% + (change in revenue 2015-2014) *30% + (change in revenue 2014-2013) *20%

[5] **CSR component score:** Index of third-party corporate social responsibility measures of commitment, transparency and performancet

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

2016 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.

Source: Gartner

were joined by perennial supply chain leader: Amazon.

Apple continues to improve and innovate both its solutions and the means of producing them. For instance, the company sees manufacturing equipment design and capabilities as a competitive differentiator, even as the actual production is done by manufacturing partners. In this way, the tech leader takes a very strategic approach to what it will directly own versus exerting control over the ecosystem of partners in delivering its solutions to market. This ownership extends to the design of the processing and graphics chips that form the brains for its devices. While Apple has backed off plans to produce its own cars, it is still actively working on autonomous vehicle technology. It is also experimenting with augmented reality (AR) technologies that could eventually be used to create its products, as well as be run on their products, as a solution platform.

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

Storied CP giant P&G also returns to the Masters group this year. The heartbeat of P&G's operational success is its E2E synchronization program, focused on pulling daily demand flows from points of sale back through DCs, plants and, ultimately, its suppliers. This holistic program is supported by mature business process management and advanced technologies in each supply chain function, including P&G Integrated Work Systems for manufacturing and supply chain. P&G continues to innovate through digital automation of workflows and the use of algorithm-driven tools to reduce exceptions and enable E2E planning. Investments in digital manufacturing move P&G closer to the ability to mass personalize products. It is also automating DC operations for step function improvements in efficiency and partnering with other companies in an innovative resource-sharing platform for intermodal transportation. In recent years, P&G has accelerated its investment in people and environmental initiatives. It has, for instance, vowed to eliminate manufacturing waste being sent to landfill from more than 100 plants around the world by 2020.

Amazon joins the Masters group for the first time this year, after seven consecutive years of scoring in the top five of our study. Hardly a day goes by without another announcement of Amazon's foray into a new market, ownership of its own logistics capabilities or filing of patents to improve customer experience. A critical pillar in Amazon's digital business strategy is leveraging its own Cloud computing platform, Amazon Web Services. Amazon also invests heavily in automation technology and increased its use of industrial robots by 15,000 at approximately 20 fulfillment centers in 2016. Automation of manual and repetitive processes like picking and sorting is the force behind Amazon's rapid fulfillment capability. When we introduced the CSR component of the Supply Chain Top 25 in 2016, we noted that Amazon scored low in terms of clear reporting of its activities. We are still waiting for fuller transparency in this area, though some announcements on using hydrogen fuel cell forklifts and renewable power at distribution facilities point to its work in this area.

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

The Top 5

Unilever, the Anglo-Dutch CP leader, remains at No. 1 this year based, in part, on high opinion poll votes reflecting its strong supply chain brand and a perfect 10 on its CSR component score. It was the first major CP player to achieve zero hazardous waste to the landfill and is focused on sustainable sourcing and creating more circular supply chains for both manufacturing and post-consumer waste. Unilever has incorporated systemic environment monitoring and response planning into its highly automated S&OP process. On its factory floors, it has deployed a mobile application that captures real-time manufacturing performance measures for time, material, equipment and labor to determine areas of opportunity. In the logistics domain, Unilever completed a five-year project this year to revamp its European supply chain, resulting in a 20% reduction in trucking, about 1.1 billion euro in savings, a 750 million euro cash contribution to the parent business and a 40% reduction in capital expenditure.

Returning at No. 2 is McDonald's. After quickly deploying its popular all-day breakfast offering across thousands of company and franchise-owned stores, it has turned significant attention toward making its ingredients more fresh and natural. In 2016, McDonald's announced a 10-year plan to produce cage-free eggs. As the largest restaurant chain in the world, anything McDonald's decides to change on its menu has massive implications for upstream food suppliers. It is using its scale to drive continuous improvement and innovation in responsible sourcing that spans beef, poultry, fish, coffee, palm oil and the forestry behind its packaging. McDonald's corporate supply chain has been adept at orchestrating the upstream supply network to maintain service levels and efficiency as part of the transition. McDonald's is a classic example of how smaller teams

at brand owners can manage large-scale transformation across outsourced vendors, suppliers, corporate stores and external customers.

Inditex, Spain's leading fashion retail group best known for its Zara brand, climbed to a personal-best at No. 3. Inditex continues to post remarkable financial performances in three-year weighted average ROA (16.3%) and revenue growth (12.0%) and scored 10 for CSR. With over half its garments produced in Spain, Turkey and North Africa, the fast-fashion leader can send garments anywhere in the world within 48 hours. Rapid design-to-hanger flows using small-scale production runs mean some new designs can arrive in store within 15 days of concept, allowing Zara to respond to its customer demand by producing more of its popular products and fewer unpopular garments. Zara has no chief designer and little hierarchy. Its 350 designers are allowed independence to approve products and campaigns, shipping new styles to stores twice a week. Guided by daily POS data and comments from customers, store managers and country managers, the teams develop fashions for the coming weeks.

Silicon Valley mainstay Cisco jumps to No. 4, due in part to its perfect CSR score and strong opinion polls. As the world's largest designer, manufacturer and seller of networking equipment, Cisco Systems faces many supply chain sustainability issues. Through partnership with suppliers and the use of digital technologies, it has worked to improve energy efficiency, focused on turning waste into resources and has set a goal to avoid one million metric tons of greenhouse gas (GHG) emissions from its supply chain operations by 2020. Cisco has shifted its view of logistics from cost center to value-added services, recently opening an innovation lab with some partners and exploring location-based services and AI in the warehouse. Its supply chain team has a robust talent management strategy built on empowering employees and building trust through transparency. University engagements include senior staff involvement in hiring, a broad global footprint, sponsored R&D projects for supply chain students and new hire rotation programs.

Rounding out the top five this year is H&M at No. 5. The Swedish fast-fashion retailer maintained this position on a combination of strong historical financial performance and a stellar record in sustainability and workers' rights. H&M recently joined the United Nations' Better Than Cash Alliance to accelerate the transition from cash to digital payments in its supply chain. H&M sees this shift as supporting women's economic independence as suppliers provide more transparent records in wage management systems. While H&M has been on a rapid multiyear expansion path with its brick-and-mortar stores, some changes are afoot based on a more recent slowdown in growth. In response to an industry shift toward online growth and digitalization, H&M is now taking an all-of-the-above approach to meet growth targets that include expanding online and in-store revenue. H&M has also introduced automation and the use of optimization algorithms in its warehouses.

Movers and Shakers: No. 6 through No. 15

Chip titan Intel moved down to No. 6, based in part on a slight decline in its three-year weighted average ROA. Intel has continued its evolution from solely dominating the PC and server-based microprocessor markets to also powering solutions composed of the billions of smart devices coming online each year. In the automotive sector, this includes enabling semi-automated automotive driving features and future autonomous vehicles. Intel has likewise made significant investments in AI solutions providers handling tasks like deep learning. The step-function increase in network complexity, associated with breaking into new product markets, has been managed through sophisticated planning and optimization tools designed by internal technologists.

CP heavyweight Nestlé continued its upward climb to No. 7, fueled by positive community opinion. Nestlé's choosing a new external CEO from the healthcare industry clearly signals its shift toward health and nutrition. Its new supply chain mantra is "better, closer, ahead." "Better" speaks to the improvement of current capabilities to reach zero accidents, wastes and misses. "Closer" is focused on customer intimacy with new and evolving customers. And "ahead" aims at growing new markets such as personalized confection and nutrition products. Nestlé's supply chain also has consistent priorities around fresh product availability, customer collaboration, capital efficiency, data-driven decision making, complexity management and people development. In the area of fresh product, it is proliferating an internally crowdsourced innovation idea labelled InShelf, a smartphone app that allows any employee on normal shopping trips to get a view of availability and freshness of products at any store.

Footwear and apparel leader, Nike, moved up to No. 8 on strong financial performance, with a three-year weighted average ROA of 16.2% and growth rate of 7.9%. Nike has placed a big emphasis on personalization at scale for products. One enabler is Flyknit technology that has been incorporated into almost every product. The lightweight fabric is stitched together using advanced computer technology that allows for more agile production, allowing the company to significantly reduce manufacturing waste in the process. The company makes much of its polyester from recycled plastic bottles, reducing energy consumption by 30% while repurposing millions of bottles that were headed to landfills. Nike's supply chain team has focused on maturing its sales and operations planning capabilities and improving its product life cycle management (PLM).

No. 14 Coca-Cola recently implemented an asset-light supply chain strategy called Coke Light, selling its U.S. manufacturing and distribution assets to separate bottling companies and allowing the company to focus on its more profitable concentrate making business.

CP leader Colgate-Palmolive jumped to No. 9, improving its three-year weighted average ROA by nearly 300 basis points to 18.0%. Like clockwork, Colgate-Palmolive generates these results through its long-standing continuous improvement program called "Fund the Growth." This program has consistently generated cash saving for the past 15 years through upward of 10,000 savings projects, run each year in every function and at every level of the company. For the past several years, the Colgate-Palmolive team has applied this disciplined culture to environmental goals such as energy, emissions, water and waste reductions. The company reduced its waste to landfill by nearly half since 2010. From a people perspective, it has received multiple external recognitions for ethics and support of a diverse workforce. Improvement programs it is implementing include automation of repetitive warehouse and manufacturing tasks, material handling and loading, and the use of machine vision to improve product quality.

Starbucks moved two slots higher to No. 10 as it brewed up a three-year weighted average ROA of 20.3% and growth rate of 12.7%. At more than 20,000 global locations, Starbucks is not taking its foot off the accelerator, announcing plans at the end of 2016 to add 12,000 more locations, including new roasteries and high-end reserve stores. Meanwhile, its supply chain is focused on securing the millions of pounds of additional certified coffee, dairy-products and café foods required to feed that growth. To improve productivity and sustainability of its coffee supply, Starbucks shares research and resources it accumulates on farming best practices at global Farmer Support Centers that are open to coffee farmers regardless of whether they sell to Starbucks. One area of customer service where Starbucks leads is using technology to link mobile phones to its store experience.

Advanced food and beverage purveyor, PepsiCo jumped to No. 11 on a surge in peer opinion. PepsiCo and its supply chain have increased focus on what they refer to as "performance with a purpose." 2025 goals in this area include seven million acres of land covered under a sustainable farming initiative, double-digit percentage improvements in water use and GHG emissions, at least two-thirds of global beverage volume with less than 100 calories per 12-ounce serving, more than three billion servings of nutritious foods to underserved communities and a $100 million investment fund to benefit women and girls' societal programs. Increased visibility in PepsiCo's value chain, particularly in distribution and at point of sale, are improving efficiency, including a reduction in inventory, while also improving agility. It continues to leverage retailer point-of-sale data, along with new digital shelf visibility tools to improve forecast accuracy and on-shelf availability.

Industrial innovator 3M moved up to No. 12. Its supply chain strategy consists of three primary elements centered on putting the customer first. The first is to regionalize supply chains to shorten lead times, reduce complexity and foster local talent. Next is harmonizing standard global processes and tools. The third is to accelerate the use of disruptive technologies to improve quality, lower costs and deliver more innovative products to customers. Current supply chain initiatives include manufacturing footprint optimization, E2E supply chain segmentation and leveraging disruptive technology

platforms, such as robotics, 3D printing and machine vision, to improve manufacturing and supply chain performance. 3M scored 10 out of 10 for CSR and has set clear 2025 sustainability goals for energy use and emissions, raw material and waste management, water conservation, health and safety, and education and people development.

Healthcare conglomerate Johnson & Johnson, a perennial on our list, jumped to No. 13 based on higher opinion poll votes and an improved CSR score of seven points. J&J has a strategic ambition to operate the best supply chain in the world and is running three "north star" initiatives to support this outcome. The first is transforming the customer experience through increased connectivity, transparency and collaboration. The second is shaping a product portfolio that expands options for customers, patients and consumers while simultaneously reducing cost, risk and complexity, strengthening quality and reducing total cost to serve. The last centers on manufacturing of the future by identifying and rapidly deploying new and innovative operational technologies and the data/analytics surrounding them. This year, J&J is piloting 3D printing manufacturing lines to provide customizable, on-demand patient-specific products for vision and bone replacement solutions. The healthcare giant is also increasing use of sensors, analytics and robotics on its factory floors.

No. 14 Coca-Cola recently implemented an asset-light supply chain strategy called Coke Light, selling its U.S. manufacturing and distribution assets to separate bottling companies and allowing the company to focus on its more profitable concentrate making business. The big forward-looking question will be whether it can orchestrate its partners toward continued success in a marketplace shifting toward non-soda beverages. Like many other large packaged food and beverage companies, it faces headwinds from consumers seeking fresher, healthier options. In some markets, it is moving to avoid lost sales, and keep product flowing in smaller traditional retailers, by encouraging them to use a mobile app to replenish shelves with cans and cases on demand. Stores can send an order to local distributors, which bid on the deal. They promise a price and certain time period for delivery and then enlist help from freelance workers with motorbikes to bring the products to the stores.

Returning to the global Top 25 list after seven years is Nokia at No. 15. The disciplined management team at this leading telecommunications equipment company turned around its core business and, more recently, acquired competitor, Alcatel-Lucent. Nokia's global operations team had a productive 2016, transforming its factories through further robotic automation and piloting the use of digital technologies such as mobile manufacturing monitoring and analysis tools, as part of a long-term "conscious factory" strategy. Nokia is also using customer-facing segmentation in its operations and has invested in improving its integrated business planning performance, leading to reduced excess and obsolete inventory. Nokia scored a 10 in the CSR measure for a second year. It has cut its emissions by more than half over the past five years and has also developed products that reduce customer emissions by 60% through the use of renewable energy to power cellular base stations.

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

Chemical conglomerate BASF moves four positions higher to No. 16, due in part to higher opinion poll scores and a perfect score for CSR. BASF has made a conscious decision to staff one leader for both supply chain and IT and leverages this relationship to drive its digitalization efforts. As a shared service provider to 80 different business units, its supply chain team has created a detailed design framework for customer-facing supply chain differentiation and is now rolling it out systematically in high-value areas. Likewise, its lighthouse programs, focused on digitization of logistics and horizontal digital integration from customers through internal operations and upstream to suppliers, is now deploying with some businesses. Finally, BASF's supply chain has invested in analytics to improve sales insights and to make more data-driven network decisions balancing service, risk, cost and environmental considerations.

Energy management and automation specialist, Schneider Electric, returns for a second time at No. 17, with a 10 CSR score and strong community opinion of its supply chain. Schneider Electric is well into the second iteration of its tailored supply chain approach to align with customer requirements, in a scalable way, through a small number of differentiated E2E flows through ordering, planning, sourcing, manufacturing and delivery. As part of this effort, it has run projects to reduce E2E customer lead times by double-digit percentages. Another investment area is collaborative S&OP. Supply chain is embedding more external partners into its process and rolling out rapid response capabilities to more businesses

and geographies. The industrial leader has deployed digital tools across its entire supply chain, with notable efforts in co-planning, purchasing analytics, smart factory and digital customer logistics capabilities.

Megaretailer Wal-Mart returns at No. 18. Continuing its drive into e-commerce, Wal-Mart spent several billion dollars to acquire the innovative Jet.com and incorporated the team into a broader @WalMartLabs group based in Silicon Valley. Wal-Mart's e-commerce growth of 63%, in early 2017, reflects this move and a massive overhaul of its other online marketplaces. In the past year, Wal-Mart.com has more than quadrupled offerings to 35 million items, in an effort to better compete with the likes of Amazon. Further upstream in its supply network, Wal-Mart is testing blockchain technology for supply chain management. And as part of a long-standing practice, Wal-Mart partners with suppliers embedded at or near its U.S. headquarters to holistically improve merchandising and customer logistics using network design and planning optimization techniques.

Silicon Valley innovator, HP Inc. returns to the list at No. 19 after separating its printer and PC business from Hewlett Packard Enterprise, which now runs its enterprise computing and services business as an independent company. Freed to put a laser focus on its consumer businesses, HP Inc. turned its attention toward several priorities, including the use of several dozen software-based robots to automate and shorten time-to-answer customer support questions and yield double-digit percent improvements in perfect order commitments and deliveries. HP's supply chain has also enabled a successful ramp up of its Instant Ink solution that allows customers to have their printer ink replenished based on predictive analysis of local device usage patterns. As a longtime advocate for sustainability and workers' rights across its value chain, HP marked another perfect 10 on the CSR component.

Cosmetics giant L'Oréal returns at No. 20. It is transforming itself from solely a manufacturing-based supply chain to a retailer supply chain supporting an increase in e-commerce and company-owned stores. In response, its supply chain is ramping digital capabilities to increase partner integration and new business-to-customer connection and analysis. Upstream, L'Oreal has developed strong supplier planning and collaboration over the years and uses connected solutions to run integrated supplier S&OP. L'Oréal's Sharing Beauty With All program, which is integrated with its broader value chain, sets out sustainability commitments for 2020 and is based on four pillars: innovating sustainably, producing sustainably, living sustainably and developing sustainably. The company has reduced its carbon emissions by 20% over the past five years, while unit shipments have increased more than 20%. It also runs formal programs focused on responsible sourcing and product waste reduction. L'Oréal is a constituent of the 2016 FTSE4Good global index and one of two companies worldwide rated "AAA" by CDP for top marks

Characteristics of leaders

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

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

- **Outside in focus.** Most companies think that they are demand driven and focused on the customer, but the two concepts are not identical. You can be focused on the customer from either an outside-in or inside-out mentality. Leaders start with the customer experience of their supply chain and work their way back through their supply chain designs for an appropriate, profitable response.
- **Embedded innovation.** Indicates a supply chain's close integration into product lifecycle management both internally and with up and downstream partners. There is also the ability to innovate supply chain practices. This means not only adopting and adapting others best practices, but also breaking the rules, defying conventional wisdom and writing new rules for the supply chain community, as a whole. These companies are not afraid to experiment, fast fail in some areas and drive competitive advantage in others.
- **Extended supply chains.** More mature companies are managing multi-tier networks with strong visibility and agility to support rapid changes in demand or disruptions in supply.
- **Excellence addicts.** These companies are never satisfied, even if their performance in an area would be considered world class by objective standards. Most often there is an underlying culture driving this behavior and strong governance mechanisms managed through centers of excellence.

in climate, water and forest management.

Personal care and paper product leader Kimberly-Clark moved up to No. 21, on a nearly three percentage improvement in its three-year weighted average ROA to 11.8%. In North America, Kimberly-Clark captures real-time demand data from more than a dozen retailers to generate its forecasts. In response to changes, supply chain makes short-term adjustments in distribution, inventory and factory production. This capability has enabled much higher demand forecast accuracy, allowing the company to support demand with millions of dollars less finished goods inventory. Another focus for Kimberly-Clark and its supply chain is sustainability. Last year, it announced that it had achieved or surpassed its five-year sustainability goals, including diversion of nearly all manufacturing waste from landfills. At the same time, it introduced new goals through 2022 and is exploring ways to reduce post-consumer waste.

The German luxury automobile maker, BMW, returned for a second year at No. 22, based on strong community opinion polls and a top CSR component score. BMW was named most sustainable automotive company in the most recent Dow Jones Sustainability Index. BMW's Connected Supply Chain program includes innovation initiatives in areas focused on IT connectivity, automated guided vehicles and smart robots, augmented reality, connected vehicle distribution and sustainability. In particular, BMW has invested heavily in smart factory technology, which includes collaborative manufacturing robots. Another key priority for BMW's supply chain team is managing the ecosystem of technology suppliers and partners required to deliver future self-driving cars. BMW intends to field an autonomous vehicle in the next five years that requires zero input from a driver to navigate city and highway roads.

Up eight positions at No.23, and making our top global list for the first time, is U.K.-based beverage leader Diageo. The company operates in a business environment where growth is fueled by product innovation. Much of its success comes from its ability to "innovate fast" and "fail fast." This culture means that the company can be highly innovative while keeping product complexity and cost under control. Diageo uses a creative product assessment technique called "tramlining" to ensure that product and packaging features are competitive relative to market requirements and competitor offerings. It has created similarly innovative techniques in manufacturing to experiment in new markets. Nicknamed "The Cube," Diageo has created pop-up manufacturing by connecting a handful of converted shipping containers as a way to test demand for new drinks while minimizing capital deployment in emerging markets.

Lenovo moves up a slot to No. 24, this year. The Chinese high-tech company has been a leader in the mature PC market for the past few years, and branched out into enterprise servers and mobile devices in pursuit of growth. Lenovo has matured its S&OP process over the years and integrates predictive analytics to simulate threats and opportunities, dramatically improving forecast accuracy and reducing excess and obsolete inventory. Its supply chain has evolved to customer-centric quality measures focused on customer experience versus traditional product-centric quality metrics. Upstream, Lenovo is implementing an enterprise-grade visibility and risk management tool to improve performance in sourcing, manufacturing and logistics. It is also investing in smart manufacturing, including automation, toward a goal to have the most advanced factories in the PC industry.

Dropping significantly to No. 25 is Samsung Electronics. 2016 was a terrible year for the consumer electronics and semiconductor leader. Serious quality issues caused it to discontinue the Galaxy Note 7 smartphone, which was prone to catch fire due to a faulty battery design. On the governance front, its vice chairman was jailed earlier this year for bribing associates of South Korea's impeached former president. Even with all of these negatives, Samsung Electronics, including its supply chain team, is pulling itself up and dusting itself off. Recent record earnings reflect world class semiconductor businesses and a mobile device group that is moving past last year's debacle. Its latest Galaxy S8 smartphones, which have innovative features, launched smoothly.

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 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 best practices and characteristics of leaders to inspire and challenge the supply chain community to new levels of performance.

Technology Spotlight:

The Great DIGITIZATION of Industry

While it's easy to dismiss the "great digitization" of industry as hype, it is already happening faster than expected. In this new report, ARC Advisory presents data about how industrial companies are thinking about digital transformation.

The next several years will bring about the "great digitization" of industry. This will touch nearly every aspect of business as existing systems, jobs and business processes are instrumented, redefined and optimized with artificial intelligence. This transformation will be widespread and far reaching. Information technology (IT), operational technology (OT), engineering technology (ET), supply chain, asset management, services and customer-facing systems will all be affected. Discrete manufacturing, process industries, utilities, energy, infrastructure and more are already beginning the transformation.

Those are pretty big claims. Is it real? Is it overstated? And, if it's real, how long will it take?

Based on research we at ARC conducted at the end of last year, it is indeed real. And, while it will surely take many years to be fully realized, the "great digitization" is already happening faster than many might expect. The second half of this report presents data from our research about how industrial companies are thinking about digital transformation. But first, before we present the research, you can also see the transformation underway in the trends ARC tracks today. Let's take a look.

Advanced analytics and machine learning. The most noticeable and probably most important trend today is the proliferation of advanced analytics and machine learning (artificial intelligence, cognitive computing, etc.). The technology has reached a tipping point and can now deliver value in setting after setting. In turn, this fuels demand for smart connected sensors, digital networks and other ways to collect and move data to the analytics systems—and vice versa. Is mass displacement of workers on the horizon? Perhaps. But it is clear that these technologies will result in substantial change.

BY GREG GORBACH

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Platform vs. platform. Cloud application platforms provide a modern approach for developing and deploying software applications. The approach is gradually displacing the older client/server model, in which large, complex, monolithic applications were created and run. In industrial companies, the client/server model came to dominate both the IT and the OT software spaces in recent decades. The pace of this changeover is accelerating, however, as more and more companies embrace the modern platform approach. This has also sparked a "platform vs. platform" competition in the marketplace, with large suppliers seeking to establish the dominant platform ecosystem and the broadest library of third-party applications and smaller suppliers trying to figure out just how they should compete in the emerging environment.

Open systems. We can see the drive toward open systems in two levels: the platforms/apps level and the automation level. At the platform/apps level, many of the competing cloud platforms are based on the open source Cloud Foundry platform. At the automation level, The Open Group is the primary mover behind an open process automation initiative, although Namur has a complementary effort in progress.

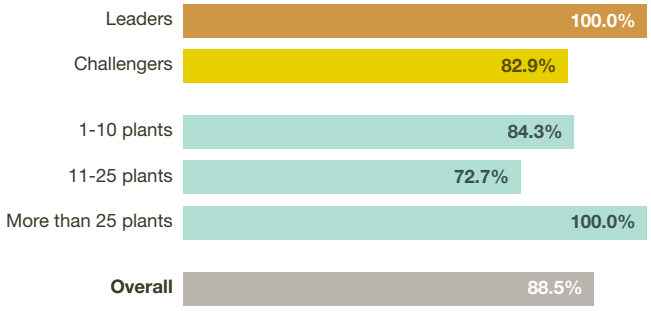
Supply chain digitization. As the digitization of the supply chain progresses, new approaches are disrupting established business models. Omni-channel retailing uses a variety of channels in a customer's shopping experience, including research before a purchase. These channels include retail stores, online stores, mobile stores, mobile app stores and telephone sales. The customer dictates how a transaction occurs. Digitized systems and processes facilitate the customer journey to transact and be served. Digitization also enables personalization of products and services, and customers increasingly seek out personalized products or prefer to shop where they can select from larger assortments of SKUs. Autonomous vehicles and enhanced product, pallet and container tracking and real-time status are also making inroads in warehouses and on the highways.

Edge and fog. Cloud-only approaches can no longer keep up with the volume, latency, mobility, reliability, security, privacy and network bandwidth challenges of the industrial plant. Fog computing distributes computing, communication, control and storage closer to where the data originates, enabling faster processing times and lowering network costs. Fog pools the resources and data sources between devices that reside at the edge and other nodes in the network, where edge tends to be limited to a small number of layers. Any device with computing, storage and network connectivity—such as industrial controllers, switches, routers, embedded servers and video surveillance cameras - can be a fog node.

FIGURE 1

Importance of achieving digital transformation

In your opinion, how important is achieving a digital transformation to your company's future success? (Chart reflects those answering "important" or "very important")



Source: ARC Advisory Group

Smart products and services. By offering smart, connected products, manufacturers can position themselves to improve their customers' experiences with their products. Digitization enables manufacturers to improve the performance of their service operations through remote connectivity and enables predictive maintenance; continuous uptime; rapid service response; and the opportunity to offer incremental, revenue-producing products and services.

Outcomes. Another trend is the migration from selling products to selling the value of the product, or product-as-a-service. Examples include an aircraft engine builder billing airlines on the amount of thrust provided, instead of just an aircraft engine and a maintenance contract. A compressor company sells compressed air as a service, instead of compressors.

By selling outcomes or product-as-a-service, a manufacturer or OEM retains ownership of the asset itself, and provides all required maintenance, service and repair to meet agreed-upon service level agreement (SLA) levels.

Smart factories, plants and operations. In plant operations, digitization means we must recognize that digitization involves connectivity to much more than the production machines and systems. Wearables, augmented reality helmets or glasses, mobile devices, smart carriers, smart containers, smart components, smart products, autonomous machines, video, third-party services, social applications, additive manufacturing, voice control, remote sensing and more are now an active part of the real-time, data-rich environment in the plant. Autonomous inventory movers can navigate independently throughout the manufacturing plant, delivering components where needed and on time. Still, connectivity only improves performance when advanced analytics and execution software are also applied.

Additive manufacturing. Additive manufacturing continues to make unbelievable strides towards the manufacturing mainstream. It has progressed farther and faster than almost anyone foresaw. Driven by materials science and design software advances, this technology can already build optimum parts—in significant volume—that cannot be made any other way. The hype around 3D printing may have died down, but it may be the most potentially disruptive technology in manufacturing. Companies that neither prepared for (nor anticipated) its emergence on an industrial scale could soon find themselves at a significant disadvantage.

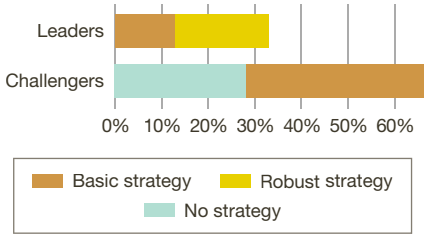
Asset performance management. Improving asset performance can improve efficiencies in two main areas: enhancing production performance and offering new business models and services based on smart, connected products. That being the case, it's no surprise to find many solutions focused on predictive maintenance, asset analytics and asset management. There are opportunities to better utilize assets, coordinate with operating and business needs, improve the availability of replacement parts and improve the efficiency of field service groups. Equipment manufacturers are rapidly adopting IoT to offer asset health monitoring and predictive maintenance subscriptions to create new sources of aftermarket revenue.

Smart environments. A smart city is connected,

intelligent and optimized by a municipality to reduce costs, increase safety, attract investment, be sustainable and enhance livability. Smart cities depend upon the digital transformation of assets and the deployment of sensor networks with ubiquitous multi-modal connectivity smart governance. Smart cities present tremendous opportunities for Industrial IoT (IIoT)—but challenges abound. Technology innovation often outpaces policy, including standards for data privacy. The bureaucratic red tape involved with government contracts also remains a major obstacle. Startups with novel solutions are shut out of the contract process and the transition to service-based models does not align with the often archaic government thinking and processes. Nevertheless, the trend toward smart cities is clear.

FIGURE 2

Digital transformation strategy



Source: ARC Advisory Group

By the numbers

As we mentioned in the beginning, ARC conducted research in Q4 of 2016 intended to shed light upon the digital transformation of industry. We wanted to learn more about current perceptions and attitudes about digitization and the prospects for digital transformation. We also wanted to get a sense of the uptake in Industrial Internet of Things (IIoT) in the industrial space. What are the potential benefits? What are the hurdles to be overcome?

We asked respondents to interpret "digital transformation" in a broad sense: planning and implementing solutions for improving factory, distribution, transportation, inventory/demand and procurement operations; as well as smart connected products and related services. We attempted to get a picture that included the whole technology stack—including Cloud and analytics—not just device or asset connectivity. And we asked that, for this research, terms such as Industrial Internet of Things (IIoT), Industrie 4.0, Smart Manufacturing and digital transformation should be considered as equivalent and interchangeable.

We characterized respondents with a good IIoT/digital strategy and roadmap, and with a high degree of satisfaction with their company's progress toward digitization as "leaders." The others are "challengers." Respondents revealed some interesting differences between the two groups. For example, half as many leaders cite lack of management vision as a hurdle, compared to challengers. Similarly, about half as many see lack of budget as a hurdle, compared to challengers.

Near-universal belief that achieving digital transformation is critical to success. There is a broad recognition that it is not only possible to achieve digital transformation, but important to do so. Virtually all the leaders in our survey, and all of the companies with more than 25 plants, certainly think so (Figure 1). Most challengers agree as well by a wide margin. Interestingly, companies with between 11 and 25 plants weren't quite as sure, but it's unclear why. The main takeaway here is that when it comes to the question "is this real?" the evidence suggests that there is no longer any doubt.

Leading companies have a more robust digital transformation strategy. It may seem obvious that digital transformation leaders overall have more robust strategies than challengers. The results confirm it. All the leaders have at least a basic strategy for digitizing their companies, and none of the challengers have a robust strategy for doing so. Among the leading companies, more than half claimed to have a fairly robust strategy (Figure 2). Leaders were found in both process and discrete industry sectors, in roughly equal measure. Digitization is important across the board, and all sectors are responding.

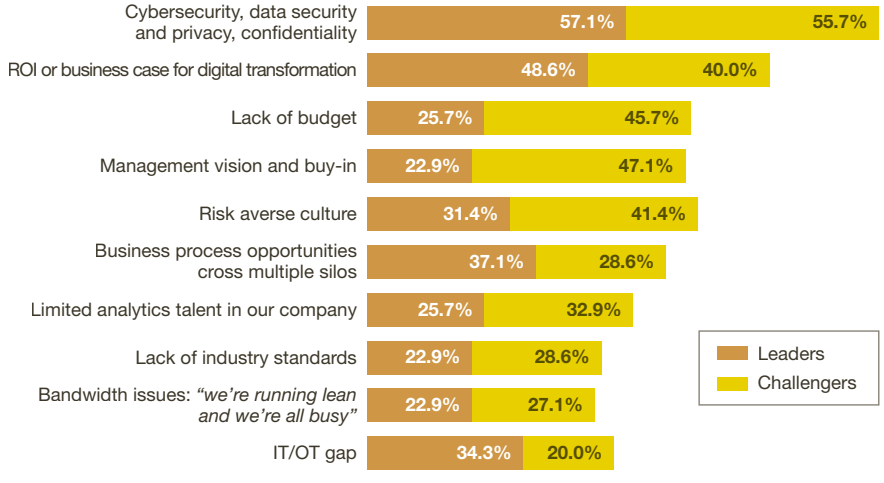
Large companies and leaders are satisfied with their digital transformation progress. While large companies are generally satisfied with their progress in executing their strategy and roadmap for digitizing, small and mid-size companies are not. Both leaders and large companies feel they are making decent progress toward digitization, while small and mid-size companies don't think so. This could be due to two factors that may be showing up to a greater degree in small and mid-size companies: lack of budget and limited management vision about the need and promise of digitization.

Top hurdles to overcome. Despite a great deal of industry activity, some real progress, and growing comfort with the Cloud, issues related to cyber-security, data security and privacy and confidentiality still lead the list of

hurdles to be overcome. Approximately 55% of the respondents cited this as a hurdle (19% of Leaders and 36% of Challengers). Put another way, 45% of respondents did not cite this as a hurdle—which suggests that while this is an important concern, it is not necessarily a show stopper.

FIGURE 3

Top hurdles to be overcome for digital transformation



Source: ARC Advisory Group

With all the digitization activity currently under way, this shouldn't be surprising (Figure 3).

Another group of leading hurdles or obstacles relate to technology issues arising from the fact that today's plants aren't highly connected yet. It's a big part of the digitization work to be done. These include:

- lack of strategy for dealing with legacy systems and equipment;
- limited availability of machine health data; and
- complexity of potential solution space (where to focus).

The other leading hurdles are not about technology, but relate to normal business issues:

- lack of budget;
- management vision and buy-in; and
- ROI or business case for digital transformation.

It's worth taking the time to examine the rest of the hurdles in the chart, not because any one stands out as a show stopper, but because this list is a pretty good proxy for the kinds of issues that might arise in any digitization journey, and it is a good idea to think them through in advance.

Business transformation opportunities. The move to digitization has been sold, at least in part, based on the possibility of significantly improving or transforming the business. About half of the respondents see opportunities for new business models and revenue streams, as well as opportunities for improving business responsiveness and agility (Figure 4). ARC frequently sees this expressed as "moving closer to the customer."

It is sometimes realized through new service offerings based on connected products or other customer needs. For example, in the paints and coatings market, companies have begun offering online design services to help customers select and visualize color schemes in advance. An element of creativity and innovation is needed to bring about a business transformation. Even though they may not quite see the shape of the change, about 40% of respondents see opportunities to grow existing markets, increase market share, or create new markets.

Performance improvement opportunities. It is useful to examine the expected performance improvement opportunities from the perspective of the respondent. Here we look at the top performance improvement opportunities identified by those whose focus is business, supply chain, operations, and engineering and maintenance.

From a business perspective, plant operating performance tops the list, but operating performance is also important. The supply chain group sticks to its "knitting," identifying related opportunities as top opportunities in this order: demand forecasting, inventory optimization, warehouse operating performance, sustainability and compliance and transportation operating performance

Those whose focus is operations identify a mix of supply chain and operations opportunities: inventory optimization, plant operating performance, demand forecasting and warehouse operations performance. The engineering and maintenance group identified plant operating performance, inventory optimization and sustainability and compliance as opportunities. There are some differences, but it is encouraging to see that these groups are largely aligned in their assessments of opportunities—even

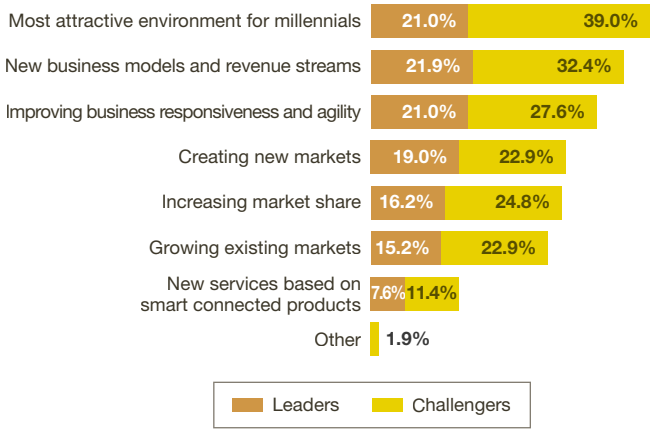
though the supply chain group clearly sees the most opportunities in their own domain.

Product improvement opportunities. For discrete manufacturers that make machines, appliances and the like, a broad agreement that opportunities abound for improving the products through digitization. This applies not only to new products. Add-on connectivity solutions for products already in the field are also seen as a big opportunity. There are also some big opportunities related to the data provided by these newly-connected products: the chance to improve product designs based on in-service operation performance data, the chance to increase sales of replacement parts and supplies, and the chance to reduce warranty costs by predicting the need for maintenance in advance of failures.

These companies also stand to improve overall product quality and reduce energy consumption, as well as improving product performance by engineering for software-defined functions in the products themselves.

FIGURE 4

Business transformation opportunities



Source: ARC Advisory Group

It's time to act

Regardless of the specific terminology you might use (Industrial Internet of Things, Industrie 4.0, Smart Manufacturing, Digital Transformation, etc.), there is widespread and growing recognition among industrial companies that things are changing. Leading companies already have a robust strategy for digital transformation, along with a realizable roadmap. While many are making good progress in executing the strategy and roadmap, there are some important hurdles to be overcome, notably cyber-security, data security and privacy, and data confidentiality.

Companies also cite the lack of a clear ROI or business case for digitization as another significant hurdle. Challengers report that another set of interrelated hurdles impedes their progress: lack of budget, lack of management vision and buy-in and a more risk-averse culture. ARC sees this among some of our clients as well, but we recognize that it may be due to these companies being a little farther behind on the adoption curve. Nevertheless, many if not most of these companies are actively putting digitization strategies and roadmaps in place.

On the opposite side of the scale, companies do recognize that with the connectivity and advanced analytics of digitization, substantial performance improvements and transformational opportunities for their business may be within reach. ARC's assessment is that like any innovation, this is still an area that needs an imaginative leap before the path to a big transformation can be seen.

Based on ARC research and analysis, we recommend the following:

- Industrial companies should look for areas of improvement within production operations; especially in optimizing maintenance and asset performance, and optimizing production.
- Companies that manufacture discrete products such as appliances or vehicles or industrial machines should also look for opportunities to build smart, connected products, and opportunities to offer new services or outcome-based delivery models to move closer to customers.
- Invest in learning about modern platforms, advanced analytics, machine learning, and other technologies of digitization. Start hands-on pilot programs if you haven't already done so.
- Be sure to consider all aspects of the coming great digitization. Production operations is a good place to start, but design and engineering, supply chain, customer service, and business operations will all soon undergo a digital transformation.

If our research reveals anything, it's that industry leaders—your competitors—have a digital strategy in place and are moving forward. For companies that intend to compete in the future, now is the time to act.

Wal-Mart's Omni-channel Synergy

When it comes to online and offline distribution, Wal-Mart has chosen synergy over integration. Other brick-and-mortar retailers can learn from Bentonville's approach.

BY STANLEY FREDERICK W.T. LIM, LINA WANG AND JAGJIT SINGH SRAI

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"We'll be the first to deliver a seamless shopping experience at scale: No matter how you choose to shop at Wal-Mart—in stores, online, mobile or a combination—it will be fast and easy." –Wal-Mart 3-Year Growth Plan

Retail has always been competitive. But, with the rise of pure-play e-commerce giants like Amazon, an over-abundance of retail stores and an ever-changing consumer, it's hard to imagine a tougher environment for brick-and-mortar retailers.

Jumping into e-commerce is no longer an option for any major retailer that wants to survive. As a result, many are hatching plans to integrate the different distribution channels of their businesses in order to compete in the new retail landscape, what we've come to think of as omni-channel distribution. We think there's a better way. Rather than integration, which can take time to accomplish, the goal should be to create a seamless synergy between the different functions of the organization—perhaps we can call it "synergization."

Our aim in the following pages is to establish that the perfect execution of the omni-channel customer experience is better implemented through omni-channel synergy than omni-channel integration, which has certain drawbacks. In fact, being "overly integrated" could result in rigidity and tardiness in responding to a fast-changing retail environment that is driven by changing consumption patterns and new technologies such as the Internet of Things and Artificial Intelligence.

What's the difference? For the purposes of this article, we think of organizational integration as the extent to which distinct and interdependent organizational components constitute a unified whole. Integration happens when a company's functional areas (e.g. marketing and operations), internal (e.g. systems and structure) and external (e.g. business model) factors are successfully meshed, suggesting a tight coupling among them. Synergy, on the other hand, is the condition that exists when an organization's functional areas and resources interact to produce a joint effect that is greater than the sum of the individual parts. Within the strategic and operations management literature, the concept of synergy across complex networks comprising multiple entities suggests they can lead to additional tangible and intangible benefits through appropriate network configurations, leveraging shared resources, innovations, knowledge and image. The application of the synergy concept to the omni-channel distribution context can provide insights on recent developments in this fast-moving sector.

Perhaps the best example of synergization across a distribution network is Wal-Mart Stores Inc., the world's largest retailer with nearly 4,700 stores and annual sales revenue of more than $485 billion. While Wal-Mart, like other brick-and-mortar retailers, has had its share of misfires in the evolving retail market, it is making what we believe to be great strides to deliver the "seamless shopping experience at scale" described in its three year growth plan. Wal-Mart's winning omni-channel strategy looks something like the illustration in Figure 1.

Based on a series of interviews with Wal-Mart managers, coupled with secondary data from published reports, news articles and recent press releases, we will discuss in sequence the three areas of synergy that constitute Wal-Mart's efforts: (1) Organizational realignment; (2) omni-channel distribution; and (3) key enablers.

It is a formula that other retailers may want to emulate in their supply chains.

Why synergy?

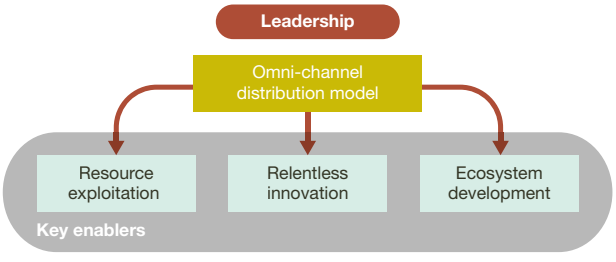
There's a reason that a new approach to omni-channel distribution is so important. With the rise of mobile shopping on laptops, tablets and smartphones, consumers now have instant and easy access to a variety of channels for shopping besides the traditional retail store. Providing them with a seamless shopping experience and content-driven communication has become a new imperative. According to statistics published by Invesp: retail organizations that have implemented "omni-channel engagement strategies retain on average 89% of their customers, compared to 33% for companies with weak omni-channel customer engagement."

Similarly, the consulting firm PwC predicts that by 2020, the omni-channel customer experience will be enhanced by the need for accurate execution. Many consumer-facing organizations are trying to solve this puzzle by integrating the different channels in which they serve the customer, such as purchases in the store or made on a laptop or smartphone. But customers don't think in terms of channels. Instead, they want a consistent shopping experience, regardless of how they shop. A survey by eMarketer, for instance, reveals that during holiday shopping, consumers purchase almost equally from online and offline channels (Figure 2). Therefore, we need to think of consumers as traveling on a buying journey and think of how to make this journey as experiential and effortless as possible.

That's where the idea of synergy comes into play. While synergy is not always preferable to integration across channels, we recognize that in a volatile environment, integration requires time to produce results. In a fast-paced retail environment, time is a precious commodity that is often in short supply; moreover, a retailer runs the risk of capability atrophy once the implementation is complete. After all, a solution designed today may no longer meet a retailer's needs a year from now when the integration is complete. Meanwhile, synergy delivers a means to respond to the needs of the market and generate quick leverage in the omni-channel context. That's the lesson to be learned from Wal-Mart.

FIGURE 1

Wal-Mart's winning omni-channel strategy



Source: Authors

Let's look at the three components of Wal-Mart's approach to omni-channel synergy.

Synergy Area 1. Organizational Realignment: Rewiring key leadership

"Our customers don't distinguish between a Wal-Mart store and Wal-Mart.com. They only see one Wal-Mart. So we need a strategy based around serving customers however they want to shop, and we've changed our planning approach to take an enterprise view." C. Douglas McMillon, president and CEO, Wal-Mart Stores, Inc.

Since taking over the C-Suite in 2014, Doug McMillon has overseen a "synergization" masterplan that brings together Wal-Mart's stores with its logistics network and digital commerce capabilities. The point of this new alignment is to empower customers to shop whenever, wherever and however they want. As part of that enterprise view of planning, the retailer undertook a three-part organizational realignment.

Establishment of cross-functional business units. Central to the plan was the establishment of dedicated business units in planning, merchandising, replenishment and fulfillment to support e-commerce operations. That was a departure from the previous approach in which e-commerce shared resources with its offline operations.

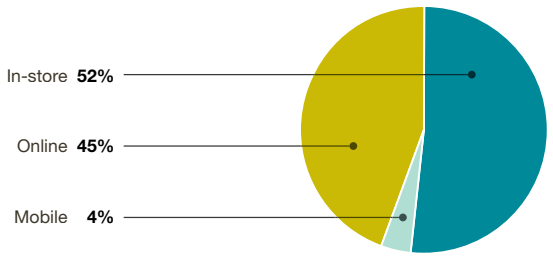
The merging of previously compartmentalized expertise within the various functional units combined expertise to enable better performance across all channels. "Inside the company, we think about this: if we pull e-commerce and stores too far apart, we may confuse the customer," McMillon told the management and consulting firm Innosight in 2014. "If we coordinate our efforts too much, the larger core may diminish the progress on new capabilities. That's why striking the right balance is so important."

Key performance indicators to reflect a "single" channel. Up until 2016, offline and online channels relied on separate performance measurement systems and were measured by their own sets of key performance indicators (KPIs). Because e-commerce sales account for just 2% of overall sales in the United States, the resources allocated by corporate to this channel had been limited. However, as Wal-Mart began to strengthen its customer proposition by delivering low prices, high access, wide assortments and a pleasant experience, a single integrated channel was developed with a single measurement system where sales performance is tracked through Wal-Mart's four anchor channels: Those are Ship to Store, Ship from Store, Pickup Today and Ship to Customer. These four channels are used extensively by customers, with some 70% of online U.S. shoppers using a portal to place an order that is picked up in a store, and provide a better performance tracking system.

FIGURE 2

Channels for impulse purchase

Primary device/location where U.S. internet users plan to complete their holiday shopping, December 2016 (% of respondents)



Source: Market Track, "Shopper Insights Survey 2016" conducted by Quantrics, December 15, 2016

Powering up e-commerce leadership. In 2017, Wal-Mart announced a new blended leadership structure in which the retailer's U.S. chief marketing officer leads the marketing strategies over Wal-Mart Stores, Wal-Mart e-commerce and Jet.com to bring synergy. Additionally, Marc Lore, the co-founder and former CEO of Jet.com oversees Wal-Mart e-commerce and Jet.com. Lore brought with him a coterie of senior managers from Jet.com, including Nate Faust, Jet.com's former chief operating officer. As the senior vice president for e-commerce and supply chain for Wal-Mart U.S., Faust oversees all logistics and supply chain activities supporting both offline and online channel requirements. Communication was an important element of this effort, as employees received memos from top leadership explaining the changes that were made to blend online and retail leadership.

Synergy Area 2. Managing the flow of merchandise and information

Creating a seamless face to the customer is one side of the omni-channel challenge. The other side is a supply chain with the capacity and processes to source, manage and deliver inventory across all of the supply channels, which can include merchandise sourced by Wal-Mart (First Party, or 1P), merchandise offered by third parties on Wal-Mart's marketplace and merchandise offered for sale on one of Wal-Mart's Websites that is shipped directly from a supplier. To that end, Wal-Mart launched an initiative designed to ensure the consistent flow of goods to the customer.

Synergizing at the supply-side. Following the acquisition of Jet.com, the plan developed by Marc Lore to restructure Wal-Mart's omni-channel operations included the acquisition of a number of specialty online retailers, such as ShoeBuy, MooseJaw, ModCloth and Hayneedle. But more than that, all of the merchandise available in Wal-Mart stores was made available online to e-commerce customers, with the exception of a few items that require special handling.

This approach allows Wal-Mart to realize economies of scale in negotiations with suppliers and expand the bargaining power of its incumbent store merchandising team. Now, store and online buyers are closer to each other, with the former also contributing to the online business. Together, they make their purchases from store and online, while the online merchandising team manages the consumer-facing 1P and third-party (3P) marketplace inventory.

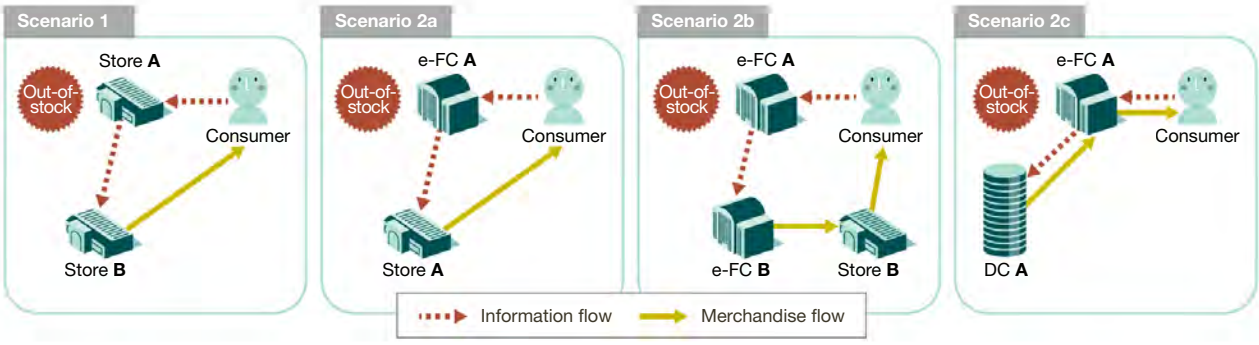
Wal-Mart also launched an effort to enhance the content related to online and offline merchandise, regardless of which channel a customer chooses to shop. To that end, Wal-Mart is using a content management platform from Salsify, which gives a common interface the suppliers who publish product-related content to Wal-Mart channels. Digital content, including pictures, product descriptions and other related information, can be uploaded in a matter of minutes. That content is then available to consumers as they shop online, through mobile devices or using in-store systems.

Up-to-date and accurate content is a crucial component of the seamless shopping journey we described at the beginning of this article, according to Rob Gonzalez, co-founder of Salsify. "Digital product content affects not only online commerce, but also the mobile and in-store experience," Gonzalez says. "Providing consumers with clear and compelling product information is important for the entire buyer's journey."

Dynamic merchandise flow management. Wal-Mart's ecosystem of distribution networks, transportation resources and sophisticated inventory management, planning and replenishment systems has long been considered its competitive advantage. Indeed, at one point, Wal-Mart was thought of as a supply chain and technology company as much as it was considered a retailer. Its ability to dynamically manage the flow of merchandise through its distribution and fulfillment centers to its stores and end-customers positions it as one of the market leaders capable of delivering anything ordered by a consumer anywhere and at any time.

FIGURE 3

Dynamic merchandise flow management in action



e-FC: e-commerce fulfillment center **DC:** Distribution center

Source: Authors

The scenarios in Figure 3 illustrate the point. In the first scenario, a consumer places an online order via the Ship from Store delivery mode. Once Wal-Mart's order management system realizes the item is out of stock in the selected store, the order is instantaneously directed to the nearest store with available stock and the ability to deliver the order based on the consumer's expected lead time.

In the second scenario, the e-commerce fulfillment center tasked to fulfill an online order experiences an out-of-stock situation. In this instance, order fulfillment is dynamically rerouted to the nearest (a) physical store, (b) alternate e-commerce fulfillment center or (c) one of Wal-Mart's distribution center. Once a fulfilment location is chosen, the system selects a delivery mode based on the lowest delivery cost that can meet the promised delivery date. Above all, inventory balancing occurs at regular intervals across the fulfillment centers and stores to optimize inventory availability across the entire network. This is critical as the online channel often experience excess stocks due to demand uncertainty.

According to CEO McMillon, the system has enabled Wal-Mart's distribution and logistics engine to execute on promotions, especially during the critical peak season when consumer expectations are at the highest. "One great example was on the morning of Black Friday, when we saw a Smart TV sell out online within 20 minutes," McMillon recalled in an interview. "We had another TV from that supplier available in stores, so we dialed up the promotion on walmart.com and made it available for store pickup. The item quickly sold out in stores. To customers, it was a seamless access to a gift they wanted."

When it comes to last-mile delivery, Wal-Mart constantly benchmarks its cost-to-serve the home delivery shopper via fulfillment from the warehouse compared to fulfillment from the store. Figure 4 illustrates the competitive advantage delivered by Wal-Mart's distribution network compared to a pure-play e-tailer such as Amazon and another bricks and-mortar retailer with online presence such as Target.

Information flow management. Wal-Mart utilizes several different automated systems to manage the flow of information to its suppliers. Using the SPARC mobile app, for instance, suppliers can view stock levels in specific location in real time. Wal-Mart's proprietary Global Data Synchronization Network (GDSN) platform securely provides continuous synchronization of accurate product and location information. The framework can be used to automatically communicate and add products via the Synchronized Item Network. Fig. 5 depicts Wal-Mart's high-level information flow diagramming.

With over 2,000 suppliers in the network, Retail Link, Wal-Mart's inventory management system, has long been used as a collaborative planning, forecasting and replenishment engine for its brick-and-mortar stores, while the e-commerce team at San Bruno uses a dedicated and proprietary system developed by Wal-Mart Lab. Overall, order information across online and offline channels is synchronized in real-time across the e-commerce fulfillment centers and the store distribution network. In the future, Wal-Mart plans to change its manual exchange of data between the stores and the e-commerce channels. Those changes will be implemented in stages.

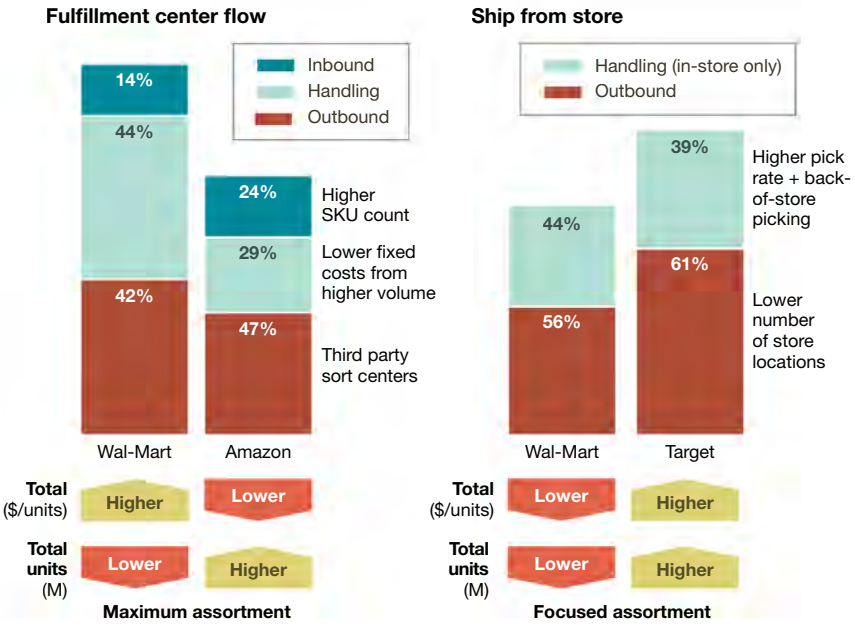
Given the rapid growth in the online business, coupled with high demand uncertainty affecting investment risks, Wal-Mart utilizes a range of service providers to subsidize its

in-house technology infrastructure. It uses these arrangements as test labs for future technological acquisitions. These specialized service providers often provide quick prototyping and support electronic data interchange with suppliers as a way to assess the feasibility of a particular technological solution.

For example, using a pre-wired plug-in integration from SPS Commerce, suppliers can now exchange item, inventory and fulfillment information with Wal-Mart. Further, these solution providers, often recommended by Wal-Mart, offer marketplace suppliers a full suite of integration solutions ranging from item set-up to inventory and order fulfillment to pricing, all of which increase the inter-firm operability due to common interfacing.

FIGURE 4

Wal-Mart's logistics cost-to-serve benchmark for general merchandise



Note: Figures provided as a percentage of total cost-to-serve. Actual values not provided to maintain confidentiality

Source: Authors

Synergy Area 3. Key enablers: Resource exploitation, relentless innovation and ecosystem development

Wal-Mart has what is arguably the largest retail logistics and distribution network in the United States to serve its different channels of business. How Wal-Mart exploits those resources, while continuing to innovate and expand its ecosystem is a key enabler of its ability to meet the objective laid out in its three-year plan: to deliver a seamless shopping experience at scale, no matter how a consumer chooses to shop at Wal-Mart.

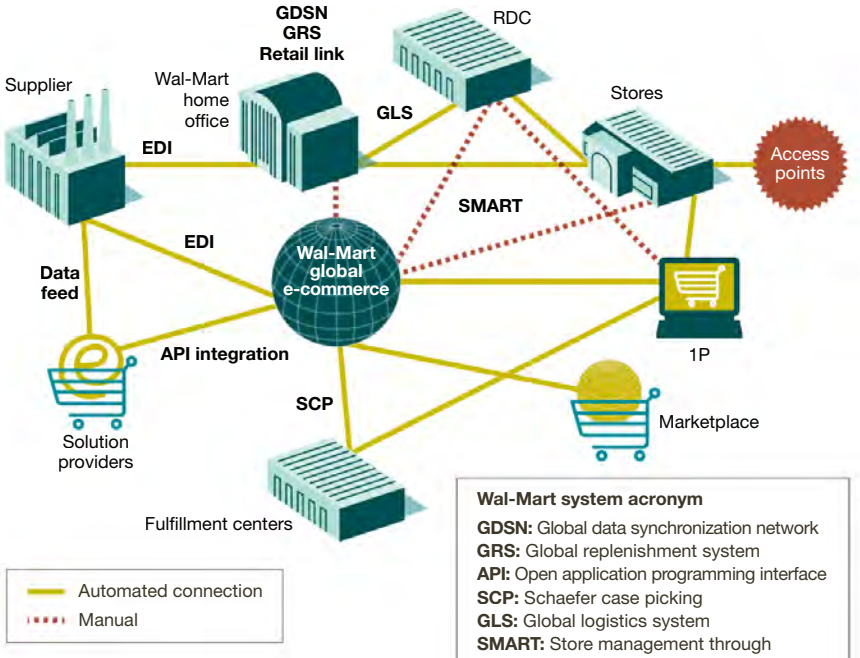
Resource exploitation. Whether you are looking at its online or brick-and-mortar presence, Wal-Mart's physical footprint is huge. In addition to distribution centers serving nearly 4,700 stores, at the time of this writing, Wal-Mart has six fulfillment centers and 86 stores equipped with online fulfillment capability for its ship-from-store program. It can also access the remaining stores as needed to improve delivery lead times. Leveraging its store presence not only reduces the associated last-mile delivery costs, but also creates opportunities to offer value-added services such as in-store pickup and return.

Wal-Mart also leverages its private fleet to haul online shipments directly to the stores as part of its regular replenishment deliveries, bringing the cost-to-ship to as low as $1 per package. That allows Wal-Mart to offer discounts for store pick up that might also increase foot traffic and generate opportunities for additional sales. The initiative works because 90% of the U.S. population lives within a 10-mile radius of a Wal-Mart store for a density of 16 stores per million population (see Figure 6). "Only Wal-Mart can bring together a dense network of stores, supported by a supply chain and systems like ours, with an emerging set of digital capabilities to win with customers," CEO McMillon has said.

Relentless innovation. Wal-Mart's reliance on innovation is evident in its omni-channel efforts. Innovations just over the last two years include a test of an on-demand last-mile delivery service with Uber and Lyft; the opening of a Culinary & Innovation Center to test private label food products; the roll out of the Scan & Go app that

FIGURE 5

High-level information flow diagramming



Source: Authors

allows Sam's Club members to scan and pay for items on their smart phones while shopping, bypassing the checkout line; and an application for a patent for an automatic home ordering subscription system.

Yet, as all companies know, in a fast-moving industry, speed to market rules. To counter that, Wal-Mart has adopted a smart acquisition strategy to bring in expertise now from outside the organization rather than devote time to build it in-house (see Fig. 7 for timeline of selected Wal-Mart's recent acquisitions). Some experts have argued that the acquisition of Jet.com could turn Wal-Mart into the world's leading omni-channel retailer. Moreover, acquisitions like Jet.com, Modcloth and Moosejaw open up Wal-Mart to a millennial customer base that doesn't presently shop in its stores. They also strengthen Wal-Mart by bringing in talent in emerging areas like analytics and mobile commerce.

Ecosystem development and sustenance. Wal-Mart has created an ecosystem that includes a marketplace for 3P vendors as well as a vendor dropship program that works seamlessly to fulfill orders placed by customers. Last year, over 1,000 3P sellers helped Wal-Mart reduce its inventory costs while still serving its customers. The network of third party partners also gave customers access to some 50 million different items as of the end of the first quarter in 2017, compared to 10 million items in 2016. With the addition of an estimated 1 million new SKUs per month, Wal-Mart is making up lost ground against Amazon's vast online assortment.

Notwithstanding, 25% of e-commerce volume is fulfilled directly via the dropship vendor partner program, where vendors ship direct to customers on behalf of Wal-Mart while Wal-Mart handles customer services and returns. While the program meets today's need, it is not part of Wal-Mart's long-term strategy. On the contrary, the retailer is aiming to own the inventory and fulfillment process in the future in order to better control customer experience.

Strive for synergy over integration

Our aim in this article is to demonstrate that synergy is a more effective strategy than integration in the new world of omni-channel retailing and fulfillment. The insights gained from Wal-Mart can be used by brands, retailers and supply chain managers in their own organizations to offer omni-channel experience in an optimized way. Following are our takeaways.

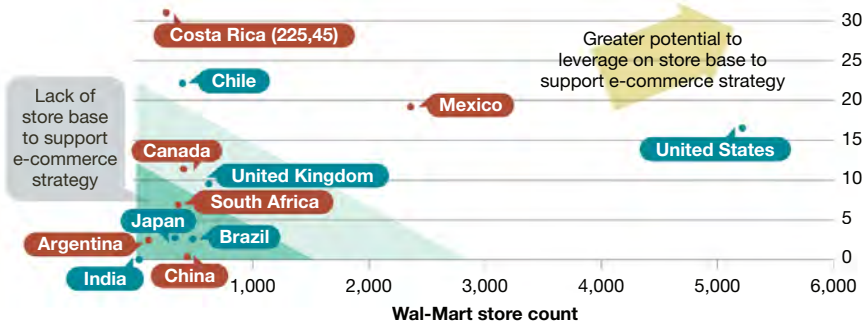
1. Organizational leadership alignment with company's mission and vision: Top-down and bottom-up collaboration. There must be synergy between top-down leadership and bottom-up execution to bring about real change. Consistent goals must be prepared for each level with the appropriate allocation of resources. Leadership should also be changed if the existing one is causing a hindrance to the implementation of omni-channel efforts.

2. Channel-agnostic KPIs. Performance measurement systems should be in line with the omni-channel efforts of the company. In the case of Wal-Mart, a change in KPIs gave the retailer better insight into its sales and

FIGURE 6

Wal-Mart's store density

(Number of stores per million population)



Note: Store count as of January 31, 2016. Population based on 2015 estimates.

Source: Authors

performance. That led to changes that strengthened its seamless customer experience.

3. Joint merchandising and replenishment plan: Develop economies of scale and strengthen buying power. Retailers should not operate product merchandizing separately for online and offline demand regardless of demand imbalances. Recall that Wal-Mart performs merchandising and replenishment at the joint level when interfacing with vendors and suppliers, using forecasts made at the channel and product level. The goal is to maximize economies of scale by leveraging a retailer's aggregate buying and negotiation power.

4. Joint inventory and fulfillment management. In turn, inventory management and fulfillment should also take a network perspective to maximize availability. Wal-Mart's approach to dynamic merchandise flow management illustrates how demand can be fulfilled using the whole network, without restricting it to channel-based inventory. In this way, stock-outs are reduced while raising customer satisfaction.

5. Enterprise-wide network visibility: Across channels and stakeholders. The brand must own a suitable IT and infrastructure to enable enterprise-wide network visibility across channels and across key stakeholders (e.g. suppliers and customers) so that consistent and timely information is presented to end customers. In that way, any hiccups during the distribution process can be addressed instantaneously.

6. Resource exploitation. Not every company has access to the resources available to Wal-Mart, but whatever they possess should be utilized carefully so that there are no redundancies. Moreover, identify any source of competitive advantage, exploit the advantage and do not overly diversify, diluting the concentration of any competitive advantage.

7. Innovate continuously and make smart acquisitions. When organic growth is not possible, innovations and acquisitions extend the talent pool. To that end, Wal-Mart acquired Jet.com and other selected online specialty retailers to fuel the development of its e-commerce capability despite having the scale to develop in-house.

8. Develop and sustain your own ecosystem. An ecosystem of the right suppliers can give your company a competitive advantage in the future. In the case of Wal-Mart, that led to the development of its 3P marketplace and 1P ecosystem, while reducing product ownership and exposures to associated inventory risks.

If you think retail is competitive now, just imagine what it will be like in the future. Supply chain managers who intend to thrive in this emerging economy should rethink the concept of integration versus synergy and restructure their operations in a way that promotes operational efficiencies without comprising organizational nimbleness; it's critical to staying relevant in the evolving retail landscape.

FIGURE 7

Timeline for Wal-Mart's e-commerce acquisitions

Source: Company reports, Fung Global Retail & Technology

HOW TO BUILD A SUPPLY CHAIN CHAMPION

Want to avoid striking out? Supply chain managers can learn plenty from Theo Epstein's 5R approach to building a championship baseball team.

On November 2, 2016, the Chicago Cubs did the unthinkable:

They won the World Series after coming back from a 1-3 deficit to the Cleveland Indians. For Cubs fans, the victory marked the end of a 108-year streak of competitive futility. Although the Cubs game seven, extra-inning victory is inspirational, you may be wondering: "As a supply chain professional, why should I care?" Answer: Because Theo Epstein, the Cubs President of Baseball Operations, knows how to build a championship team, a task that is likely high on your to-do list. Vitally, Epstein's role in the Cubs turnaround wasn't a fluke. In 2004, Epstein, as Red Sox General Manager, helped Boston vanquish the Curse of the Bambino and end an 86-year title drought.

Deciphering how Theo Epstein took the Cubs, a perennial loser, to a World Series championship has been a hot topic in the sports world. Based on our 20-plus years working with supply chain leaders, we argue that Theo Epstein's job assembling a champion on the field is a model for the supply chain leader's quest to build a winning supply chain. Let's take a closer look at how Epstein transformed the Cubs into champions. His approach highlights five principles of supply chain design that we call the 5Rs (Figure 1). The 5Rs have enabled companies from Amazon to Zara to win on the world's toughest playing field—today's global marketplace.

BY STANLEY E. FAWCETT, A. MICHAEL KNEMEYER , AMYDEE M. FAWCETT AND SEBASTIAN BROCKHAUS

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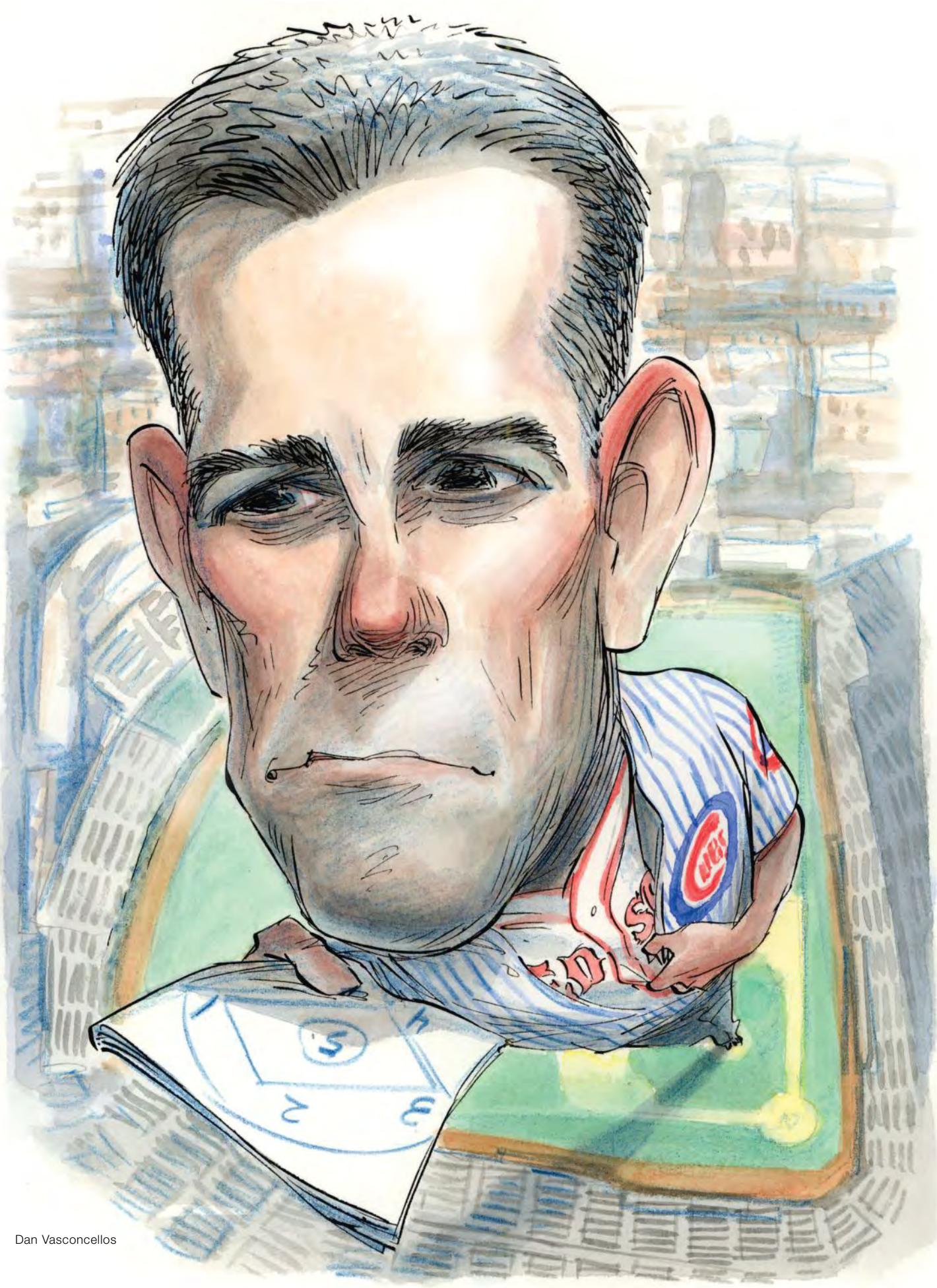
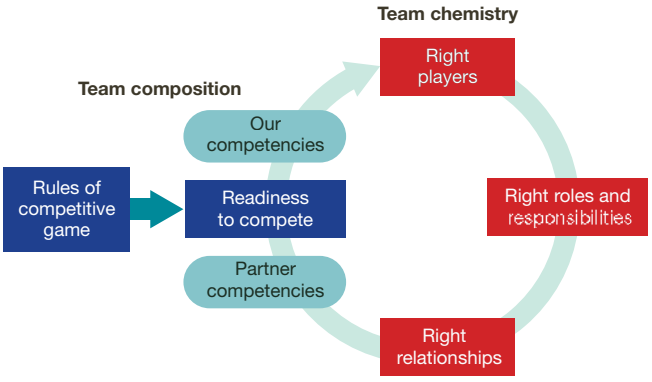


Dan Vasconcellos

FIGURE 1

The 5Rs of supply chain excellence



Source: Authors

Know the rules and break them when necessary

If you want to win on the baseball field—or in the marketplace—you need to know the rules of the game. The rules define not just your strategy and value-added capabilities, but also your team's composition. Rules, however, change and disrupt industries and dethrone champions. For proof, look no further than A&P, Compaq and Pan Am. Thus, it's not enough to know the rules; you also need to pay attention to how they are changing. Spotting inflection points before rivals—and responding effectively—can give you a competitive edge. Andy Grove modeled this reality when he made the case for Intel to make the leap from RAM/DRAM to CPUs before the memory market crashed. Grove's anticipation of a threat before it was widely discerned is a big reason you know the phrase "Intel Inside."

Of course, sometimes the rules aren't fair, which is a plus if they favor you and a travesty if they don't. When you find your team disadvantaged, your job is to change the rules. This is the scenario Billy Bean, general manager of the Oakland Athletics, faced in 2001. The A's $40 million payroll couldn't compete with the New York Yankees $115 million player budget. Not only did the Yankees beat the A's in the divisional championship series but they signed the A's Jason Giambi to a big-budget free agent contract. To compete, Bean needed to build a different type of team. He stepped away from traditional approaches to player evaluation and embraced sabermetrics, a novel statistical approach that became known as "moneyball." His goal: Identify players undervalued by other teams. Bill Henry, the new owner of the Boston Red Sox, saw value in Bean's approach, and offered him the Sox' GM job. When Bean declined, Theo Epstein stepped in. He levered Boston's big payroll with sabermetrics to assemble a team that won the World Series in 2004, followed by two more championships in 2007 and 2013.

Great companies do the same thing. They execute within the rules better than rivals, or they exploit opportunities to change the rules. Consider Amazon, the poster child for e-commerce. Launched in 1995 as the "Earth's largest bookstore," Amazon began life as a pure play e-tailer, with no inventory or brick and mortar presence. It acted as a broker, linking customers to publishers. Amazon went public in 1997 and immediately began to rewrite the rules of online retailing and expand its product line. At a time when other organizations were outsourcing fulfillment operations, Amazon invested in its own distribution network. By 2016, Amazon operated 383 fulfillment centers worldwide, supporting sales of $136 billion. Amazon even began to build out an in-house network of trucks and planes to "own" the delivery experience all the way to the customer door.

Today, Amazon sports a market capitalization of $400 billion. Its allure is a willingness to push boundaries and redefine rules. Amazon made two-day "Prime" delivery an industry standard that customers were willing to subscribe to. Amazon also enabled eager consumers and intrigued investors to envision the day when drones, predictive shipping and checkout-free shopping will be common. The result: Amazon is forecast to reach half a trillion in sales over the next decade. More amazing, Amazon achieved this unparalleled success without ever making a meaningful profit on operations. According to The Economist, 92% of Amazon's value is due to profits that won't be earned until after 2020.

Amazon's story stresses a point that you need to remember. To build a winning team, you must change the competitive rules even as you execute the daylights out of existing rules. The remaining four Rs of supply chain design can help.

Assess readiness; your own and that of potential partners

By winning the World Series, the Cubs proved their greatness. Nonetheless, you wouldn't bet on the Cubs

to win the Rugby World Cup. After all, the Cubs weren't built to play rugby. Yet, many companies try to do the equivalent every day. They come to market with the wrong supply chain. How do smart managers get stuck in such a predicament? Two explanations persist.

1. **Wrong focus.** Great ideas spawn companies. But, source, make and deliver decisions are often an afterthought, following marketing, engineering or finance. No one asks whether, or how, SCM can confer a competitive edge. Market mediocrity is the result.
2. **Poor scanning.** Even cutting-edge supply chains can fall behind the obsolescence curve. You've read, for instance, about the woes of some high-profile brick-and-mortar retailers. As the Internet changed the rules of retail, they didn't adapt. Now, they are dying.

Readiness assessment is a key weapon in Theo Epstein's arsenal. By conducting a two-step readiness assessment—the second R—you can avoid these losing outcomes.

Step 1 is an honest self-appraisal of the team's current competencies. Simply put, ask: "Do we have the skills we need to play, and win, our industry's competitive game?" If not, ask two questions:

- Which skills are you missing?
- What do the gaps look like?

By making capability gaps visible, you can prioritize your skill-acquisition efforts.

Step 2 is to assess potential partner competencies. Your job, like Epstein's, is to close the gaps by building or buying the right capabilities. Now, let's take a peek into how Epstein leveraged the second R to turn the Cubs into champions.

The key to winning a baseball game is to score more runs than the other team. The emphasis on runs scored has always placed a premium on two player-evaluation metrics: Batting average and RBIs (runs batted in). Sabermetrics argues you should set these metrics aside in favor of on-base percentage. After all, you can't score unless you get on base, and it doesn't matter whether you get on base via a hit or a walk. The logic of sabermetrics is simple: By using more-valid-but-less-used metrics, you can acquire the right skills at a lower price. Of course, winning attracts benchmarking, and rivals quickly copied Epstein's approach. Epstein's response: Keep refining the readiness-assessment process.

1. **Neuroscouting.** Neuroscouting uses a computer simulation to make the connection between a player's cognitive function (recognizing a pitch) and motor skills (swinging a bat). A player who picks up a pitch five feet out of the pitcher's hand will get on base more frequently than a player who doesn't read the pitch until 20 feet or 30 feet out. Neuroscouting helped Epstein identify Mookie Betts as a top prospect in the 2011 draft. Betts is now a rising star.
2. **Wins above replacement (WAR).** Epstein has grown fond of WAR, a metric that estimates how many wins a player contributes to above a replacement player at the same position. Going into the 2016 season, WAR indicated that the Cubs excelled in starting pitching, first base and third base. But, right field was identified as a liability. To fill the gap, Epstein acquired Jason Heyward in free agency.
3. **Predictive analytics.** Epstein is now experimenting with simulations to predict how a given team composition will fare in each game throughout the season. Inputs can be quite detailed and include things like ballpark where the game is played, time of day and pitcher-versus-batter matchups.

Beyond closing capability gaps, readiness assessment serves another purpose. In 2011, as Epstein's tenure with the team began, Cubs owner Tom Ricketts asked when the Cubs would be ready to compete for a championship. Epstein's response: The Cubs would get worse before things could get better. Building a strong farm system and young talent meant that the Cub faithful would need to be patient. Epstein's plan, however, leveraged the "rules" of the collective bargaining agreement, one that allocated larger draft budgets to losing teams. Losing early to win later enabled the Cubs to acquire players like Kris Bryant and Kyle Schwarber, who were key contributors to the 2016 championship run.

Readiness assessment is a pivotal part of Zara's story. Zara, like Amazon, is a rule breaker; its fast-fashion business model is truly game changing. So too are the supply chain capabilities needed to make fast-fashion work. Compare the

TABLE 1

Zara has built unique capabilities to change the rules

	Zara	Gap
Design concepts	• **What's selling:** POS data • **What's not selling:** data on styles tried on, but not purchased • **Customer desires:** daily feedback from store managers • **Fashion trends:** copy and adapt fashion-house designs	• **Fashion trends:** In-house designers • **What's selling:** POS data
Concept to market cycle	• 14-24 days • New designs (30,000 per year) arrive twice a week	• Four to six months • New designs timed to four major seasons
Sourcing	**Local sourcing:** • 60% in Spain • 25% in low-cost European countries	Asia-centric global sourcing
Production	• Cutting at the cube • Assembly at small, flexible "workshops" in Spain • Small production runs to demand	• Large production runs to forecast
Inventory	• Stockouts are fashionable • Markdowns on 15% of SKUs	• Stockouts frustrate customers • Mark downs on 40% of SKUs

Source: Authors

Zara way to Gap's approach (see Table 1).

The backstory: Amancio Ortega, Zara's founder, got his start in the apparel industry as a 14-year old errand boy. A decade later, Ortega began developing his own designs, reproducing popular styles, but with his own twists. He soon realized that if he could bring trendy designs to market quickly and inexpensively he could wow consumers. Ortega simply needed to convert concept into capabilities. Readiness assessment provided Ortega the insight needed to build the capabilities that would fuel Zara's fast-fashion strategy. Let's highlight two points here.

1. **Infrastructure**. Capabilities derive from infrastructure. For instance, Zara brings its 30,000 distinct designs from concept to rack in only 14-24 days (a 10X advantage over rivals). To reliably hit this target, Zara sources over 50% of all items from local subcontractors in Spain (over 75% in Europe) and preps all product to be rack ready in its 400,000 square meter DC called the Cube. Zara's infrastructure links supply to demand.

2. **Decision processes.** At Zara, decision makers evaluate every investment based on how it will enhance Zara's capabilities. For instance, Xan Salgado Badas, Zara's head of IT, stuck with an outdated, DOS-based point of sales system (POS) for years because newer systems didn't offer any strategic capability upgrade. Yet, when Zara figured out how to use RFID to gain insight into fashion trends and hasten replenishment, it rolled out the technology at a scale and speed that startled rivals (in 2016, Zara bought 500 million RFID chips, 16% of that year's total RFID sales).

Being fast and driving trends pays serious dividends. Customers visit Zara stores 17 times a year, compared to three times to five times for rivals. That's because they know if a trendy new outfit sells out, it may not be back. In effect, Zara has turned customers into treasure hunters, transforming stockouts into a sales pitch. Along the way, Zara became the world's largest fashion retailer and Amancio Ortega the world's second richest person. But, Zara's team also knows that readiness assessment and capability development must be a lifestyle, not an event. If Zara isn't always getting better, a rival like BooHoo or ASOS might make Zara's version of fast-fashion obsolete. Just like the Cubs and Zara, you are only as good as you are ready.

Assemble the right players; build or buy needed competencies

Redefining rules and assessing readiness are tough tasks. But, the outputs—a capability-development matrix and a talent-acquisition map—are critical to devising a winning game plan. Bringing all of the right pieces together and molding them into a champion is equally daunting. Emotional fortitude is needed. Executives like Theo Epstein, however, embrace the team-building challenge. Team ego results when you holistically progress through the remaining 3Rs—right players, right roles and right relationships. Let's explore

how Epstein brings these Rs together.

Through experience or intuition, Epstein knows the best players aren't always the right players. Many so-called super teams never hoist the Commissioner's Trophy at season's end. So, what type of player does Epstein look for? Talent is critical, but even more so, Epstein seeks a mix of athleticism and positional skill backed up by EQ and a team-first mindset. After all, when a crisis arises—and it will during the course of a 162-game regular season—team ego decides whether the team steps up or collapses. The better question is, perhaps, how does Epstein put the right mix of skills on the field? Like you, Epstein has two options. He can build competencies or he can buy them. To field a consistent contender, he must do both exceptionally well. Figure 2 depicts Epstein's method.

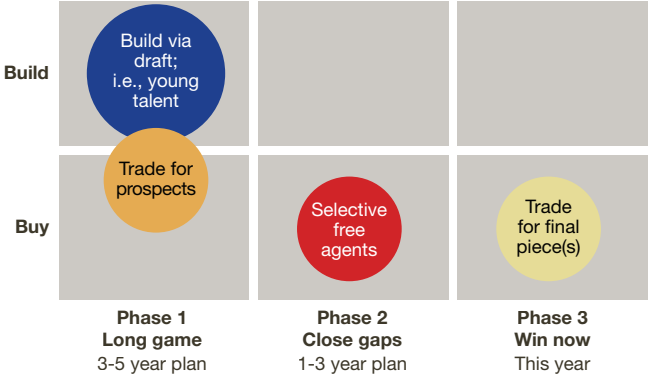
- **Phase 1: Long game.** The core of an Epstein team emerges from the draft. Young talent like Javier Baez (2011) and Kris Bryant (2013) is identified and developed. The process takes time, but it provides a big bang for the buck. Baez and Bryant both made pivotal contributions to the Cubs' World Series run. Of note, when Epstein arrived in 2011, he began to trade valuable players that didn't fit his vision and culture, giving the Cubs more draft picks.
- **Phase 2: Close key gaps.** Epstein opportunistically closes key skill gaps by acquiring proven talent via free agency or a well-timed trade. Consider Jake Arrieta, a starting pitcher acquired from the Baltimore Orioles just before the 2013 trading deadline. Arrieta won the 2015 NL Cy Young Award and was the ace of the Cubs' 2016 pitching staff.
- **Phase 3: Win now.** By July 25, 2016, the Cubs had the best record in MLB. But, by Epstein's estimation, the Cubs still lacked a critical piece: a hard-throwing lefty closer. To bring Aroldis Chapman, the hardest thrower in baseball (105-MPH fastball), to Chicago, Epstein traded four up-and-coming prospects—a steep price Epstein was willing to pay to win it all in 2016.

One more point: Epstein knows that the concept of right "players" extends beyond the playing field. To help make things click, Epstein brought on Joe Maddon, former manager of the Tampa Bay Rays. Maddon's keen sense of strategy and a sabermetrics-driven willingness to tweak the batting order and defensive alignment helped position the Cubs to win a league-leading 103 games. Simply summarized, getting ready to compete means bringing the right players on board, whether drafting undervalued prospects, signing free agents, making pivotal trades or signing a manager whose true talents are being underutilized.

Apple has shown an uncanny ability to bring the right players together to develop and deliver hit products and services. Figure 3 shows how Apple uses Epstein's playbook.

FIGURE 2

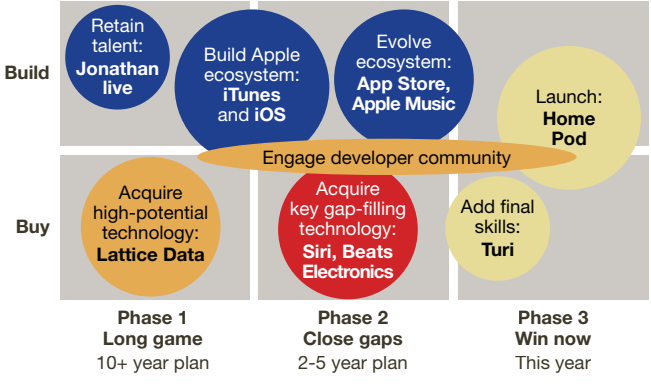
Assembling the right players



Source: Authors

FIGURE 3

Apple's path to developing the HomePod



Source: Authors

- **Phase 1—Long Game:** At the turn of the millennium, Apple began to invest in what has become the source of its success—software. The iTunes Music Store, paired with iOS, set in place the foundation for Apple's ecosystem, which consists of over one billion active devices worldwide and includes services such as App Store, Apple Pay, Apple Music and iCloud. Apple touches its owners' lives every day—and in an increasing variety of ways.

- **Phase 2—Close key gaps:** By buying Siri in 2010, Apple forged into both the search and mobile "assistant" markets. More recently, in 2014, Apple acquired Beats Electronics, quickly integrating Beats Music into its own streaming service, Apple Music. Pundits, nevertheless, questioned Beat's $3 billion price tag. But, Apple appeared to have a compelling goal: To close gaps that powered Google Android's foray into Apple's turf.
- **Phase 3—Win now:** In August 2016, Apple quietly acquired Turi, an artificial intelligence startup, for $200 million. Less than a year later, on June 5, 2017, Apple introduced HomePod, a device designed to "reinvent music in our homes." The Beats acquisition now made sense. But, that's not all. HomePod is a home assistant—Apple's answer to Amazon's Echo and Google Home. Turi's machine learning makes Siri smarter, giving Apple the win-now capability needed for HomePod to become the central nervous system for the IoT-enabled home, a nascent market with fantastic growth potential.

Apple is seldom first to market, but the design, user-friendly interface and massive ecosystem that support Apple products and services make it a game changer. The result: Apple's market capitalization hit $800 billion in 2017—2X Amazon's. Consider two facts: Despite owning only 30% of the mobile operating system market, Apple earned 90% of the industry's 2015 profits. And Apple earns developer loyalty by delivering 75% more revenue vis-à-vis Google Play, making App Store the go-to place for the latest and greatest apps. Bringing the right players to the game has made Apple a perennial industry champion.

Put players in the right roles; shift as needed

Getting the right players is just one step in the team-building process. Jim Collins described what comes next: "Get the right people on the bus, the wrong people off the bus, and the right people in the right seats." Matching players to roles is critical. Yet, the way most companies do this won't deliver a true—i.e., inimitable—competitive edge. To be a supply chain champion, you have to think differently about how to mix and match key capabilities.

With Epstein at the helm, the Cubs tinker incessantly with player roles. That's one reason Epstein hired Maddon: His teams led the league in distinct batting lineups and in-game positional shifts every year from 2006 to 2014. The goal: Tweak the lineup to improve the Cubs' chance to win any given game. Imagine sending your catcher out to pitch. Maddon did just that, inserting David Ross to pitch against the Milwaukee Brewers. Ross had never pitched in the MLB, but he recorded a perfect inning. Maddon's penchant for moving players around led the Cubs to acquire Ben Zobrist. Maddon called Zobrist a "super-U," someone who can play multiple positions. In fact, during his career, Zobrist has played every position except pitcher and catcher. Proactive role shifting made the Cubs improbable season possible.

In 2015, many pundits had already written Best Buy's obituary, claiming the electronics retailer couldn't survive Amazon's assault and consumers' affinity for "showrooming." Yet, Best Buy did survive, showing how role shifting can create a competitive edge even against Amazon. How did Best Buy do it? Consider three pivot points that enabled Best Buy to become an experience retailer.

1. **Reduced costs.** To contest showrooming, Best Buy began matching prices. To reduce costs and make price matching economically viable, Best Buy deepened collaborative relationships with suppliers, especially in the areas of merchandizing, forecasting and replenishment.
2. **Repurposed bricks.** For brick-and-mortar retailers, Amazon's onslaught turned what once was an asset into a liability. Yet by shipping online orders direct from local stores and encouraging in-store pickup of online orders, Best Buy can deliver with Amazon-like speed, turning its 1,600 physical stores back into an asset.
3. **Reimagined roles.** Clicks and mortar wasn't Best Buy's only proactive role shift. Best Buy invited top suppliers like Samsung, Apple, LG, Microsoft, Sony and Google to set up shops within its cavernous stores. Best Buy charges rent and benefits from high-margin sales of high-end appliances and electronics. What's in it for suppliers? The opportunity to create immersive customer experiences without the cost of owning stores. Google Guides, full-time Google staff, offer tutorials and tech classes, helping customers discover, play and have fun. Samsung Experience shops are located in every Best Buy store.

The result of role shifting: In 2017, Best Buy shares surged to an all-time high. However, as the Cubs know from first-hand experience, some role shifts backfire. Boeing discovered this the hard way with the launch of its vaunted 787 Dreamliner. Poorly conceived and managed shifts cost Boeing five years in first-mover advantage and, by some estimates, $20 billion in design, production and launch costs. To avoid such misfires, you really do need to do the work entailed by all five Rs. Despite the risks, as Table 2 highlights, game changers from rivals' strategic moves to disruptive technologies dictate that you begin to experiment with proactive role shifting.

TABLE 2

Forces driving role shifting

	What	Why	Who
Rationalization	The optimization of supply chain activities and relationships.	**Goal:** Drive out cost and improve relations with key SC partners.	Aldi carries 1,000 mostly store-brand SKUs per 15,000 ft² store, beating Wal-Mart on price by 18% on average.
Uberization	The "renting" of SC assets owned by someone else.	**Goal:** Enable sharing of existing assets. Owners earn rent; users reduce cost of access to assets.	General Motors' Maven on-demand mobility service allows drivers to rent a car as needed. GM also offers drivers the flexibility to trade in and out of its 10 Cadillac models up to 8 times a year for $1,500 a month.
Freelancing	The contracting of capabilities by independent agents on an as-needed basis.	**Goal:** Reduce fixed costs and create extreme flexibility.	Story is a unique retail concept that changes like an art gallery, but sells things like a store. The N.Y.-based retailer completely reinvents itself every three to eight weeks, requiring distinct, temporary supply chains for ever-changing product line.

Source: Authors

Cultivate the right relationships; build identity and trust

Having the right players in the right roles does guarantee that your team looks good on paper. Sadly, looking good on paper is no guarantee your team will win once the game begins. What separates paper tigers from competitive champions, both on the sporting field and in the boardroom? Champions possess chemistry; that is, a common vision backed by a willingness to work together to achieve strategic goals—even if someone has to play a less visible role. Critically, chemistry derives from trust. To fully sense the value of trust, consider this key fact from the auto industry: The most trusted automakers are also the most profitable. Your takeaway: Ultimate success requires that you invest in a culture of trust.

Theo Epstein is a culture guy. Organizational culture, after all, endures beyond the departure of talent. So, what are the core tenets of an Epstein-inspired culture? For starters, Epstein believes people perform best, especially under pressure, when they are part of something bigger than themselves. He also believes that environment matters. That's why the Cubs' new $300 million stadium renovation included a round clubhouse—60 feet, 6 inches in diameter (the exact distance from the pitcher's mound to home plate). Epstein wanted to promote collaboration by putting everyone within eyesight of each other and encouraging serendipitous conversations. The space eliminated hierarchy, engendering camaraderie and team identity. David Ross, the Cubs catcher, described the design as, "a subliminal message they're sending."

Beyond facilities, Epstein cultivates "lever points"—other people who help drive the culture. Epstein then steps back and lets them do some heavy lifting. Joe Maddon, the Cubs manager, is an ideal lever for an Epstein-built team. "Try not to suck," a key Maddonism, communicates big-time expectations without big-time pressure. Madden helped nurture the Cubs culture: Trust each other; do the right things consistently, including stretching for better results; have fun, but hold each other accountable; and expect greatness. Epstein and Maddon know that if you build the right culture, that come crunch time, someone will step up.

And that's exactly what happened in game seven of the World Series. After digging out of a 1-3 deficit and building a commanding three-run lead going into the bottom of the 8th inning, the Cubs did the unimaginable—they gave up the lead and gave away the momentum. The 103 wins didn't matter anymore; the dream was slipping away. Then, it began to rain—and culture took over. As the grounds crew came on the field, the Cubs exited toward the locker room. Jason Heyward impulsively called his teammates into a weight room for a player's only meeting. Never the outspoken leader, and struggling at the plate throughout the playoffs, Heyward reminded

his teammates just who the Cubs were. David Ross recounted Heyward's message: "He just said: 'We're the best team in baseball for a reason. Continue to play our game, support one another. These are your brothers here, fight for your brothers, lift them up, continue to stay positive. We've been doing this all year so continue to be us.'"

What would've happened if Heyward hadn't spoken up? The Cubs may still have won. But, Epstein knows that you leave less to chance when you invest in the right culture.

Honda is a Cubs type of culture warrior. More reliant on suppliers than rival carmakers, Honda's buyer-supplier culture is truly unique, even a little quirky. Honda treats strategic suppliers as an extension of Honda itself. Simply put, Honda invests in supply partners as if it is buying their capacity and capabilities, not just their parts. By the way, 90% of Honda's spend is with strategic partners. To help these partners succeed, Honda sends engineering teams to work on-site at suppliers for three months—and as long as 24 months—at no cost to the supplier. The goal: Help suppliers optimize manufacturing and business processes. A typical best practices (BP) improvement initiative improves quality by 30% and labor productivity by 50%. More importantly, under Honda's coaching, suppliers develop critical skills. Honda, in turn, gains stronger supply partners. Cost savings are shared 50/50 with the supplier.

The Cubs faithful view Epstein as a miracle worker. In truth, EPSTEIN SIMPLY EMBRACED CORE TENETS SUPPLY CHAIN CHAMPIONS put to work every day as they design and manage world-class value-creation teams.

Honda's investments aren't limited to BP projects. Honda expects supply partners to participate in corporate training, senior-leader business reviews and new product and target costing programs. You may be wondering why Honda invests so much in its suppliers instead of switching to more capable suppliers. Honda's response: Other suppliers would have similar problems. The nuanced answer, however, runs deeper. Like Epstein, Honda is playing the long game, building a trusted team that can compete the "Honda Way." Identity is critical. One result: Honda is the most trusted carmaker among suppliers. Almost 40 years after launching U.S. operations, nearly all of Honda's original supply team remains intact. The trust also shows up in Honda's profitability. Despite Toyota's superior scale—producing twice as many cars per year—Honda has consistently delivered higher profit margins.

Now, let's go back to the early 1990s. J. Ignacio Lopez, General Motor's purchasing czar, tore up supplier contracts, putting everything out to bid. By saving $4 billion dollars, Lopez saved GM from bankruptcy. But, Lopez alienated suppliers, solidifying a culture of mistrust. Over a decade later, supplier resentment still ran hot. Suppliers scored GM a 114 on the 2005 Supplier Working Relations Index (the lowest score ever—300 points behind Toyota's 415). The real cost: Suppliers were holding back on GM, dedicating their best engineers and sharing their latest technology with more trusted partners like Honda and Toyota. The rise of autonomous vehicles, however, forced GM in 2015 to acknowledge an existential threat, that it's future depended on supplier innovation. Compelled to change, GM began offering longer-term contracts to urge suppliers to more openly share their best ideas. Two years later, GM's 2017 WRI score reached its all-time high of 290, lagging behind only Toyota and Honda.

The journey continues

The Cubs faithful view Epstein as a miracle worker. In truth, Epstein simply embraced core tenets supply chain champions put to work every day as they design and manage world-class value-creation teams. What then is your key takeaway? Epstein succeeded by executing each R as part of an integrated 5Rs strategy. In Epstein's words: "Acquiring the talent is only half the battle. The other half of the Cubs' rebuilding required the organization to establish a winning culture. This meant devising a 'Cubs Way.'" In our experience, putting all five pieces of a 5Rs strategy together is quite a feat. Even supply chain champions struggle to implement all five Rs. But, Maddon offers a word of advice: "The process is fearless." If you continue to work the process, the 5Rs will help you break whatever supply chain curse you're facing.

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MEET THE not-so-average supply chain MILLENNIALS

Forget the stereotypes you've heard about Millennials in the workplace. New research from *SCMR*, APICS and APQC finds that the next generation is engaged and enthused about careers in supply chain management.

BY JENNIFER DANIELS, JOE TILLMAN, BOB TREBILCOCK AND JUDD ASCHENBRAND

Entitled, impatient, impetuous, narcissistic, self-absorbed, unwilling to pay their dues. The descriptive list of Millennials in the workplace has at times been more negative than positive. A lot of this stems from the changing times in which they were raised. The fall of the Berlin Wall, the rise of internet and e-commerce, personal computers and cell phones, 9/11 and the Great Recession were events that shaped the way Millennials approach their lives and careers. And, you can add to the list helicopter parents, structured learning with praise and immediate feedback, always part of a team with a focus on community over the individual and resume building activities to land the right career. This conflicts with the do-it-yourself mentality that most executives, and most logistics, procurement and manufacturing professionals, have had to deal with to survive in a rapidly changing world.

But, do those stereotypes hold true for Millennials in the supply chain? That was the question we set out to answer in our survey of Millennial readers of *Supply Chain Management Review* and members of APICS and APQC (For more, see About our research). The good news: Our research paints a very different picture from the stereotypes listed above. To the contrary, we found a group of enterprising entrepreneurs that want to tinker with processes and understand how the business was built so it can be improved. The idea of being an island is foreign to them—to be successful

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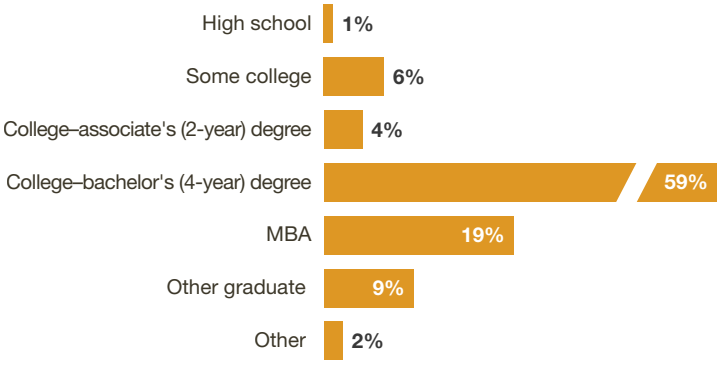
means being part of a larger team with a shared vision. Continuous improvement isn't only focused on processes, but on what they can do better to improve themselves. Think of them as your not-so-average supply chain Millennial.

Indeed, as you'll see shortly, the survey respondents expect to work hard. They are staying with their employers for longer periods of time than their job-hopping peers. And while they are ambitious, they don't expect to leap from their first job into the C-suite.

As you dig into the results, pay attention to what drives Millennials. We believe they provide a road map to their motivation, their frustrations and where they hope to be in the supply chain field in five years. And be prepared to mentor, as their top frustration is having an unclear career path. As a supply chain leader, the greatest gift to give Millennials is a path to follow.

Level of education



Source: Peerless Research Group (PRG)

Average? Not even close.

Nearly every Boomer and Xer has their favorite YouTube video highlighting Millennial professional cluelessness or privilege (Did you hear the one about the parent at the performance review?). More likely than not, the protagonists in these stories aren't in supply chain. And that's because the people aged 22 to 37 who you work with tend to break the mold.

These findings aren't an aberration. The attitudes captured in this survey align closely with another generational survey conducted by APICS in 2014. The eye-popping results of that one indicated that the societal influences shaping the work attitudes of Millennials were also influencing prior generations. And most interestingly, over 50% of the Millennials in supply chain hold workplace attitudes that mimic those of boomers and Gen Xers.

The APICS research also showed that all supply chain professionals want to be highly regarded by their employer and stay up-to-date on new developments in the field. However, the order of importance is reversed with Millennials, who place more value on building their professional reputation—and planning to do this via additional education and training. We see corroboration with our recent survey, presented in the following pages.

Down to basics

For the purposes of this survey, we defined Millennials as those born between 1980 and 1995, or between the ages of 22 and 37. While we received responses from every one of those birth years—for instance 3% of respondents were 22 years old, 9% were 30 years old and 3% were 37 years old, the survey broke down almost evenly between respondents in their 20s (49%) and more experienced respondents in their 30s (51%). We are also able to make some interesting comparisons between the professionals now entering the supply chain workforce compared to professionals in leadership positions who were surveyed by *SCMR* and APICS last year.

Men represent nearly two-thirds of Millennials in the supply chain, accounting for 61% of respondents compared to 39% who were women. The good news: It appears that more women are entering the field than in the past: In our 2016 survey of senior leaders, 76% of the respondents were men and only 24% were women.

Millennials are working in supply chains across the United States, including 25% of respondents who hailed from the Midwest, followed by the Mid-Atlantic (12%), the West (11%), the South (10%), the Southeast (7%), New England (3%) and the Mountain states (2%). Just over 30% of respondents were located in Canada (6%) and the rest of the world (25%).

This next generation of supply chain leader is also highly educated. Just shy of 60% have a bachelor's degree, compared to 45% of last year's senior leaders, and 28% report an MBA or other graduate degree. Only 10% reported a two-year associate's degree (4%) or some college but no

degree (6%). Those numbers are almost identical to the senior managers who reported some college but no degree.

Their education did not stop with graduation: 65% plan to take continuing education programs or classes during the next 12 months to advance their careers (73%), improve their job performance (56%) and take on more challenging work (47%). And, 45% agree that certifications are critical to advancing in the field. That alone is not surprising, given the participation of APICS members, but it is also consistent with the fact that articles about certification programs were among the five most downloaded content from scmr.com in 2016.

We noticed another important difference between Millennials and experienced executives: Only 19% of senior level managers had a degree in logistics or supply chain management. Rather, they came into the profession from other fields. Quite the opposite is true of the 66% of Millennial respondents who report that they have an undergraduate (43%) or graduate degree (23%) in supply chain management. This could reflect the proliferation of leading academic institutions with supply chain management programs at both the graduate and undergraduate level, and, perhaps, the increasing number of job opportunities in all areas of supply chain management.

Finally, while Millennials are working in companies of all sizes, including 21% of respondents who are employed by small firms with less than $50 million in revenue, the largest representation (41%) were working for companies with more than $1 billion in annual revenue, including 31% who reported more than $2.5 billion in revenue. Of note: These numbers are almost identical to those of senior leaders.

The largest percentage of respondents (53%) were working for manufacturers, with the remaining 47% spread across retail, consulting, wholesale distribution and providers of third party services and transportation and warehousing services in fairly even numbers.

By design or accident

It's safe to say that supply chain management is probably not top of mind when graduating high school students go off to college to choose a career. In fact, most have probably never wondered what it took for UPS or FedEx to deliver the package they ordered online to their doorstep, or even heard the term supply chain. It's also safe to say that in the war for talent, every industry association, from APICS to CSCMP to ISM to MHI, is launching programs to bring the industry to the attention of the next generation of workers. Why, then, did our Millennial respondents enter the field? That was one of the open-ended questions we asked. The answers were as divergent as the number of respondents.

For some, the choice was a matter of necessity. "I needed a job," wrote one respondent. Another facing a pile of student loans noted, "this field pays well and will allow me the opportunity to have a great salary, just as my parents did after they graduated from college. The same cannot be said about graduates in other career fields."

Others came to the field "by accident but loved it," as one respondent wrote. Another was exposed to the field during an internship. "That is when I decided to make a career in this area," the respondent wrote.

However, the most common verbal response was that supply chain management appealed to individuals with analytical and technical interests.

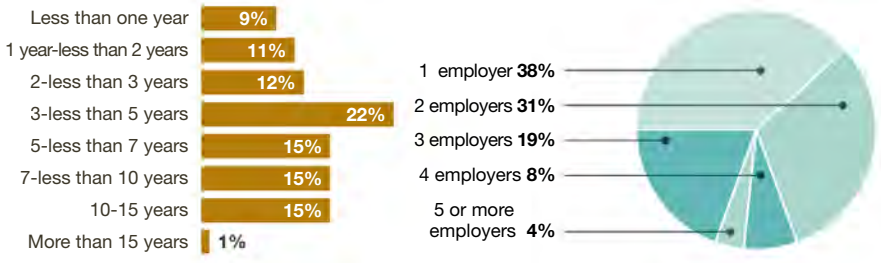
- "I wanted to enter a field that is measurable," wrote one respondent.
- "It fit my statistical background. Knowing how integrated planning is into everything sparked my interest," wrote another.
- "It offers the ability to make a difference by combining IT and supply chain," noted a third.

Most respondents entered the field intentionally. A full 75% said they began their careers in supply chain management while only 11% took a job because they couldn't find work in their degree area. The top five points of entry were planning (22%), procurement (21%), logistics (15%), inventory management and control (11%) and manufacturing (9%).

Management training and rotational programs were another way Millennials were exposed to supply chain management: 24% are currently working, or have worked, in a management training program that gave them exposure to the different areas of supply chain operation. Another 20% said they began their career in a rotational program that allowed them to experience multiple areas of their organization, and they preferred supply chain. And 21% noted that they have worked in different areas as part of their career growth or that they have always been with corporations that gave them exposure to different areas where they learned by doing.

FIGURE 2

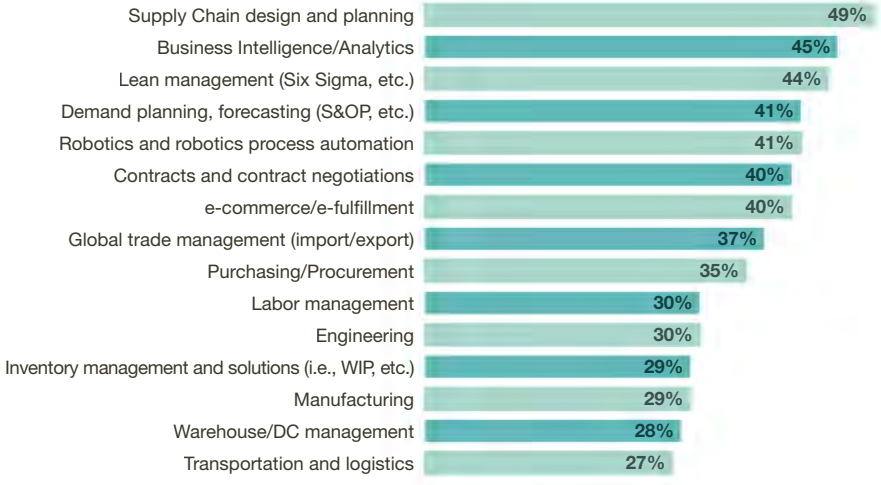
Experience within the supply chain field



Source: Peerless Research Group (PRG)

FIGURE 3

Prospective areas of future supply chain involvement



Source: Peerless Research Group (PRG)

For those who began their careers outside of supply chain, engineering (22%), sales and marketing (17%) and finance (11%) were the most common starting points.

Sixty percent are still working in the area in which they launched their supply chain careers. And 35% of respondents said they have been involved in just one area of the supply chain. What about the 40% who no longer work in the first position they held? Twenty-five percent are working in planning, 14% in procurement and 13% in inventory management and control.

While many believe that Millennials jump from career to career and job to job, our respondents were a stable group. Sixty-eight percent reported three or more years of supply chain experience, including 45% with between five and 15 years of experience. And while our research indicates that Millennials are more likely to seek opportunities with different employers early in their careers, respondents with more than three years' experience demonstrated more stability and less movement from one company to another. In fact, 38% of all respondents reported working for just one employer during their career and 31% have worked for just two employers. Only 4% reported working for five or more employers. Similarly, 38% reported working for their current employer for two years to five years and 27% have worked for their current employer for five or more years.

Finally, as a group, Millennials in the supply chain are well paid. But, just as we saw a gap between the compensation of male and female senior leaders, there is also a gender wage gap among Millennials. On average, male respondents earned salary and bonus of $92,920 while female respondents earned just $78,840. Supply chain leaders looking to retain the best talent should look at these discrepancies in the future.

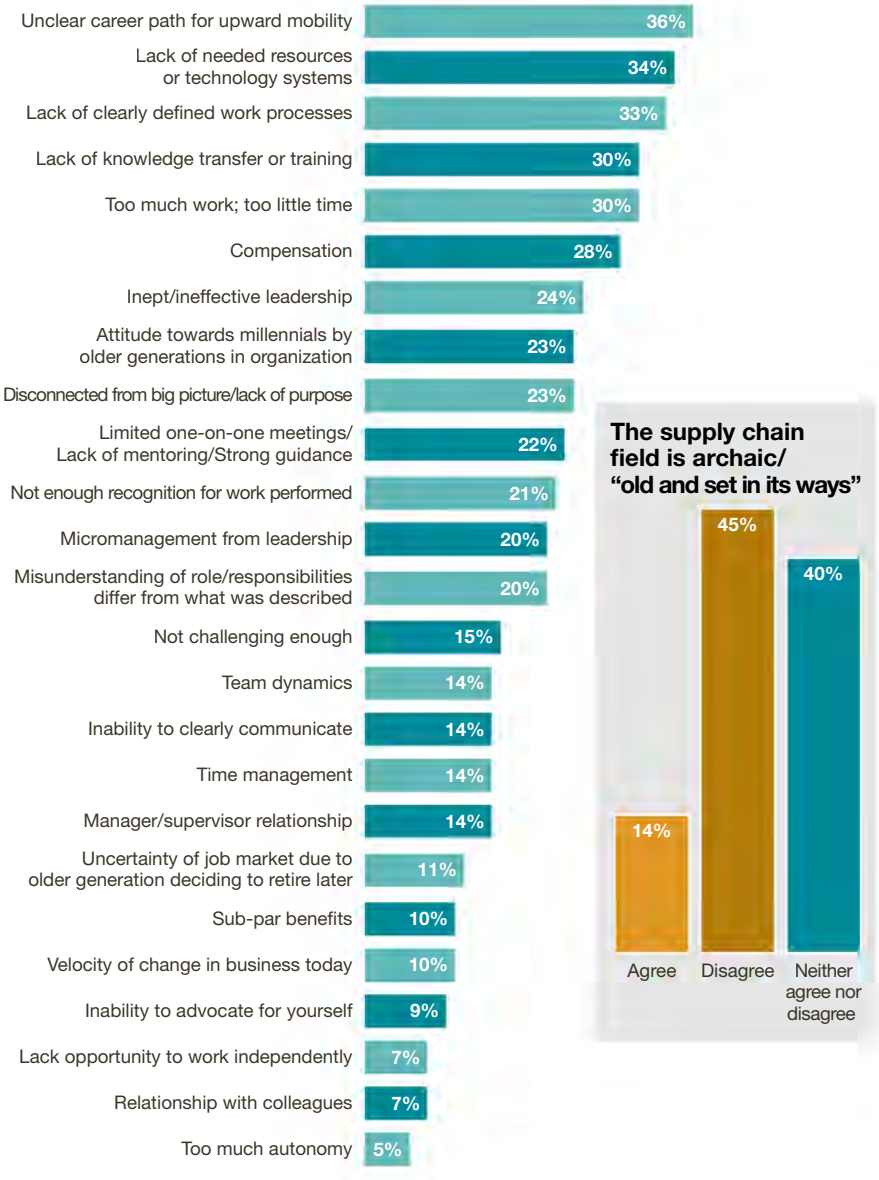
What they're doing today and tomorrow

While planning, procurement and inventory management are the top three positions for Millennials, supply chain management is increasingly a cross-functional position. This is something we noted in last year's survey of senior leaders, where only 12% of respondents listed procurement as their primary job yet 61% said they were involved in sourcing and purchasing, another 61% said that supplier relationship management was among their duties and 45% listed risk management, often viewed as a procurement function.

Millennials are similarly involved in a wide variety of supply chain functions, including 64% who are involved in inventory management, 56% in transportation and logistics, 54% in demand planning, forecasting and S&OP,

FIGURE 4

Challenges and frustrations with current job



Source: Peerless Research Group (PRG)

52% in supply chain design and planning and 51% who are involved in purchasing.

Their main areas of interest, regardless of their job function, were similarly wide ranging, with 72 interested in supply chain design and planning; 58% in demand planning and forecasting; 54% in business intelligence and analytics; 53% in inventory management; and 51% in lean management.

In the future, respondents hope to be involved in supply chain design and planning (49%); business intelligence and analytics (45%); lean management (44%); and robotics and robotics process automation (41%). This suggests that Millennials have an interest in using their experience with supply chain processes as a stepping-stone to move into "hot" areas, such as analytics and robotics. At the other end of the scale, fewer than 30% are interested in future involvement in foundational areas such as inventory management, manufacturing, warehouse and DC management and transportation and logistics.

Happy campers

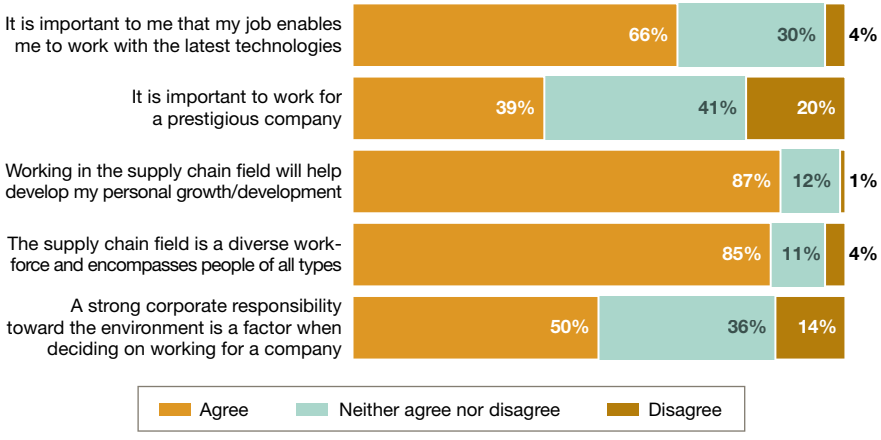
Millennials have been stereotyped as having unrealistic expectations about their career trajectory (Want to be CEO by age 25?); and as generally being hard to please on the job. This survey's Millennial respondents were, by and large, happy campers.

Indeed, a whopping 93% said they were very satisfied (49%) or somewhat satisfied (44%) with their careers in supply chain management and 83% were very satisfied (32%) or somewhat satisfied (51%) with their current job.

Eighty-one percent feel as if they can make a difference in the supply chain field; 87% believe working in the field will help with their personal growth and development; and 88% agree that there are opportunities for job advancement within the field. Far from hopping between careers, 84% expect to still be working in supply chain management in five years. Only 3% disagreed that they could make a difference in the field, which is the same percentage as those who said they expect to move on in the next five years.

FIGURE 5

Opportunities the supply chain field presents



Source: Peerless Research Group (PRG)

The survey also looked at what is important to them about the field and the companies for whom they work. Eighty-five percent noted that the supply chain employs a diverse workforce and encompasses people of all types, while 66% put a premium on a job that enables them to work with the latest technologies. While it has often been written that Millennials focus on sustainability and the reputation of the companies for whom they work, only 39% said it was important to work for a prestigious company, and half said that a strong corporate responsibility toward the environment is a deciding factor on the company for whom they choose to work.

As to those dreams of occupying the C-suite at an early age, only a handful expect to be a chief supply chain officer (7%), a director of procurement (5%) or a CEO (2%). At the other end, 18% expect to be a senior supply chain analyst while 13% aspire to be a director of operations or area manager and director of materials management (5%).

On the one hand

On the one hand, Millennials find a lot to like about working in the field. While financial concerns like compensation (39%), benefits (35%), job security (34%) and tuition reimbursement (14%) made the list, Millennials were more likely to cite the challenges of the job (56%), the work itself (56%), relationships with their colleagues (51%) and the high level of responsibility they were given on the job (50%) as the appeal of working in the supply chain. While those outside the field may view supply chain management as an archaic field, only 15% view the industry as "old and set in its ways." Still 40% were uncertain.

Yet, respondents expressed frustrations of which senior managers should take note. While no one gripe was cited by more than 36% of respondents, the most important frustrations related to the do-it-yourself nature of a career in supply chain.

For instance, the number one frustration, cited by 36% of respondents, was the absence of a clear career path for upward mobility while 11% noted that the job market was uncertain due to an older generation deciding to retire later. Similarly, 33% cited a lack of clearly defined work processes, 30% cited a lack of knowledge transfer or training and 24% cited inept or ineffective leadership as frustrations.

Relationships with management—

The Top 5 Millennial likes and dislikes in the workplace

LIKES	DISLIKES
1. The job is challenging	1. Unclear career path for upward mobility
2. Like the work itself	2. Lack of needed resources or technology systems
3. Relationship with my colleagues	3. Lack of clearly defined work processes
4. High level of responsibility	4. Lack of knowledge transfer or training
5. Development opportunities	5. Too much work, too little time

or the lack thereof—were also cited frequently. Twenty-three percent noted that they were frustrated by the attitude toward\ Millennials by older generations in their organizations; a similar number said they felt disconnected from the big picture or lacked a purpose. Another 22% were frustrated by a lack of mentoring and strong guidance while 21% indicated they did not get enough recognition for the work they performed or were frustrated by micromanagement from leadership (20%).

Taken together, the appeals and frustrations paint a picture of a new generation that finds satisfaction in the jobs they are asked to perform—they like the work—but are frustrated by the uncertainty of the future and their relationships with senior leadership. Leaders focused on the future should take note.

Meet the not-so-average supply chain Millennial

So, who is today's supply chain professional? He—and increasingly she—is not your average 22 year old to 37 year old. Your typical supply chain Millennial is sought after, educated, working for a large company and well compensated. He has worked for two companies, she has had several positions and most likely works in the Midwest for a manufacturer. He already knows about supply chain having studied it in school, graduate school, or via a training or certification program—and he's gaining valuable experience on the job. She's committed to the profession (84%), sees opportunities to advance (88%) and plans to leverage continuous learning to make his mark. They and their peers are the future of supply chain and perfectly positioned to elevate supply chain performance in the years to come. Now, how do you make sure your company has a pipeline of future supply chain leaders?

Key take-aways and actionable insights

If you haven't heard, these bright, young, focused achievers are in high demand. As the U.S. economy nears full employment and demand on supply chains continues to grow, attracting and keeping younger workers becomes paramount. Luckily, the survey highlights the likes and dislikes of this generation, and they aren't exactly what you might think. More than working for a well-known, prestigious brand or a company that has a strong corporate social responsibility program, Millennials are seeking employers that offer professional development opportunities, value diversity in the workforce and invest in technology.

If you are a manager of Millennials, a Millennial managing others or someone who aspires to become a supervisor, the survey points to clear positives and negatives that influence Millennial employee's engagement with their employer and manager.

How to attract, retain and engage Millennials in supply chain:

- meaningful assignments in areas of interest;
- training and professional development opportunities;
- clearly defined expectation and career pathways; and
- investment in processes and technologies that improve supply chain performance.

How to discourage, disengage and dissuade Millennial workers:

- lack of tools, technology and training to meet expectations; and
- unclear expectations, goals and career plan.

Apart from the emphasis on career advancement, the plusses and minuses could be universally applied to improve the workplace for all workers. Perhaps that is one more thing to gain from the not-so-average supply chain Millennials.

For more information, you can access a Powerpoint presentation of our research on scmr.com.

About our research

This research was conducted by Peerless Research Group in conjunction with *Supply Chain Management Review*, APICS, the leading professional association for supply chain and operations management, and APQC (American Productivity & Quality Center), a premier provider in benchmarking, best practices, and knowledge management. The research was conducted to better understand how Millennials become involved in the supply chain field and their viewpoints about working in today's supply chain.

A survey was sent to subscribers of *SCMR*, *Modern Materials Handling* and *Logistics Management* magazines, along with members of APICS and APQC. Results are based on 676 respondents working in supply chain management who were pre-qualified for being between the ages of 22 and 37.

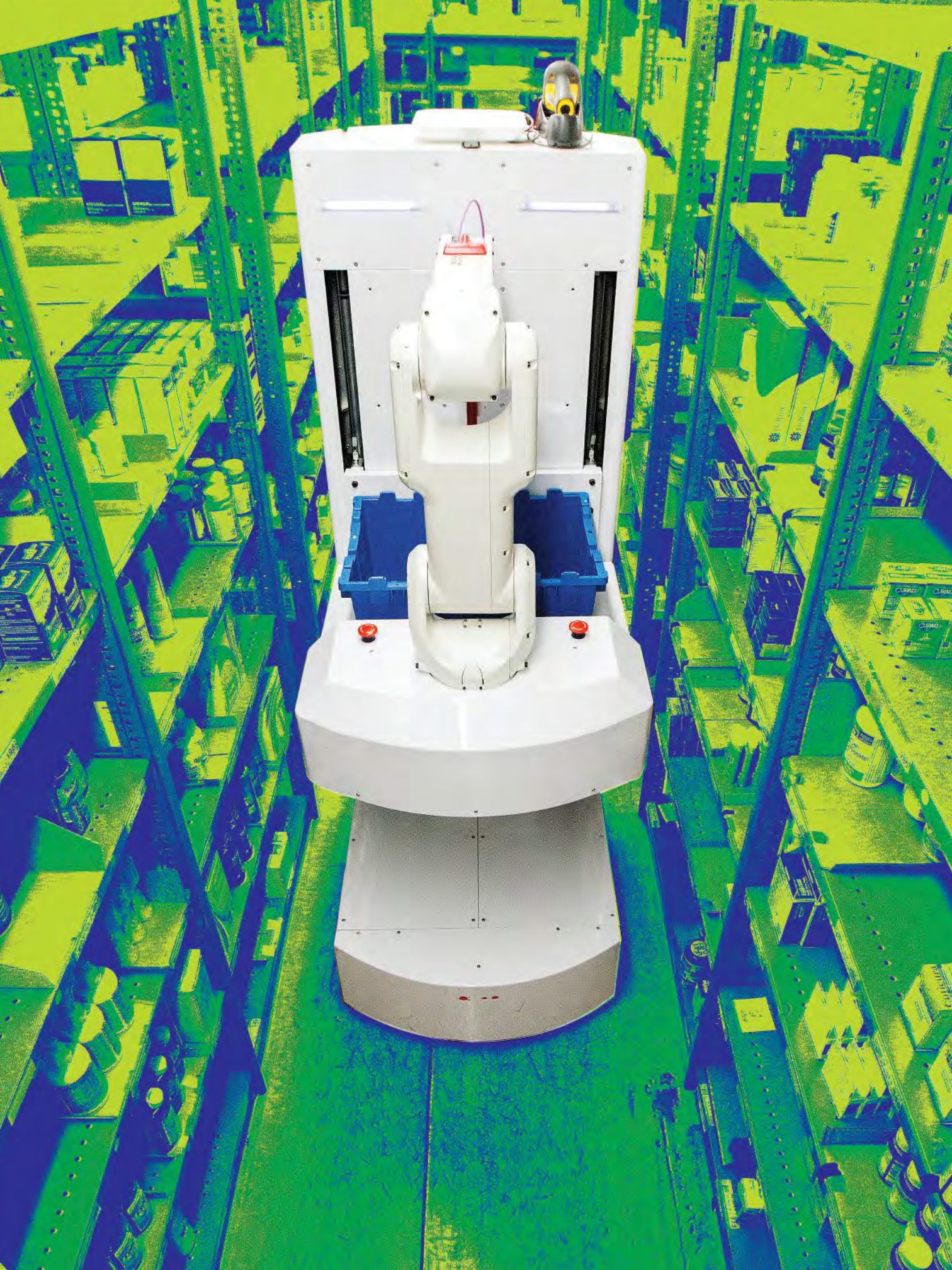
THE ROBOTS ARE READY FOR WORK

It's still early stages, but Rochester Drug Cooperative is proving that mobile robotic piece picking can get the job done in the right application.

Up on a 19,000 square foot mezzanine in a distribution center in western N.Y., order selectors at either end of a pick module are directed by voice as they walk through their zones, picking slow-moving SKUs.

There's nothing special about that process at the Rochester Drug Cooperative, which goes to market as RDC. It's the kind of piece picking solution you see in distribution centers every day. But in the middle of the pick module, something different is happening. Cleverly dubbed Adam because it's a first of its kind, a mobile piece picking robot from IAM Robotics, a Pittsburgh-based startup, picks from 1,200 SKUs stored on static shelves in a four-aisle pick zone.

BY BOB TREBILCOCK, EDITORIAL DIRECTOR



When a shipping tote representing a store order for one of RDC's independent pharmacy members is conveyed into the robot's work zone, Mike Collins, the robot operator, scans a bar code to send picking instructions to Adam. The robot then travels autonomously through the zone, utilizing an arm

The mobile robot travels through the aisles in its zone and picks items for a store order to a tote.

with a suction cup to pick items to a tote. When the order has been picked complete, the robot travels back to Collins. He scans the items into the shipping container, pushes it onto a takeaway conveyor and scans the next shipping tote to initiate the next order. Asked whether the robot is accurate and reliable, Collins chuckles: "The highlight of my night is when it misses something," he says. Which, isn't very often. While the robot was working just four aisles during a July visit, RDC was prepping an adjoining zone that would double the size of the robots' area.

> "Downstairs on the floor, our order selectors do **BETWEEN 250 AND 300 PICKS PER HOUR FROM FAST MOVING ITEMS** in carton flow racks. But upstairs, where we store our slowest moving items, the robot is only picking three hours a night.
>
> —Gary Ritzmann, project manager, Rochester Drug

While an early prototype of Adam picked 1,100 items an hour stationed in front of a shelf in the IAM Robotic's test area, this robot is picking between 100 and 110 items an hour, a rate that is similar to order selectors working the mezzanine. Whether the robot can work faster—the robot maker estimates that at speed it could make as many as 400 picks an hour—is moot, according to Gary Ritzmann, the Rochester Drug project manager who oversaw the implementation of the robot and an industry veteran. The current rate is all that's required for the application. "Downstairs on the floor, our order selectors do between 250 and 300 picks per hour from fast moving items in carton flow racks," Ritzmann says. "But upstairs, where we store our slowest moving items, the robot is only picking three hours a night. Our order selectors need to pick about 100 lines per hour to get their work done, and the robot has no problem keeping up."

The robot went into production in January 2017 and picked test orders until March. Seven months in, Ritzmann says RDC is still learning how to get the most out of the application. At present, the robot is between 95% and 98% accurate, compared to 99.9% accuracy for voice-directed associates. "But most of the errors can be eliminated if we do a better job of putting product away on the shelf correctly," he says. He adds that if the next steps they have planned to integrate the robots further into the automation system pan out, RDC plans to expand the fleet to four robots. "I'm convinced it's going to work," he says.

The dynamics that convinced RDC to take a chance on a new, emerging technology, as well as the cooperative's methodical step-by-step approach to rolling out robotics could very well provide a road map for other end users who are also thinking about becoming early adopters of robots.

Early adoption

Let's face it. It's a pretty exciting time to be in the distribution business. Automation is old hat to manufacturers, but many retailers and distributors like Rochester Drug Cooperative have long gotten by adding more pick modules and throwing more people at the problem. After all, traditionally people were both plentiful, flexible and relatively inexpensive when compared to automation. That was especially true in facilities with uneven demand.

For many, that old formula is no longer working. New customer and market demands, especially those

related to e-commerce, have put a premium on getting every order accurate and complete, and doing so in record time to meet aggressive order cut-off times. At the same time, it's harder than ever to find a reliable workforce, especially for two and three shift operations. The result has been a slew of new automated offerings to solve the piece picking and packing problem.

Count Rochester Drug Cooperative in that category. Founded in 1905, RDC describes itself as "a marriage of a traditional drug distribution company, a buying cooperative, and a private long-term investment structure formed for the sole benefit of pharmacist-entreprenuers." With over $2 billion a year in sales, RDC provides pharmaceuticals, over-the-counter health and beauty care products and health care supplies to over 1300 independently-owned community retail pharmacies, long-term care pharmacies and home health care stores in the Northeast. It currently ranks as the 7th largest full-line distributor in the US. In this industry, RDC's top three competitors control over 90% of the market. Customer service is paramount—all orders are delivered next day.

RDC did not set out to become an early adopter. As recently as five or six years ago, the Rochester facility was relatively light on automation—a conveyor and voice technology. But, with business growing, labor was becoming an issue, especially on the second shift that operates from 5:30 p.m. till 2:00 a.m. At the time, the facility was processing about 30,000 lines a night with a crew of 45 people. The slow-moving SKUs on the mezzanine were the hardest to pick. "It was a hectic work environment and we had a lot of turnover," says Joe Brennan, who has been with RDC for 25 years and recently became CEO. Or, as Larry Doud, Brennan's predecessor, explained in 2015: "Too often, people are scheduled to work and don't show up, or go out for a meal and don't come back." Turnover was as high as 40% a year.

To address the issue, RDC considered expanding the Rochester operation. Instead, it opted to build a new highly-automated 110,00 square foot automated facility in Fairfield, N.J. because more than 60% of the cooperative's business is in the N.Y. metropolitan area. That facility, developed with SSI Schaefer, represented RDC's first leap into automation, with A-frames, carousels and other automation. The new facility took some of the pressure off the Rochester facility. It also provided a window into the benefits of automation. Yet, the second shift continued to experience constant turnover.

The robot reads end of aisle bar codes to navigate through the pick zone.

What happened next was as much a matter of coincidence as design. As Doud, the former CEO, told the story back in 2015, he shared his frustration with one of RDC's pharmacist customers and said something like: "Someone ought to invent a robot." As it turned out, Tom Galluzzo, the pharmacist's son, was a roboticist at Carnegie Mellon University in Pittsburgh, and the co-founder of IAM Robotics.

While materials handling wasn't necessarily top of mind for Galluzzo, he went to Rochester to learn about the picking process for slow-moving SKUs. In the spring of 2014, he made a pitch. "He asked us if we could get something that could pick two to three times faster than our current pickers and work multiple shifts without a break or vacation, would

we be interested," Ritzmann says. "Well, of course!"

Over the next six months, Ritzmann and IAM Robotics worked together to better understand just what a robot would have to do to integrate with RDC's operation. At one point, RDC sent IAM about 20 common SKUs to practice

Once the robot reaches a pick location, it identifies the item to be picked. The solution was designed to work with static shelves.

on. In November 2014, right before Thanksgiving, a prototype was ready for a demonstration.

To get ready, Ritzmann prepped a test area with about 60 items. They were stored next to one another on a limited number of shelves in one aisle. The prototype showed up on a Thursday afternoon. A team from IAM Robotics uncrated it, put it together and ran some tests. "The next day, we were picking," Ritzmann says.

The prototype had limited capabilities, and the picking demonstration was similarly limited, but in that environment, the robot did what it was supposed to do. RDC decided to go to the next step.

Next steps

There was risk-taking on everyone's part, which meant that part of the next step was a contract, with RDC providing some funding for a Beta model of the robot. Those were corporate issues. From Ritzmann's point of view, there were operational issues to get the robot ready for prime time.

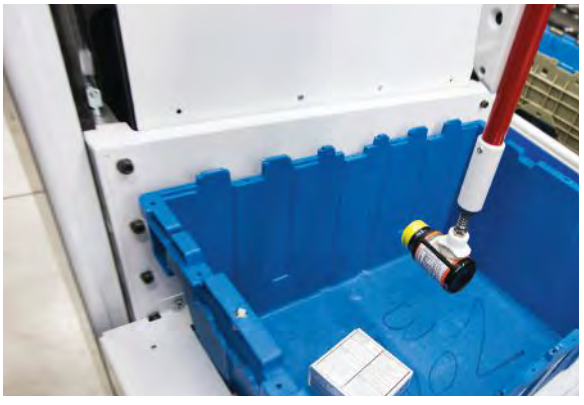
For one, the prototype had limited maneuverability. It moved up and down aisles, but it couldn't turn corners. To work in the pick module it had to make 90 degree turns so that it could access multiple aisles. It also needed a lift so that the robotic arm could access a wider range of shelves.

To enter new SKUs into the system, IAM Robotics developed a high-speed 3D scanner that rapidly weighs and scans an item, creates a 3D model, classifies the new product and then enters it into the database of products being picked by the robot.

Speed was part of the discussion, but less of an issue given the application. While the roboticists estimated that the robot could pick as much as 400 pieces an hour, and work the same pace at the end of the shift as at the beginning of the shift, for now, a robot only needed to pick 100 or so pieces an hour to meet RDC's needs.

Of course, prototypes aren't built in a day, and given that this was a new solution designed for RDC's picking environment, this was no exception. By April 2016, however, a team from RDC traveled to Pittsburgh to watch a demonstration of the new Beta robot. At that point, RDC gave the go ahead to build a production-ready robot. "We went back in September and approved what they'd built," Ritzmann says.

IAM Robotics put the new robot through its paces in Rochester, then took it back to Pittsburgh for tweaking, delivering the completed robot in late October. "We took a slow approach rolling it out," Ritzmann says. "Rather than just go live, we used the



Here, the robot arm drops an item into a tote.

robot intermittently during the day for test orders through the end of the year. They made tweaks and updates, and then we'd test again."

By the end of the year, RDC was satisfied that the robot was ready to go into production on the mezzanine in January 2017, after the holidays.

Working with robots

Being an early adopter is no easy task. As Ritzmann puts it, "If it was easy, someone else would've already done it." Rather than flip the switch last January, go live, and then install the other three robots, RDC has taken a "crawl to walk, walk to run, run to sprint" approach to minimize the risk of failure.

For the first several months, someone from IAM Robotics was on site to address any issues and to train Mike Collins, the robot operator. Now that Collins is self-sufficient, he's working on his own. Still, IAM Robotics gets real time feedback via the cloud that allows it to monitor the performance of the robots and report back important metrics to RDC.

The robot was assigned to an area with just four aisles and 1,200 SKUs. And, to get started, the robotic picking process mimics what order selectors are doing in the adjoining aisles. Collins scans new shipping containers when they arrive in the robot's zone to initiate picks for that order, just like the nearby order selectors. The robot picks to an onboard tote as it travels through the pick zone; when the order is picked complete, Collins empties the contents into the shipping container and inducts it onto a take away conveyor. Similarly, order selectors pick to a lightweight carrier that they then dump into a shipping container and induct it onto the takeaway conveyor.

For now, Collins also scans the items to ensure accuracy before pushing the container onto the takeaway conveyor. "We don't have to do that," says Ritzmann. "But for now, we want to make sure that the order was picked accurately and complete. And, we're doing it to keep statistics."

Next steps are already on the drawing board. First, RDC is going to double the size of the robot's pick zone. "If we're able to do that successfully, we can double the number of orders the robot picks for and do batch picking," Ritzmann says. In addition, RDC is working with SSI Schaefer to integrate the robot with the conveyor system. The idea is to have the shipping container automatically roll on and off the robot, freeing up Collins for other tasks. Assuming these ideas pan out, RDC plans to expand the fleet to four robot zones that could handle most of the slow-moving SKU picking on the second shift.

The robot uses a suction cup end effector to pick.

Having worked with the robot for six months, Ritzmann's biggest surprise was the speed of the IT integration. "We're piggy-backing off information we're already sending to our voice system and the warehouse control system managing the conveyors," he says. "Getting the information from our ERP to their server and from their server to the robot went better and faster than I imagined," he says.

> "We took a slow approach rolling it out. Rather than just go live, **WE USED THE ROBOT INTERMITTENTLY DURING THE DAY FOR TEST ORDERS** through the end of the year. They made tweaks and updates, and then we'd test again."
>
> —Gary Ritzmann

He has also learned that precision counts, as is the case with most automated equipment. Most of the robot's mistakes are the result of how items were put away onto the shelving. "Those can be eliminated if we put things away correctly, which ought to be a best practice anyway," he says.

He says that other potential users call and ask if picking

from static shelves isn't a limiting factor. Ritzmann points out that the robot was designed to pick from his static shelves—he doesn't need robots to pick from case flow rack. While it is a niche solution, most automation is suited to specific applications. AGVs aren't a replacement for all lift trucks; automated storage hasn't replaced all pallet and pallet rack and

> "If it was easy, someone else would've already done it. **RATHER THAN FLIP THE SWITCH LAST JANUARY, GO LIVE, AND THEN INSTALL THE OTHER THREE ROBOTS,** RDC has taken a 'crawl to walk, walk to run, run to sprint' approach to minimize the risk of failure."
>
> —Gary Ritzmann

shuttles and pocket sorters have not yet made pick-to-light mezzanines obsolete. "I spent fifteen years selling materials handling solutions," he says. "There are thousands of warehouses with static shelving."

There is more work to be done. It is after all, just one robot working three hours a shift during part of the week. But both Ritzmann and CEO Joe Brennan believe that robots are ready for work today for those companies brave enough to be early adopters.

While the robot operates on a mezzanine, associates are directed by voice to pick faster-moving items on the main floor.

Once an order is completed, the robot travels to an induction station. For now, an associate inducts the tote onto the takeaway conveyor.

"We saw what automation could do for us when we opened the new DC in Fairfield, New Jersey," says Brennan. "We all get that this is the so-called bleeding edge, but I think there will be rewards in the end."

Ritzmann says robots will position the facility for the future. "Right now, we're in ten states and trying to expand the territory that we cover with this facility," he says. "If we're able to use a fleet of mobile robotic pickers, we can increase our business without having to bring on additional help, and, I think it acts as a motivator to the other order selectors."

Time to take a broader view

Organizations may improve their supply chain planning by re-evaluating or adopting three high-level practices.

By Becky Partida, APQC

There is no shortage of practices that organizations can adopt to improve their supply chain planning efforts. These include sales and operations planning, optimization of networks and forecasting to improve production scheduling. Yet the overall need remains the same: Regardless of the approach, organizations must find better ways to coordinate suppliers, manufacturers, distributors and even retailers to balance supply and demand to best meet customer requirements.

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

To that end, APQC recommends organizations not lose sight of the bigger picture. Using its Open Standards Benchmarking® data in supply chain planning, APQC recently looked at how the frequency of supply chain planning, as well as some more strategic aspects of planning (defining a strategy for the next two to three years and the use of predictive analytics to identify potential risks) can potentially affect supply chain performance. Through its analysis, APQC found that it might be worthwhile for organizations to re-evaluate the frequency of their planning and the extent to which they develop a supply chain roadmap and strategy. For organizations looking to use analytics, it would be wise to make sure that they can invest the time and resources for a well-organized analytics effort.

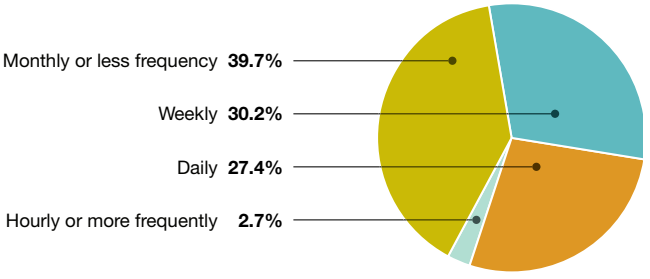
Frequency of planning

APQC asked organizations responding to its benchmarking survey to indicate the frequency with which they perform supply chain planning. As shown in Figure 1, the largest group of respondents plan monthly or less frequently, but nearly one-third of organizations plan on a weekly or daily basis.

APQC's data reveal that organizations conducting supply chain planning more frequently have shorter customer order cycle times than organizations with less frequent planning. As shown in Figure 2, organizations in the two groups with the most frequent planning (hourly and daily) have a median cycle time of nine days, whereas organizations with the least frequent planning (monthly or less often) have a median cycle time of over 23 days—an overall difference of more than two weeks.

FIGURE 1

Frequency of supply chain planning



Source: APQC

It appears that organizations conducting more frequent supply chain planning are able to adapt to changes in market conditions or supply availability so that they can deliver customer orders more quickly. With such a large difference

in customer order cycle times, it appears that planning more frequently can in turn lead to more satisfied customers.

Despite the difference in cycle times, organizations conducting supply chain planning less frequently have slightly more finished goods inventory turns. Organizations conducting their planning monthly or less often make 8.9 inventory turns at the median, whereas organizations planning hourly or more frequently make 8.3 inventory turns. The performance among organizations planning weekly or daily is even lower, with a median of 8.0 inventory turns for each of these groups. It may be that organizations conducting less frequent planning have to make production changes less often due to changes in the market. However, this small benefit must be considered in light of the fact that organizations planning less frequently ultimately suffer when it comes to customer order cycle times.

Defined supply chain strategy

As part of its benchmarking data collection, APQC also asked organizations whether they have a defined supply chain strategy and roadmap for at least the next two to three years. Having a defined strategy helps guide organizations in their planning efforts and also aids them in setting goals for performance. A majority of organizations surveyed by APQC (64%) have defined a supply chain strategy for the next two to three years to a significant or very great extent. However, nearly one-third of organizations (28.7%) have defined their supply chain strategy to only some extent. Just over 7% of organizations have not defined a strategy at all or have defined their strategy to a small extent.

Those organizations without a supply chain strategy for the next two to three years, or that only define their strategy to a small extent, need the fewest full-time equivalent employees (FTEs) for supply chain planning (see Figure 3). This is not surprising given that these organizations spend less time working on strategy and thus would need fewer FTEs for planning. However, as also shown in Figure 3, organizations that define their strategy to a significant or very great extent need only 3.3 more FTEs at the median. Organizations that create a strategy to a greater extent may be able to achieve efficiency in other aspects of their supply chain planning, which allows them to devote only a small number more FTEs to planning.

Interestingly, organizations that define their supply chain strategy to a greater extent have lower supply chain costs despite needing more FTEs for supply chain planning. As Exhibit 3 also shows, organizations that define their supply chain strategy to at least some extent for the coming two to three years spend $50.00 at the median on supply chain management per $1,000 in revenue. Those organizations defining their strategy to a small extent or not at all spend $70.35 per $1,000 in revenue at the median—quite a cost difference. In fact, for an organization making $1 billion in revenue, the cost difference between the two groups would be over $20 million.

Clearly organizations that take the time to set a roadmap for their supply chain efforts for the next few years reap cost benefits over those organizations that only define their strategy to a small extent or not at all. By taking the time to set their strategic course, organizations can perhaps identify and act on ways to lower their costs.

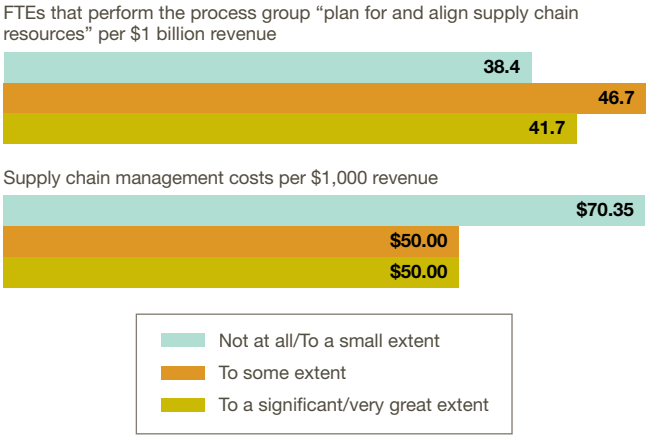
FIGURE 2

Frequency of supply chain planning and median customer order cycle time

Source: APQC

FIGURE 3

Defined supply chain strategy and supply chain management performance



Source: APQC

Use of predictive analytics

APQC also considered how the degree to which an organization uses predictive analytics to identify potential supply chain risk can affect supply chain performance. Organizations rated their use on a scale ranging from not at all to a very great extent. The largest group of responding organizations (just over one-third) indicated that they use predictive analytics to identify potential risks only to some extent, which falls at the mid-point of the rating scale. This is closely followed by 31% of respondents indicating that they use predictive analytics to a significant extent. Ten percent of organizations use predictive analytics to a very great extent, and the same amount of responding organizations do not use predictive analytics for this purpose at all.

The majority of responding organizations fall near the middle of the rating scale, which indicates that organizations have started to embrace the use of analytics in order to predict potential supply chain problems. With an effective analytics program in place, an organization can be more nimble in the face of market shifts and global instability, which can lead to fewer production and distribution disruptions and ultimately lower supply chain costs.

Yet APQC's data points to the possibility that many organizations are still trying to create effective analytics programs. When it comes to supply chain management costs per $1,000 in revenue, the organizations spending the least are those who either do not use predictive analytics at all or use predictive analytics to a very great extent—the two extremes. These two groups have a median supply chain management cost of $50.00 per $1,000 in revenue. Those using predictive analytics to some extent have the highest supply chain cost: $64.87 per $1,000 in revenue at the median.

Organizations that have taken the step to fully develop a predictive analytics program to identify potential supply chain risks are able to invest in the use of analytics while reducing their supply chain costs. However, the fact that organizations using analytics to a lesser extent have higher supply chain costs than organizations not using analytics at all indicates that investments in analytics programs are not always paying off.

Re-evaluate practices

APQC's data indicates that, despite the many nuanced practices organizations can adopt to improve their supply chain performance, sometimes revisiting higher-level practices can yield benefits. Evaluating the frequency of their supply chain planning may be needed, as organizations that plan more frequently have shorter customer order cycle times than organizations that plan less frequently.

Defining a strategy and roadmap for an organization's supply chain efforts for the next two to three years can also yield benefits. Organizations that take this on to a greater extent have lower supply chain management costs despite needing more FTEs to plan for and align their supply chain resources than organizations that define their strategy to little or no extent.

APQC recommends organizations take a close look at how they handle these three high-level practices for supply chain planning.

Finally, evaluating the use of predictive analytics to anticipate potential supply chain risks presents an opportunity for organizations to consider how much they can benefit from a fully developed analytics program. Many organizations that have fully embraced predictive analytics have higher supply chain management costs and thus not as much payoff as one would expect.

APQC recommends organizations take a close look at how they handle these three high-level practices for supply chain planning. By finding the most beneficial frequency for supply chain planning, defining supply chain strategy for the coming two to three years, and developing a strong analytics program that can both anticipate supply chain risk and lead to lower costs, organizations can strengthen their supply chain planning efforts and then shift their focus to additional practices that can benefit their supply chains.

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.

"You can get anything you want at Alexa's restaurant"

Emerging digital technologies foreshadow a future where you can "get anything you want."

Sean T. Monahan

"You can get anything you want at Alice's restaurant," the opening line of Arlo Guthrie's Alice's Restaurant Masacree, really had nothing to do with Alice's restaurant or unlimited potential; however, today's emerging digital technologies, of which Amazon's Alexa is but one example, do foreshadow a future where you can "get anything you want."

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The emergence of procurement 4.0

In the last 25 years, procurement has undergone a steady and dramatic transformation in both processes and scope. Procurement 1.0 (transactional era) focused purely on the transactional execution of requests. Procurement 2.0 (strategic sourcing era) introduced the globalization of supply, calling for more sophisticated approaches to managing third party relationships, and more sophisticated approaches to procurement (e.g., 7-step sourcing). The dawn of the 21st century revealed Procurement 3.0 ("e" era), with the emergence of software tools designed to computerize one or multiple functions such as eAuctions and eRFPs. With software tools facilitating the creation, storage and processing of procurement related data, strategic sourcing took on additional power and the role of procurement, while still largely focused on cost management, began to elevate.

Today's new technologies herald the arrival of the 4th Industrial Revolution and the emergence of Procurement 4.0, the digital era. This era will be characterized by data-driven optimization of cross-domain/value chain interactions enabled by analytics and artificial intelligence. Downstream/transactional procurement activities will be rapidly transformed by Robotic Process Automation (RPA) and other automation tools that drastically improve efficiencies. In this era, procurement takes a central role in value creation by connecting the organization with a network of external partners to innovate new business models.

Digital drivers shaping procurement

Advanced analytics, Artificial Intelligence (AI) and Robotic Process Automation (RPA) are the three digital drivers that are shaping the future of Procurement 4.0.

Advanced analytics. While the lines between advanced analytics and AI can blur at points, for most organizations, the best place to begin a digital journey is with advanced analytics. These involve processing structured (e.g. purchase history, supplier performance, production, sales) and frequently, unstructured data (e.g. external data on weather, social media activity) to feed three core advanced analytics categories: descriptive analytics (what happened), predictive analytics (what might happen) and prescriptive analytics (what should happen to achieve the desired outcome). In the context of procurement, advanced analytics supports capabilities in spend cube visualization (current spend), predictive demand planning and forecasting (future

spend), dynamic inventory management (how much inventory should be held given uncertainty in supply or demand) and multi-objective optimization (how to maximize savings considering objectives for Minority and Women Business Enterprises (M/WBE), maximum number of suppliers and limits on new supplier introduction).

The first step to take advantage of these advanced analytic capabilities is data access. Unfortunately, many organizations continue to lag in this area. In our most recent Assessment of Excellence in Procurement (AEP) survey, Leaders (top 8% of respondents) were generally 1.5 to 2 times as likely to have real-time data (52% vs. 24%) or at least refreshed monthly (73% to 46%). The benefits of analytics, and other capabilities, are meaningful as Leaders generated 2 times greater cost reduction and have earned a mandate to drive value beyond cost alone.

Artificial Intelligence. Building on the foundational capabilities of advanced analytics using machine learning, AI is rapidly advancing capabilities in natural language processing, vision, pattern recognition and reasoning and optimization. With these capabilities, advanced organizations are stepping up algorithmic spend categorization, enhanced demand forecasting (e.g. social media sensing), supply risk awareness (e.g. media event monitoring), supply market trend analysis and other activities.

In collaboration with manufacturing colleagues, procurement leaders are working to unlock historic supply constraints. To illustrate, imagine a food manufacturing process that relies on highly specified ingredients linked to specific manufacturing standard operating conditions to achieve a desired output product quality. Leveraging Industrial Internet of Things (IIoT) capabilities to monitor process conditions and performance, captured data and advanced AI algorithms can be used to establish a digital twin to optimize manufacturing operating conditions for variation in input ingredients while still achieving desired output product quality. This flexibility can open the supply base to both drive cost reduction and provide flexibility in the case of potential supply disruption.

Robotic Process Automation. Robotic process automation (RPA) uses software technology to replicate how a human completes a business process. The robot is "trained" to complete jobs that are typically high-volume, simple and repetitive, such as those entailing heavy data entry or rekeying. As the process steps are repeated, robotic process automation systems become more efficient. Robotic process automation software processes operations 20 times faster than the average human—and does it around the clock with almost no errors, no absences and no diminishing returns. Meanwhile, human employees can be redeployed from these necessary (but often tedious) activities to do more strategic, innovative work.

Procurement has made tremendous strides over the past decades, but in a world of increasing complexity and uncertainty, the digital era represents the next step change in capabilities.

To illustrate the potential of RPA, consider Procure-to-Pay.

- ***Simpler:*** A recent client found that 70 to 80% of invoice processing activity could be automated—25% of employee time spent on rules-based repetitive tasks; 80% of data entry could be automated. At 1/3 the cost of an offshore full-time equivalent (FTE) or 1/5 the cost of an onshore FTE, software robots generate 30% to 60% savings.
- ***Speedier:*** an outsourced FTE handling invoices could complete the process in 20 minutes. RPA software completed the process in one minute, with reduced downtime.
- ***Smarter:*** Out of 100 steps, a human is likely to make 10 errors, even when performing somewhat redundant work. Robots are 100% accurate, and process exceptions are referred to experienced staff who benefit from working only with more interesting and less repetitive work.

For an organization processing 900,000 invoices annually at $8.58 per invoice, RPA generates savings of $2.3 to $4.6 million for an ROI of 6 to 10 times.

Step-change in the digital era

Procurement has made tremendous strides over the past decades, but in a world of increasing complexity and uncertainty, the digital era represents the next step change in capabilities. Understanding and integrating these digital drivers will create transformational changes in today's procurement activities and will truly foreshadow a future where procurement will be able to deliver "anything you want."

A SPECIAL SUPPLEMENT TO:
SUPPLY CHAIN MANAGEMENT REVIEW

6 ways BIG DATA is enhancing the global supply chain

As global supply chains become more complex and customers more demanding, the race is on to develop software applications that can effectively manage and make sense of the zettabytes of data being generated by our digital world.

BY **BRIDGET McCREA**,
CONTRIBUTING EDITOR

Defined as the massive volume of structured and unstructured data that can't possibly be processed using traditional software or database strategies, Big Data is affecting every corner of the business world. It's no surprise, really, seeing that more data has been created in the past two years than in the entire history of the human race. By 2020, roughly 1.7 megabytes of new information will be created for *every second* for every human being and, at that point, the digital universe will be 44 zettabytes strong (up from a current 4.4 zettabytes).

As supply chain managers scramble to wrap their arms around the reams of information now at their fingertips, a growing number of software providers are making the task more manageable and useful. In other words, simply having the data at your avail isn't enough; it's about taking that information and transforming it into actionable insights that help drive operational efficiencies across the supply chain.

Top 20 supply chain management software suppliers

SCM (SCE, SCP, Procurement) Total Software Revenue

No.	Supplier	2015 Revenue	2016 Revenue	SCP	WMS	MES/ MRP	TMS	Procurement	Website
1	SAP	2,666.8	2,932.4	x	x	x	x	x	sap.com
2	Oracle	1,447.8	1,552.9	x	x	x	x	x	oracle.com
3	JDA Software	467.8	475.9	x	x		x		jda.com
4	Infor Global Solutions	105.5	243.3	x	x	x	x	x	infor.com
5	Manhattan Associates	209.3	218.8	x	x		x		manh.com
6	Epicor	162.1	191.6	x	x		x	x	epicor.com
7	Descartes Systems Group	145.3	159.2				x		descartes.com
8	HighJump	129.7	134.9	x	x		x		highjump.com
9	Basware	112.6	122.3					x	basware.com
10	Coupa	72.4	114.3					x	coupa.com
11	IBM	126.6	112.0	x				x	ibm.com
12	PTC	105.8	104.6	x				x	ptc.com
13	Dassault Systemes	74.9	92.9	x		x	x		3ds.com
14	BluJay	76.6	85.8				x		blujaysolutions.com
15	Jaggaer	82.2	84					x	jaggaer.com
16	Kinaxis	66.3	82.8	x					kinaxis.com
17	Perfect Commerce	44.5	72					x	perfect.com
18	e2open	57.7	69.8	x			x	x	e2open.com
19	Zycus	49.4	65					x	zycus.com
20	GEP	55	63.3					x	gep.com
Total		**10,180.7**	**11,183.3**						

Revenue listed in millions of USD
Source: Gartner

"Supply chains are more complex than ever, and with these complexities come many challenges," says Shannon Vaillancourt, president at RateLinx. "Big Data allows companies to diagnose the issue so they truly understand what is causing it." Of course, capturing the data and then using it to make good decisions are two entirely different things. To help fill that "gap," Vaillancourt says software developers are focusing on the 5 Vs of Big Data: variety, velocity, veracity, volume and value.

Vaillancourt says the final "v" is extremely important and often overlooked. "Companies need to be looking for software that turns all of their data into value—or, actionable," he points out. "Actionable data is created through analytics; it's the analytics that tells the user what to do, and ultimately what action to take."

Following are six big ways that Big Data is affecting the supply chain and helping companies take the right actions.

1 Get better diagnostic information. To solve problems and circumvent future challenges, companies need good diagnostic data. Big Data gives them that, according to Vaillancourt, while also ensuring that their future strategies are based on solid historical information. "Big Data can help companies diagnose many issues, which will in turn allow them to develop strategies to solve the issues," he says, "and then ultimately deploy the strategies successfully." For example, the organization that wants to leverage Big Data for track and trace of its products can do so by combining the purchase order (PO) details, shipment information and the carrier's tracking information. Then, once that data is standardized and cleansed, analytics can be applied to it in a way that truly makes the information actionable. "If the analytics notifies the user about a late shipment *before* the carrier issues the notification," Vaillancourt explains, "then that user can enact a contingency plan and get the product faster from an alternate source."

2 Get a clearer "crystal ball" for the future. Defined as the data mining, statistics, modeling, machine learning, and artificial intelligence used to analyze current data to make predictions about the future, predictive analytics is the modern-day supply chain manager's crystal ball. "Predictive analytics makes it possible to analyze data and create assumptions as to what will happen to not only predict the future, but influence it as well," says Marcell Vollmer, chief digital officer at SAP Ariba. In Kansas City, for instance, a local police department is using data to stop crime before it happens by identifying "hot spots," patrolling those areas more aggressively and then more closely monitoring the activities of recent parolees. In the business world,

SCM market will hit $13 billion in 2017

As global supply chains become more complex and intertwined, a growing number of companies are turning to technology to help them manage their supply chains in a way that maximizes customer value while improving competitive advantage. The proof is in the numbers: the market for supply chain management (SCM) software grew by 9% in 2016, according to Gartner, which includes both supply chain execution (SCE) and supply chain planning (SCP) applications under the SCM umbrella. The SCM market is expected to exceed $13 billion in total software revenue by the end of 2017, with Cloud-based applications growing by 20% annually.

Supply chain execution systems, which include warehouse management systems (WMS) and transportation management systems (TMS), grew more than 10% to $3.5 billion. The market for supply chain planning systems crossed the $4 billion mark after growing nearly 8%, with the top five companies accounting for 59% of the list's total revenues.

Market leaders in the overall SCM category continued to dominate the market in 2016, with the top five providers accounting for 49% of the total market (see chart page S69).The same top five market leaders had dominated the list since 2012, but Infor's acquisition of GT Nexus has bumped it from 11th place in 2015 to No. 4 with $243 million. There is still a sizable gap between fourth place and the top three, where SAP ($2.93 billion), Oracle ($1.55 billion) and JDA ($476 million) retain their ranks. In fifth place is Manhattan Associates with $209 million, followed by Epicor, which grew 18% to $192 million.

The push for Cloud capabilities also fueled some of the acquisition activity over the last year. Key transactions included Infor's acquisition of GT Nexus, Kewill's acquisition of LeanLogistics, Oracle's acquisitions of LogFire and NetSuite, and E2open's acquisitions of Terra Technology (and, more recently, Steelwedge). Other notable trends include suite vendors' ongoing push to develop end-to-end solutions that help tie customer relationship management (CRM), replenishment, network design and other capabilities into their broader solutions.

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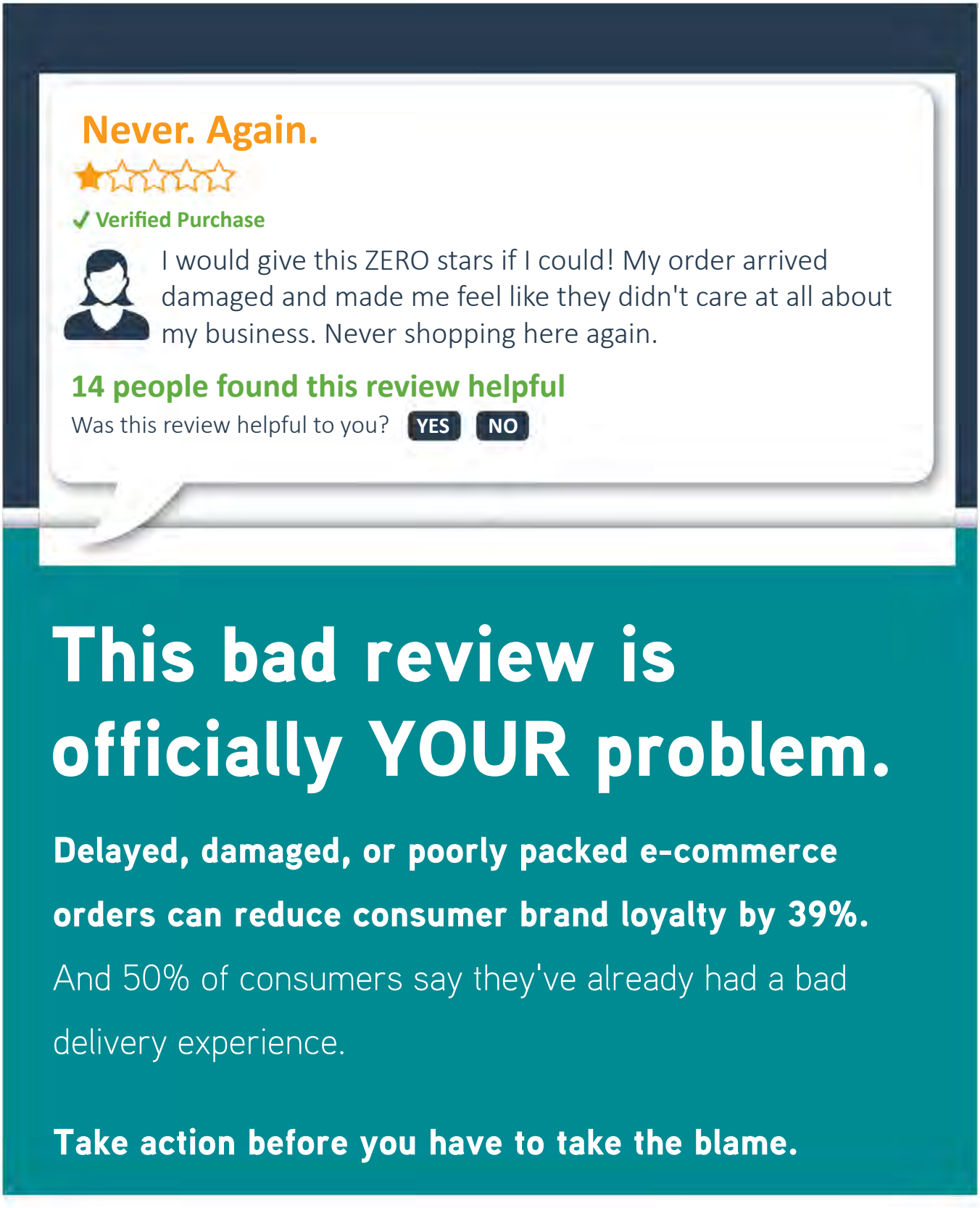
predictive analytics is allowing firms to more clearly understand customer needs and adapt their business to accommodate them. Take pricing, for example. Using predictive analytics, companies can predict equilibrium before releasing a new product, thus maximizing the revenue of the solution out of the gate while also understanding future demand. "Data is the new currency," Vollmer adds, "and predictive analytics is the key to collecting the dividends it pays."

3 Manage external factors that are beyond your control. External factors can have a substantial impact on supply chains, yet in many cases these outside forces are hard to control and even detect. "From weather to oil prices to consumer demand, supply chain executives who can quantify and anticipate such impact can better plan their materials and inventory," says Rich Wagner, CEO at Prevedere. He says retailers are particularly well positioned to leverage this advantage, namely because they're operating in a dynamic environment where consumers expect quick, accurate deliveries. "If a product is unavailable, manufacturers and retailers alike risk not only losing a customer forever, but also a digital media backlash," Wagner points out. How can Big Data help? By helping firms better predict demand, and therefore better plan their inventory to mitigate against shortages. The same benefits apply on a global scale, where both

"By coupling Big Data with predictive analytics, it's quite possible to keep a handle on numerous economic and consumer behavior metrics to be better prepared for what's coming next."



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supply chains and operations are becoming more interconnected and, subsequently, more impacted by world events. "By coupling Big Data with predictive analytics," Wagner says, "it's quite possible to keep a handle on numerous economic and consumer behavior metrics to be better prepared for what's coming next."

4 Make more profitable supply chain demand forecasts. Access to global data, combined with the power of Cloud computing, is giving technology more power to tackle even the toughest supply chain challenges. "With today's advancements in machine learning, companies can use technology to constantly monitor those external forces," says Wagner, "and get a real-time view of what's ahead." He sees this as a fundamental change in demand planning—compared to traditional forecasts built on past performance with the assumption of stable economic conditions. "Executives know that they can't rely on precedence and they need insights to make decisions about the future with certainty," says Wagner. "This desire to be immediately notified of shifts in momentum is now a reality." For example, one global beverage manufacturer saved about $9 million by improving product distribution through predictive demand models. "The manufacturer realized that external factors (e.g., the architectural billings index) were leading indicators of performance," says Wagner, "so it adapted its supply chain planning across 400 brands and 21 distributors."

5 Reduce demand variability and cycle times. Big Data is turning supply chain managers into "mind readers," allowing them to predict and react to buyer behaviors in new ways. On the demand side, for instance, Big Data helps companies gain better understanding over consumer behaviors, foot traffic, buyer preferences and the actions that their competitors are taking. "This gives companies a solid offen-

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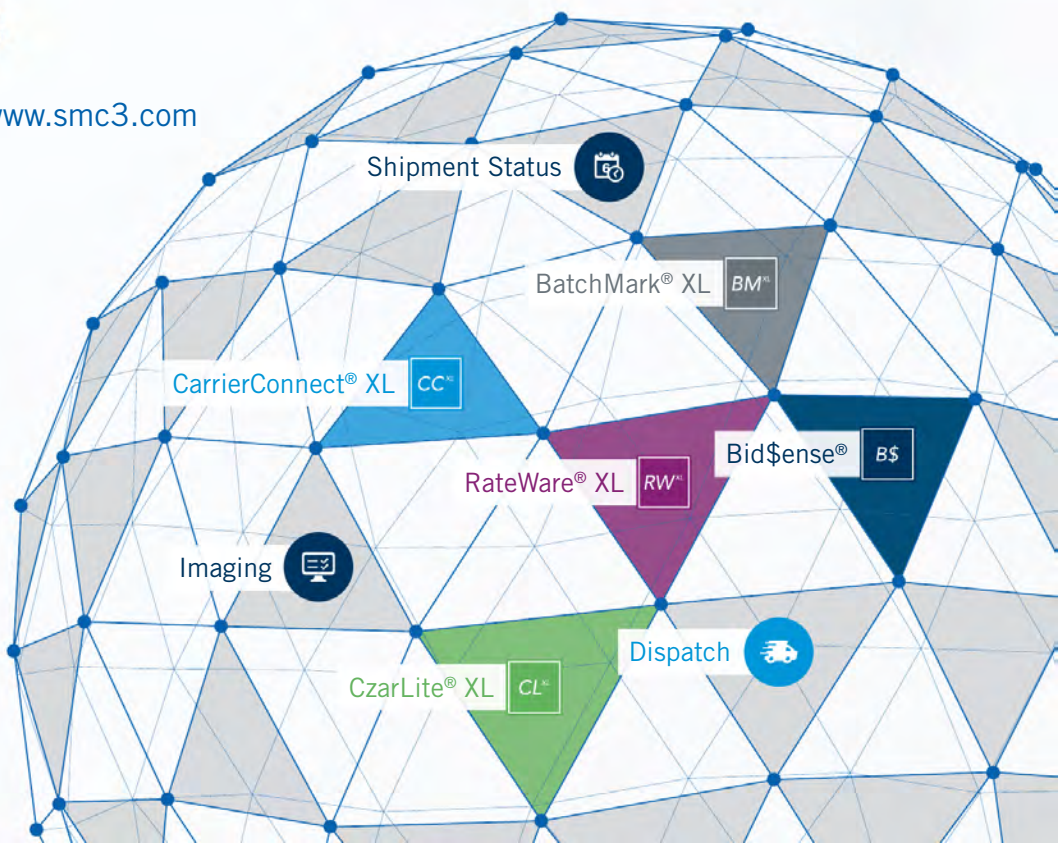

sive footing," says Dennis Groseclose, president and CEO at TransVoyant, "and allows them to fuse external data and demand patterns to more effectively reduce demand variability." Having actionable data also helps companies better manage lead times, variability and capacity. This, in turn, helps them better understand manufacturer and carrier behaviors. "With this information in hand, companies can squish planning cycle times down to one month vs. five months," says Groseclose, "or to one week vs. five weeks."

6 Prepare for the "SNEW" wave. Here's a buzzword you may not have heard of yet: SNEW, or social media, news, event and weather data, is the next acronym that's either going to make supply chain managers sit up and take notice, or make them roll their eyes and groan. Either way, SNEW data promises to help improve supply chain capabilities and give companies even more data to sift through, digest and make sense of. An existing forecast, for example, can be adjusted accordingly when accurate weather predictions are factored into the equation. Driven by the Internet of Things (IoT), SNEW uses a "combination of data feeds to determine the best routing, risk management, and other supply chain decisions," according to Steve Banker, vice president, supply chain management at ARC Advisory Services, who sees SNEW as a potential player in the future of supply chain visibility and risk avoidance (or mitigation). "This is a new solution to the market, and it's being driven by the emergence of new technological capabilities," Banker notes. The integration of social media, news, event and weather data into the manufacturing and distribution process is also getting a boost from the ongoing digitization of the supply chain. "What we're looking at is a series of technologies that are either rapidly emerging or already further along in terms of emergence," says Banker, noting that while IoT is a bit further along in terms of maturity, concepts like SNEW and blockchain (i.e., a digital ledger where transactions made in bitcoin are recorded chronologically and publicly) are still nascent. "Over time," he concludes, "these [innovations] will continue to generate Big Data that companies will use for decision making."

A SPECIAL SUPPLEMENT TO:
SUPPLY CHAIN MANAGEMENT REVIEW

Data is the new oil:

Managing financial- & credit-related RISK

Today's global supply chains are fraught with financial- and credit-related risks. Here's how software and online information platforms can help your company overcome these obstacles and create a sustainable supply chain.

BY BRIDGET McCREA,
CONTRIBUTING EDITOR

It doesn't take a tsunami, flood, cyber attack or geopolitical instability to disrupt a supply chain. In some cases, all it takes is one Tier 2 supplier to file for bankruptcy—or one plant fire at a Tier 1 vendor's facility—to reduce the integrity of the entire global supply chain, damage the firm's brand and send its customers looking for other suppliers. In the absence of an accurate crystal ball, many companies are turning to software and technology platforms focused on credit and financial risk to help them navigate the maze, stay informed and make good decisions.

Supply chain disruption happens

According to the Business Continuity Institute, supply chain resiliency isn't exactly top of mind for today's organization. In its most recent Supply Chain Resilience Report (2016), BCI says that 70% of companies surveyed experienced at least one supply chain disruption over the prior 12 months, and that 34% (up from 15% in 2015) attribute those lapses to "disruptions from their external, inbound supply chains."

"This underscores the strong dependencies of organizations to their suppliers which may prove to be a point of failure if left unmanaged," BCI points out in its report, which pinpointed loss of productivity, customer complaints, impaired service outcomes, brand/reputation damage, and revenue losses as the biggest problems caused by the disruptions.

Tom Greco, VP at ThomasNet.com, says that as supply chain as a discipline gets a "bigger seat at the corporate table," the need for improved risk management is rising exponentially. And while high-profile cases involving Chipotle Mexican Grill and Samsung take center stage, there are myriad credit- and finance-related risks lurking under the surface, ready to negatively impact the supply chain.

"If you consider the implications of supply chain disruption, the results can be very negative from a publicity point of view and ultimately can lead to revenue and profitability shortfalls," Greco points out. "This is just one reason why all companies should not only be monitoring the risk, but why they should also have a plan in place for dealing with those risks, should they be become realities."

The "new normal"

Operating in a business world where constant change and disruption are the "new normal," companies are turning to software platforms that help them transact, collaborate, and share information. At the same time, connected ecosystems empower enterprises across all industries to capture new growth opportunities and fuel innovation. "Change is always at your door, and successful enterprises have developed agile models to innovate and thrive," says Mike Jud, director of product marketing at TRADESHIFT.

In this environment, Jud says managing supply chain risk is more critical than ever because the stakes are higher than ever. "In this age of digital disruption, fast-paced change and volatility, the supply chain can be a source for competitive advantage, differentiation and risk management," Jud says. "It can also be a source of risk."

"If you consider the implications of supply chain disruption, the results can be very negative from a publicity point of view and ultimately can lead to revenue and profitability shortfalls."

On the financial front, for example, organizations need to have deep visibility into the financial health of their suppliers—and their supplier's suppliers. "Imagine being an on-demand manufacturer and your production line is stalled," says Jud, who sees software as an important tool for firms that want to be able to share, collaborate and network with all links in their supply chains. Open platforms like Tradeshift, for example, enable the gathering of content from different providers of risk information (e.g., Moody's, EcoVadis or riskmethods), and provide a way for companies to help their own suppliers access cash.

Software also helps companies think out of the box when it comes to credit and financial risk. "Most companies think about supply chain disruption when they talk about risk; they don't have visibility into events that could impact the supply chain--like a natural disaster, or a work stoppage at a supplier's supplier," says Jud. Using real-time monitoring, however, companies can receive an alert when there is the potential for disruption in the supply chain. Alerted in advance, the procurement team can devise an alternative source of supply in the network to maintain production. "Thus," says Jud, "the company avoids the financial impact of missed deliveries or even a plant shutdown."

Shining a light on potential problems

Knowing that supply chain managers and procurement professionals are thinking well beyond price, quality and delivery when placing orders and working with their own suppliers, Peter Roma says the need to add "supply chain risk" to that list became apparent during the last recession. "Understanding financial risks, first and foremost, shines a light on other issues that may be lurking under the covers," says Roma, a vice president at CreditRiskMonitor, "and also raises the questions that need to be answered from both a supplier management and mitigation perspective."

A platform that provides access to information about public companies, CreditRiskMonitor helps organizations "understand what's going on in their supply chains," says Roma, and helps them build out more resilient, recoverable supplier networks in an era where financial and credit risk are fairly commonplace. "A lot of companies learned their lessons the hard way back in 2008-09," says Roma, "and are now using technology to get out in front of these risk-related issues."

Jerry Flum, CreditRiskMonitor's CEO, is also seeing more companies take an interest in financial risk management. "As the world becomes more and more indebted, the 'leveraging up' of companies is now making their futures a bit more difficult to assess," says Flum. "As firms encounter financial difficulties, that difficulty becomes a catalyst that drives other problems." For example, in an effort to offset their financial woes, companies will pull back on research and development (R&D), reduce their quality control efforts or do less "backing up" of their operations. When this happens, a whole host of other problems begin to surface, says Flum, pushing the company deeper and deeper into financial distress.

So how can a supply chain manager identify and then circumvent these issues? Roma says the answer starts with proactive monitoring that, in turn, allows companies to quickly focus their attention on the problem before it shuts down their supply chains. Software platforms like CreditRiskMonitor and Rapid Ratings, for instance, actively monitor these issues, and then alert companies to potential risks, and can help companies get out in front of the problems before it's too late.

"When you're running a supply chain, there are a lot of decisions that need to be made in terms of doing things in-house, finding new suppliers, and then managing those supplier relationships," says Roma, who adds that his firm's supplier "scoring" process is currently 96-97 percent effective at predicting potential financial distress or bankruptcy. "Getting it right requires many different levels of analysis, and the ability to respond quickly to potential problems."

In some instances, Greco says a seemingly positive trend may actually foreshadow a potential supply chain threat. A supplier that's seen a sharp revenue increase in the last six months, for example, may actually have a negative impact on a customer that's not driving that spike.

Recently, for example, Greco says THOMASNET.com recorded a spike in printed circuit board (PCB) sourcing activity due to high demand for copper (a major PCB component) from the electric vehicle sector. "If PCBs are a critical component in your product, and if you're not paying attention to these trends," says Greco, "then you could miss out on activity that could put your supply at risk."

Staying reactive and ahead of the game

If the downsides of financial supply chain risk are lost productivity, more customer complaints, poor service outcomes, brand damage, and revenue losses, then what are the upsides of applying technology to the problem? Both Flum and Roma say the biggest benefits include better oversight and perspective on a problem that can crop up at any time and potentially disable the end-to-end supply chain. "When you can easily view data and information that would otherwise be extremely difficult to gather and assess," says Roma, "you can be reactive and ahead of the game."

"In these rapidly-changing markets, suppliers have become more accountable in their customers' value creation to deliver product timely, to collaborate, to improve process efficiency, and to co-innovate."

Jud sees agility and trust as the key benefits of a good supply chain risk management approach.

Using technology, companies can also improve supplier performance, uncover better sources of supply (i.e., from a cost and risk perspective), locate integrated partners that can provide financing options or supply chain finance, and enable supplier access to capital to fund working capital demands.

"In these rapidly-changing markets, suppliers have become more accountable in their customers' value creation to deliver product timely, to collaborate, to improve process efficiency, and to co-innovate," Jud explains, noting that with that level of engagement in—and identification with—the business, companies want the confidence that suppliers will share company values (e.g.: stay out of trouble). "This is a very challenging model to scale when a company has thousands of suppliers. The technology enables companies to scale for agility and shared values."

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